RMOL

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RMOL is a C++ library of revenue management and optimisation classes and functions. RMOL mainly targets simulation purposes. N

RMOL makes an extensive use of existing open-source libraries for increased functionality, speed and accuracy. In particular GSL (*GNU Scientific Library*) and Boost (*C++ Standard Extensions*) libraries are used.

The RMOL library originates from the department of Operational Research and Innovation at Amadeus, Sophia Antipolis, France. RMOL is released under the terms of the GNU Lesser General Public License (LGPLv2.1) for you to enjoy.

RMOL should work on GNU/Linux, Sun Solaris, Microsoft Windows (with Cygwin, MinGW/MSYS, or Microsoft Visual C++ .NET) and Mac OS X operating systems.

Note

(N) - The RMOL library is **NOT** intended, in any way, to be used by airlines for production systems. If you want to report issue, bug or feature request, or if you just want to give feedback, have a look on the right-hand side of this page for the preferred reporting methods. In any case, please do not contact Amadeus directly for any matter related to RMOL.

2 People

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Note

(N) - Amadeus employees.

3 Coding Rules

In the following sections we describe the naming conventions which are used for files, classes, structures, local variables, and global variables.

3.1 Default Naming Rules for Variables

Variables names follow Java naming conventions. Examples:

- `lNumberOfPassengers`
- `lSeatAvailability`

3.2 Default Naming Rules for Functions

Function names follow Java naming conventions. Example:

- `int myFunctionName (const int& a, int b)`

3.3 Default Naming Rules for Classes and Structures

Each new word in a class or structure name should always start with a capital letter and the words should be separated with an under-score. Abbreviations are written with capital letters. Examples:

- `MyClassName`
- `MyStructName`

3.4 Default Naming Rules for Files

Files are named after the C++ class names.

Source files are named using `.cpp` suffix, whereas header files end with `.hpp` extension. Examples:

- `FlightDate.hpp`
- `SegmentDate.cpp`

3.5 Default Functionality of Classes

All classes that are configured by input parameters should include:

- default empty constructor
- one or more additional constructor(s) that takes input parameters and initializes the class instance
- setup function, preferably named `'setup'` or `'set_parameters'`

Explicit destructor functions are not required, unless they are needed. It shall not be possible to use any of the other member functions unless the class has been properly initiated with the input parameters.

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4.1 GNU LESSER GENERAL PUBLIC LICENSE

4.1.1 Version 2.1, February 1999

```
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as the successor of the GNU Library Public License, version 2, hence
the version number 2.1.]
```

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4.3.2 END OF TERMS AND CONDITIONS

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To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the library's name and a brief idea of what it does.>
Copyright (C) <year>  <name of author>

This library is free software; you can redistribute it and/or
modify it under the terms of the GNU Lesser General Public
License as published by the Free Software Foundation; either
version 2.1 of the License, or (at your option) any later version.

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License along with this library; if not, write to the Free Software
Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA  02110-1301  USA
```

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the
library 'Frob' (a library for tweaking knobs) written by James Random Hacker.

<signature of Ty Coon>, 1 April 1990
Ty Coon, President of Vice
```

That's all there is to it!

Source

5 Documentation Rules

5.1 General Rules

All classes in RMOL should be properly documented with Doxygen comments in include (`.hpp`) files. Source (`.cpp`) files should be documented according to a normal standard for well documented C++ code.

An example of how the interface of a class shall be documented in RMOL is shown here:

```
/*!
 * \brief Brief description of MyClass here
 *
 * Detailed description of MyClass here. With example code if needed.
 */
class MyClass {
public:
  //! Default constructor
  MyClass(void) { setup_done = false; }

  /*!
   * \brief Constructor that initializes the class with parameters
   *
   * Detailed description of the constructor here if needed
   *
   * \param[in] param1 Description of \a param1 here
   * \param[in] param2 Description of \a param2 here
   */
  MyClass(TYPE1 param1, TYPE2 param2) { setup(param1, param2); }

  /*!
   * \brief Setup function for MyClass
   *
   * Detailed description of the setup function here if needed
   *
   * \param[in] param1 Description of \a param1 here
   * \param[in] param2 Description of \a param2 here
   */
  void setup(TYPE1 param1, TYPE2 param2);

  /*!
   * \brief Brief description of memberFunction1
   *
   * Detailed description of memberFunction1 here if needed
   *
   * \param[in]     param1 Description of \a param1 here
   * \param[in]     param2 Description of \a param2 here
   * \param[in,out] param3 Description of \a param3 here
   * \return Description of the return value here
   */
  TYPE4 memberFunction1(TYPE1 param1, TYPE2 param2, TYPE3 &param3);

private:

  bool _setupDone;         /*!< Variable that checks if the class is properly
                                initialized with parameters */
  TYPE1 _privateVariable1; //!< Short description of _privateVariable1 here
  TYPE2 _privateVariable2; //!< Short description of _privateVariable2 here
};
```

5.2 File Header

All files should start with the following header, which include Doxygen's `\file`, `\brief` and `\author` tags, `$Date$` and `$Revisions$` CVS tags, and a common copyright note:

```
/*!
 * \file
 * \brief Brief description of the file here
 * \author Names of the authors who contributed to this code
 * \date Date
 *
 * Detailed description of the file here if needed.
 *
 * ---------------------------------------------------------------------
 *
 * RMOL - C++ Revenue Management Object Library
 *
 * Copyright (C) 2007-2010  (\see authors file for a list of contributors)
 *
 * \see copyright file for license information
 *
 * ---------------------------------------------------------------------
 */
```

5.3 Grouping Various Parts

All functions must be added to a Doxygen group in order to appear in the documentation. The following code example defines the group `'my_group'`:

```
/*!
 * \defgroup my_group Brief description of the group here
 *
 * Detailed description of the group here
*/
```

The following example shows how to document the function `myFunction` and how to add it to the group `my_group`:

```
/*!
 * \brief Brief description of myFunction here
 * \ingroup my_group
 *
 * Detailed description of myFunction here
 *
 * \param[in] param1 Description of \a param1 here
 * \param[in] param2 Description of \a param2 here
 * \return Description of the return value here
 */
TYPE3 myFunction(TYPE1 param1, TYPE2 &param2);
```

6 Main features

A short list of the main features of RMOL is given below sorted in different categories. Many more features and functions exist and for these we refer to the reference documentation.

6.1 Optimisation features

- Dynamic Programming (DP)
- EMSRa and EMSRb
- Network optimisation with Linear Programming (LP)

6.2 Unconstraining

- Inventory censorflag and guillotine
- E-M (Expectation Maximisation)

6.3 Forecasting features

- Exponential Smoothing
- Moving Average

6.4 Overbooking features

- Cancellations and No-Shows
- Cost-based optimisation
- Service-based optimisation

6.5 Other features

- CSV input file parsing

7 Make a Difference

Do not ask what RMOL can do for you. Ask what you can do for RMOL.

You can help us to develop the RMOL library. There are always a lot of things you can do:

- Start using RMOL
- Tell your friends about RMOL and help them to get started using it
- If you find a bug, report it to us. Without your help we can never hope to produce a bug free code.
- Help us to improve the documentation by providing information about documentation bugs

- Answer support requests in the RMOL discussion forums on SourceForge. If you know the answer to a question, help others to overcome their RMOL problems.
- Help us to improve our algorithms. If you know of a better way (e.g. that is faster or requires less memory) to implement some of our algorithms, then let us know.
- Help us to port RMOL to new platforms. If you manage to compile RMOL on a new platform, then tell us how you did it.
- Send us your code. If you have a good RMOL compatible code, which you can release under the LGPL, and you think it should be included in RMOL, then send it to us.
- Become an RMOL developer. Send us an e-mail and tell what you can do for RMOL.

8 Make a new release

8.1 Introduction

This document describes briefly the recommended procedure of releasing a new version of RMOL using a Linux development machine and the SourceForge project site.

The following steps are required to make a release of the distribution package.

8.2 Initialisation

Clone locally the full Git project:

```
cd ~
mkdir -p dev/sim
cd ~/dev/sim
git clone git://rmol.git.sourceforge.net/gitroot/rmol/rmol rmolgit
cd rmolgit
git checkout trunk
```

8.3 Branch creation

Create the branch, on your local clone, corresponding to the new release (say, 0.50.0):

```
cd ~/dev/sim/rmolgit
git checkout trunk
git checkout -b 0.50.0
```

Update the version in the various build system files, replacing 99.99.99 by the correct version number:

```
vi CMakeLists.txt
vi autogen.sh
```

Update the version and add a change-log in the ChangeLog and in the RPM specification files:

```
vi ChangeLog
vi rmol.spec
```

8.4 Commit and publish the release branch

Commit the new release:

```
cd ~/dev/sim/rmolgit
git add -A
git commit -m "[Release 0.50.0] Release of version 0.50.0."
git push
```

8.5 Update the change-log in the trunk as well

Update the change-log in the ChangeLog and RPM specification files:

```
cd ~/dev/sim/rmolgit
git checkout trunk
vi ChangeLog
vi rmol.spec
```

Commit the change-logs and publish the trunk (main development branch):

```
git commit -m "[Doc] Integrated the change-log of the release 0.50.0."
git push
```

8.6 Create distribution packages

Create the distribution packages using the following command:

```
cd ~/dev/sim/rmolgit
git checkout 0.50.0
rm -rf build && mkdir -p build
cd build
cmake -DCMAKE_INSTALL_PREFIX=/home/user/dev/deliveries/rmol-0.50.0 \
 -DCMAKE_BUILD_TYPE:STRING=Debug -DINSTALL_DOC:BOOL=ON ..
make check && make dist
```

This will configure, compile and check the package. The output packages will be named, for instance, `rmol-0.50.0.tar.gz` and `rmol-0.50.0.tar.bz2`.

8.7 Generation the RPM packages

Optionally, generate the RPM package (for instance, for Fedora/RedHat):

```
cd ~/dev/sim/rmolgit
git checkout 0.50.0
```

```
rm -rf build && mkdir -p build
cd build
cmake -DCMAKE_INSTALL_PREFIX=/home/user/dev/deliveries/rmol-0.50.0 \
 -DCMAKE_BUILD_TYPE:STRING=Debug -DINSTALL_DOC:BOOL=ON ..
make dist
```

To perform this step, rpm-build, rpmlint and rpmdevtools have to be available on the system.

```
cp rmol.spec ~/dev/packages/SPECS \
  && cp rmol-0.50.0.tar.bz2 ~/dev/packages/SOURCES
cd ~/dev/packages/SPECS
rpmbuild -ba rmol.spec
rpmlint -i ../SPECS/rmol.spec ../SRPMS/rmol-0.50.0-1.fc15.src.rpm \
  ../RPMS/noarch/rmol-* ../RPMS/i686/rmol-*
```

8.8 Update distributed change log

Update the `NEWS` and `ChangeLog` files with appropriate information, including what has changed since the previous release. Then commit and push the changes into the RMOL's Git repository.

8.9 Create the binary package, including the documentation

Create the binary package, which includes HTML and PDF documentation, using the following command:

```
make package
```

The output binary package will be named, for instance, `rmol-0.50.0-Linux.tar.bz2`. That package contains both the HTML and PDF documentation. The binary package contains also the executables and shared libraries, as well as C++ header files, but all of those do not interest us for now.

8.10 Upload the files to SourceForge

Upload the distribution and documentation packages to the SourceForge server. Check SourceForge help page on uploading software.

8.11 Upload the documentation to SourceForge

In order to update the Web site files, either:

- synchronise them with rsync and SSH:

  ```
  cd ~/dev/sim/rmolgit
  git checkout 0.50.0
  rsync -aiv doc/html/ doc/latex/refman.pdf joe,rmol@web.sourceforge.net:htdocs/
  ```

  where `-aiv` options mean:

  - `-a`: archive/mirror mode; equals `-rlptgoD` (no `-H`, `-A`, `-X`)
  - `-v`: increase verbosity
  - `-i`: output a change-summary for all updates
  - Note the trailing slashes (/) at the end of both the source and target directories. It means that the content of the source directory (`doc/html`), rather than the directory itself, has to be copied into the content of the target directory.

- or use the `SourceForge Shell service`.

8.12 Make a new post

- submit a new entry in the `SourceForge project-related news feed`
- make a new post on the `SourceForge hosted WordPress blog`
- and update, if necessary, `Trac tickets`.

8.13 Send an email on the announcement mailing-list

Finally, you should send an announcement to `rmol-announce@lists.sourceforge.net` (see `https://lists.sourceforge.net/lists/listinfo/rmol-announce` for the archives)

9 Installation

9.1 Table of Contents

9.2 Fedora/RedHat Linux distributions

Note that on Fedora/RedHat Linux distributions, RPM packages are available and can be installed with your usual package manager. For instance:

```
yum -y install rmol-devel rmol-doc
```

RPM packages can also be available on the SourceForge download site.

9.3 RMOL Requirements

RMOL should compile without errors or warnings on most GNU/Linux systems, on UNIX systems like Solaris SunOS, and on POSIX based environments for Microsoft Windows like Cygwin or MinGW with MSYS. It can be also built on Microsoft Windows NT/2000/XP/Vista/7 using Microsoft's Visual C++ .NET, but our support for this compiler is limited. For GNU/Linux, SunOS, Cygwin and MinGW we assume that you have at least the following GNU software installed on your computer:

- GNU Autotools:
  - autoconf,
  - automake,
  - libtool,
  - make, version 3.72.1 or later (check version with 'make --version')
- GCC - GNU C++ Compiler (g++), version 4.3.x or later (check version with 'gcc --version')
- Boost - C++ STL extensions, version 1.35 or later (check version with 'grep "define BOOST_LIB_VERSION" /usr/include/boost/version.hpp')
- MySQL - Database client libraries, version 5.0 or later (check version with 'mysql --version')
- SOCI - C++ database client library wrapper, version 3.0.0 or later (check version with 'soci-config --version')

Optionally, you might need a few additional programs: Doxygen, LaTeX, Dvips and Ghostscript, to generate the HTML and PDF documentation.

We strongly recommend that you use recent stable releases of the GCC, if possible. We do not actively work on supporting older versions of the GCC, and they may therefore (without prior notice) become unsupported in future releases of RMOL.

9.4 Basic Installation

Briefly, the shell commands './cmake .. && make install' should configure, build and install this package. The following more-detailed instructions are generic; see the 'README' file for instructions specific to this package. Some packages provide this 'INSTALL' file but do not implement all of the features documented below.

The lack of an optional feature in a given package is not necessarily a bug. More recommendations for GNU packages can be found in the info page corresponding to "Makefile Conventions: (standards)Makefile Conventions".

The 'cmake' shell script attempts to guess correct values for various system-dependent variables used during compilation. It uses those values to create a 'Makefile' in each directory of the package. It may also create one or more '.h' files containing system-dependent definitions. Finally, it creates a 'CMakeCache.txt' cache file that you can refer to in the future to recreate the current configuration, and files 'CMakeFiles' containing compiler output (useful mainly for debugging 'cmake').

It can also use an optional file (typically called 'config.cache' and enabled with '--cache-file=config.cache' or simply '-C') that saves the results of its tests to speed up reconfiguring. Caching is disabled by default to prevent problems with accidental use of stale cache files.

If you need to do unusual things to compile the package, please try to figure out how 'configure' could check whether to do them, and mail diffs or instructions to the address given in the 'README' so they can be considered for the next release. If you are using the cache, and at some point 'config.cache' contains results you don't want to keep, you may remove or edit it.

The file 'CMakeLists.txt' is used to create the 'Makefile' files.

The simplest way to compile this package is:

1. 'cd' to the directory containing the package's source code and type './cmake ..' to configure the package for your system. Running 'cmake' is generally fast. While running, it prints some messages telling which features it is checking for.

2. Type 'make' to compile the package.

3. Optionally, type 'make check'to run any self-tests that come with the package, generally using the just-built uninstalled binaries.

4. Type 'make install' to install the programs and any data files and documentation. When installing into a prefix owned by root, it is recommended that the package be configured and built as a regular user, and only the 'make install' phase executed with root privileges.

5. You can remove the program binaries and object files from the source code directory by typing 'make clean'. To also remove the files that 'configure' created (so you can compile the package for a different kind of computer), type 'make distclean'. There is also a 'make maintainer-clean' target, but that is intended mainly for the package's developers. If you use it, you may have to get all sorts of other programs in order to regenerate files that came with the distribution.

6. Often, you can also type 'make uninstall' to remove the installed files again. In practice, not all packages have

tested that uninstallation works correctly, even though it is required by the GNU Coding Standards.

9.5 Compilers and Options

Some systems require unusual options for compilation or linking that the ‘cmake’ script does not know about. Run ‘./cmake --help’ for details on some of the pertinent environment variables.

You can give ‘cmake’ initial values for configuration parameters by setting variables in the command line or in the environment. Here is an example:

```
./cmake CC=c99 CFLAGS=-g LIBS=-lposix
```

See also

Defining Variables for more details.

9.6 Compiling For Multiple Architectures

You can compile the package for more than one kind of computer at the same time, by placing the object files for each architecture in their own directory. To do this, you can use GNU ‘make’. ‘cd’ to the directory where you want the object files and executables to go and run the ‘configure’ script. ‘configure’ automatically checks for the source code in the directory that ‘configure’ is in and in ‘..’. This is known as a "VPATH" build.

With a non-GNU ‘make’, it is safer to compile the package for one architecture at a time in the source code directory. After you have installed the package for one architecture, use ‘make distclean’ before reconfiguring for another architecture.

On MacOS X 10.5 and later systems, you can create libraries and executables that work on multiple system types--known as "fat" or "universal" binaries--by specifying multiple ‘-arch’ options to the compiler but only a single ‘-arch’ option to the preprocessor. Like this:

```
./configure CC="gcc -arch i386 -arch x86_64 -arch ppc -arch ppc64" \
            CXX="g++ -arch i386 -arch x86_64 -arch ppc -arch ppc64" \
            CPP="gcc -E" CXXCPP="g++ -E"
```

This is not guaranteed to produce working output in all cases, you may have to build one architecture at a time and combine the results using the ‘lipo’ tool if you have problems.

9.7 Installation Names

By default, ‘make install’ installs the package’s commands under ‘/usr/local/bin’, include files under ‘/usr/local/include’, etc. You can specify an installation prefix other than ‘/usr/local’ by giving ‘configure’ the option ‘--prefix=PREFIX’, where PREFIX must be an absolute file name.

You can specify separate installation prefixes for architecture-specific files and architecture-independent files. If you pass the option ‘--exec-prefix=PREFIX’ to ‘configure’, the package uses PREFIX as the prefix for installing programs and libraries. Documentation and other data files still use the regular prefix.

In addition, if you use an unusual directory layout you can give options like ‘--bindir=DIR’ to specify different values for particular kinds of files. Run ‘configure --help’ for a list of the directories you can set and what kinds of files go in them. In general, the default for these options is expressed in terms of ‘${prefix}’, so that specifying just ‘--prefix’ will affect all of the other directory specifications that were not explicitly provided.

The most portable way to affect installation locations is to pass the correct locations to ‘configure’; however, many packages provide one or both of the following shortcuts of passing variable assignments to the ‘make install’ command line to change installation locations without having to reconfigure or recompile.

The first method involves providing an override variable for each affected directory. For example, ‘make install prefix=/alternate/director
will choose an alternate location for all directory configuration variables that were expressed in terms of ‘${prefix}’. Any directories that were specified during ‘configure’, but not in terms of ‘${prefix}’, must each be overridden at install time for the entire installation to be relocated. The approach of makefile variable overrides for each directory variable is required by the GNU Coding Standards, and ideally causes no recompilation. However, some platforms have known limitations with the semantics of shared libraries that end up requiring recompilation when using this method, particularly noticeable in packages that use GNU Libtool.

The second method involves providing the ‘DESTDIR’ variable. For example, ‘make install DESTDIR=/alternate/directory’ will prepend ‘/alternate/directory’ before all installation names. The approach of ‘DESTDIR’ overrides is not required by the GNU Coding Standards, and does not work on platforms that have drive letters. On the other hand, it does better at avoiding recompilation issues, and works well even when some directory options were not specified in terms of ‘${prefix}’ at ‘configure’ time.

9.8 Optional Features

If the package supports it, you can cause programs to be installed with an extra prefix or suffix on their names by giving 'cmake' the option '--program-prefix=PREFIX' or '--program-suffix=SUFFIX'.

Some packages pay attention to '--enable-FEATURE' options to 'configure', where FEATURE indicates an optional part of the package. They may also pay attention to '--with-PACKAGE' options, where PACKAGE is something like 'gnu-as' or 'x' (for the X Window System). The 'README' should mention any '--enable-' and '--with-' options that the package recognizes.

For packages that use the X Window System, 'configure' can usually find the X include and library files automatically, but if it doesn't, you can use the 'configure' options '--x-includes=DIR' and '--x-libraries=DIR' to specify their locations.

Some packages offer the ability to configure how verbose the execution of 'make' will be. For these packages, running './configure --enable-silent-rules' sets the default to minimal output, which can be overridden with 'make V=1'; while running './configure --disable-silent-rules' sets the default to verbose, which can be overridden with 'make V=0'.

9.9 Particular systems

On HP-UX, the default C compiler is not ANSI C compatible. If GNU CC is not installed, it is recommended to use the following options in order to use an ANSI C compiler:

```
./configure CC="cc -Ae -D_XOPEN_SOURCE=500"
```

and if that doesn't work, install pre-built binaries of GCC for HP-UX.

On OSF/1 a.k.a. Tru64, some versions of the default C compiler cannot parse its '<wchar.h>' header file. The option '-nodtk' can be used as a workaround. If GNU CC is not installed, it is therefore recommended to try

```
./configure CC="cc"
```

and if that doesn't work, try

```
./configure CC="cc -nodtk"
```

On Solaris, don't put '/usr/ucb' early in your 'PATH'. This directory contains several dysfunctional programs; working

variants of these programs are available in ‘/usr/bin’. So,
if you need ‘/usr/ucb’ in your ‘PATH’, put it _after_ ‘/usr/bin’.

On Haiku, software installed for all users goes in ‘/boot/common’,
not ‘/usr/local’. It is recommended to use the following options:

```
./cmake -DCMAKE_INSTALL_PREFIX=/boot/common
```

9.10 Specifying the System Type

There may be some features ‘configure’ cannot figure out automatically,
but needs to determine by the type of machine the package will
run on. Usually, assuming the package is built to be run on
the _same_ architectures, ‘configure’ can figure that out,
but if it prints a message saying it cannot guess the machine
type, give it the ‘--build=TYPE’ option. TYPE can either be
a short name for the system type, such as ‘sun4’, or a canonical
name which has the form CPU-COMPANY-SYSTEM

where SYSTEM can have one of these forms:

- OS
- KERNEL-OS

See the file ‘config.sub’ for the possible values of each field.
If ‘config.sub’ isn’t included in this package, then this package
doesn’t need to know the machine type.

If you are _building_ compiler tools for cross-compiling, you
should use the option ‘--target=TYPE’ to select the type of
system they will produce code for.

If you want to _use_ a cross compiler, that generates code
for a platform different from the build platform, you should
specify the "host" platform (i.e., that on which the generated
programs will eventually be run) with ‘--host=TYPE’.

9.11 Sharing Defaults

If you want to set default values for ‘configure’ scripts to
share, you can create a site shell script called ‘config.site’
that gives default values for variables like ‘CC’, ‘cache_-
file’, and ‘prefix’. ‘configure’ looks for ‘PREFIX/share/config.site’
if it exists, then ‘PREFIX/etc/config.site’ if it exists. Or,
you can set the ‘CONFIG_SITE’ environment variable to the location
of the site script. A warning: not all ‘configure’ scripts
look for a site script.

9.12 Defining Variables

Variables not defined in a site shell script can be set in the environment passed to 'configure'. However, some packages may run configure again during the build, and the customized values of these variables may be lost. In order to avoid this problem, you should set them in the 'configure' command line, using 'VAR=value'. For example:

```
./configure CC=/usr/local2/bin/gcc
```

causes the specified 'gcc' to be used as the C compiler (unless it is overridden in the site shell script).

Unfortunately, this technique does not work for 'CONFIG_SHELL' due to an Autoconf bug. Until the bug is fixed you can use this workaround:

```
CONFIG_SHELL=/bin/bash /bin/bash ./configure CONFIG_SHELL=/bin/bash
```

9.13 'cmake' Invocation

'cmake' recognizes the following options to control how it operates.

- '--help', '-h' print a summary of all of the options to 'configure', and exit.
- '--help=short', '--help=recursive' print a summary of the options unique to this package's 'configure', and exit. The 'short' variant lists options used only in the top level, while the 'recursive' variant lists options also present in any nested packages.
- '--version', '-V' print the version of Autoconf used to generate the 'configure' script, and exit.
- '--cache-file=FILE' enable the cache: use and save the results of the tests in FILE, traditionally 'config.cache'. FILE defaults to '/dev/null' to disable caching.
- '--config-cache', '-C' alias for '--cache-file=config.cache'.
- '--quiet', '--silent', '-q' do not print messages saying which checks are being made. To suppress all normal output, redirect it to '/dev/null' (any error messages will still be shown).
- '--srcdir=DIR' look for the package's source code in directory DIR. Usually 'configure' can determine that directory automatically.
- '--prefix=DIR' use DIR as the installation prefix.

See also

Installation Names for more details, including other options available for fine-tuning the installation locations.

- '--no-create', '-n' run the configure checks, but stop before creating any output files.

'cmake' also accepts some other, not widely useful, options. Run 'cmake --help' for more details.

The 'cmake' script produces an ouput like this:

```
cmake -DCMAKE_INSTALL_PREFIX=/home/user/dev/deliveries/rmol-99.99.99 -DLIB_SUFFIX=64 -DCMAKE_BUILD_
-- The C compiler identification is GNU
-- The CXX compiler identification is GNU
-- Check for working C compiler: /usr/lib64/ccache/gcc
-- Check for working C compiler: /usr/lib64/ccache/gcc -- works
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Check for working CXX compiler: /usr/lib64/ccache/c++
-- Check for working CXX compiler: /usr/lib64/ccache/c++ -- works
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Requires Git without specifying any version
-- Current Git revision name: 56c6c98cf2cfb4008a0acd35d08075cf5f79e693 trunk
-- Requires Boost-1.41
-- Boost version: 1.46.0
-- Found the following Boost libraries:
--   program_options
--   date_time
--   iostreams
--   serialization
--   filesystem
--   unit_test_framework
--   python
-- Found Boost version: 1.46.0
-- Found BoostWrapper: /usr/include (Required is at least version "1.41")
-- Requires MySQL without specifying any version
-- Using mysql-config: /usr/bin/mysql_config
-- Found MySQL: /usr/lib64/mysql/libmysqlclient.so
-- Found MySQL version: 5.5.14
-- Requires SOCI-3.0
-- Using soci-config: /usr/bin/soci-config
-- SOCI headers are buried
-- Found SOCI: /usr/lib64/libsoci_core.so (Required is at least version "3.0")
-- Found SOCIMySQL: /usr/lib64/libsoci_mysql.so (Required is at least version "3.0")
-- Found SOCI with MySQL back-end support version: 3.0.0
-- Requires StdAir-0.35
-- Found StdAir version: 0.37.1
-- Requires Doxygen without specifying any version
-- Found Doxygen: /usr/bin/doxygen
-- Found DoxygenWrapper: /usr/bin/doxygen
-- Found Doxygen version: 1.7.4
-- Had to set the linker language for 'airraclib' to CXX
-- Had to set the linker language for 'rmollib' to CXX
-- Test 'UnconstrainerTest' to be built with 'UnconstrainerTestSuite.cpp'
-- Test 'ForecasterTest' to be built with 'ForecasterTestSuite.cpp'
-- Test 'OptimiseTest' to be built with 'OptimiseTestSuite.cpp'
-- Test 'BOMsForForecasterTest' to be built with 'bomsforforecaster.cpp'
```

```
--
-- ============================================================
-- ----------------------------------
-- ---     Project Information    ---
-- ----------------------------------
-- PROJECT_NAME ................... : rmol
-- PACKAGE_PRETTY_NAME ............ : RMOL
-- PACKAGE ........................ : rmol
-- PACKAGE_NAME ................... : RMOL
-- PACKAGE_BRIEF .................. : C++ library of Revenue Management and Optimisation classes ar
-- PACKAGE_VERSION ................ : 99.99.99
-- GENERIC_LIB_VERSION ............ : 99.99.99
-- GENERIC_LIB_SOVERSION .......... : 99.99
--
-- ----------------------------------
-- ---     Build Configuration    ---
-- ----------------------------------
-- Modules to build ............... : airrac;rmol
-- Libraries to build/install ..... : airraclib;rmollib
-- Binaries to build/install ...... : airrac;rmol
-- Modules to test ................ : rmol
-- Binaries to test ............... : UnconstrainerTesttst;UnconstrainerTesttst;ForecasterTesttst;U
--
-- * Module ....................... : airrac
--   + Layers to build ............ : .;basic;bom;factory;command;service
--   + Dependencies on other layers :
--   + Libraries to build/install . : airraclib
--   + Executables to build/install : airrac
--   + Tests to perform ........... :
-- * Module ....................... : rmol
--   + Layers to build ............ : .;basic;bom;factory;command;service
--   + Dependencies on other layers : airraclib
--   + Libraries to build/install . : rmollib
--   + Executables to build/install : rmol
--   + Tests to perform ........... : UnconstrainerTesttst;UnconstrainerTesttst;ForecasterTesttst;U
--
-- BUILD_SHARED_LIBS .............. : ON
-- CMAKE_BUILD_TYPE ............... : Debug
--  * CMAKE_C_FLAGS ............... :
--  * CMAKE_CXX_FLAGS ............. : -Wall -Werror
--  * BUILD_FLAGS ................. :
--  * COMPILE_FLAGS ............... :
-- CMAKE_MODULE_PATH .............. : /home/user/dev/sim/rmol/rmolgithub/config/
-- CMAKE_INSTALL_PREFIX ........... : /home/user/dev/deliveries/rmol-99.99.99
--
-- * Doxygen:
--   - DOXYGEN_VERSION ............. : 1.7.4
--   - DOXYGEN_EXECUTABLE .......... : /usr/bin/doxygen
--   - DOXYGEN_DOT_EXECUTABLE ...... : /usr/bin/dot
--   - DOXYGEN_DOT_PATH ............ : /usr/bin
--
-- ----------------------------------
-- --- Installation Configuration ---
-- ----------------------------------
-- INSTALL_LIB_DIR ................ : /home/user/dev/deliveries/rmol-99.99.99/lib64
-- INSTALL_BIN_DIR ................ : /home/user/dev/deliveries/rmol-99.99.99/bin
-- INSTALL_INCLUDE_DIR ............ : /home/user/dev/deliveries/rmol-99.99.99/include
-- INSTALL_DATA_DIR ............... : /home/user/dev/deliveries/rmol-99.99.99/share
-- INSTALL_SAMPLE_DIR ............. : /home/user/dev/deliveries/rmol-99.99.99/share/rmol/samples
-- INSTALL_DOC .................... : ON
--
-- ----------------------------------
```

```
-- ---   Packaging Configuration  ---
-- ----------------------------------
-- CPACK_PACKAGE_CONTACT ......... : Denis Arnaud <denis_arnaud - at - users dot sourceforge dot n
-- CPACK_PACKAGE_VENDOR ........... : Denis Arnaud
-- CPACK_PACKAGE_VERSION ......... : 99.99.99
-- CPACK_PACKAGE_DESCRIPTION_FILE . : /home/user/dev/sim/rmol/rmolgithub/README
-- CPACK_RESOURCE_FILE_LICENSE .... : /home/user/dev/sim/rmol/rmolgithub/COPYING
-- CPACK_GENERATOR ................ : TBZ2
-- CPACK_DEBIAN_PACKAGE_DEPENDS ... :
-- CPACK_SOURCE_GENERATOR ......... : TBZ2;TGZ
-- CPACK_SOURCE_PACKAGE_FILE_NAME . : rmol-99.99.99
--
-- ----------------------------------
-- ---     External libraries    ---
-- ----------------------------------
--
-- * Boost:
--   - Boost_VERSION .............. : 104600
--   - Boost_LIB_VERSION .......... : 1_46
--   - Boost_HUMAN_VERSION ........ : 1.46.0
--   - Boost_INCLUDE_DIRS ......... : /usr/include
--   - Boost required components .. : program_options;date_time;iostreams;serialization;filesystem;
--   - Boost required libraries ... : optimized;/usr/lib64/libboost_iostreams-mt.so;debug;/usr/lib6
--
-- * MySQL:
--   - MYSQL_VERSION .............. : 5.5.14
--   - MYSQL_INCLUDE_DIR .......... : /usr/include/mysql
--   - MYSQL_LIBRARIES ............ : /usr/lib64/mysql/libmysqlclient.so
--
-- * SOCI:
--   - SOCI_VERSION ............... : 3.0.0
--   - SOCI_INCLUDE_DIR ........... : /usr/include/soci
--   - SOCIMYSQL_INCLUDE_DIR ...... : /usr/include/soci
--   - SOCI_LIBRARIES ............. : /usr/lib64/libsoci_core.so
--   - SOCIMYSQL_LIBRARIES ........ : /usr/lib64/libsoci_mysql.so
--
-- * StdAir:
--   - STDAIR_VERSION ............. : 0.37.1
--   - STDAIR_BINARY_DIRS ......... : /home/user/dev/deliveries/stdair-0.37.1/bin
--   - STDAIR_EXECUTABLES ......... : stdair
--   - STDAIR_LIBRARY_DIRS ........ : /home/user/dev/deliveries/stdair-0.37.1/lib64
--   - STDAIR_LIBRARIES ........... : stdairlib;stdairuicllib
--   - STDAIR_INCLUDE_DIRS ........ : /home/user/dev/deliveries/stdair-0.37.1/include
--   - STDAIR_SAMPLE_DIR .......... : /home/user/dev/deliveries/stdair-0.37.1/share/stdair/samples
--
-- Change a value with: cmake -D<Variable>=<Value>
-- ================================================================
--
-- Configuring done
-- Generating done
-- Build files have been written to: /home/user/dev/sim/rmol/rmolgithub/build
```

It is recommended that you check if your library has been compiled and linked properly and works as expected. To do so, you should execute the testing process 'make check'. As a result, you should obtain a similar report:

```
[  0%] Built target hdr_cfg_rmol
[  0%] Built target hdr_cfg_airrac
[ 30%] Built target airraclib
[ 86%] Built target rmollib
```

```
[ 90%] Built target BOMsForForecasterTesttst
[ 93%] Built target UnconstrainerTesttst
[ 96%] Built target ForecasterTesttst
[100%] Built target OptimiseTesttst
Scanning dependencies of target check_rmoltst
Test project /home/user/dev/sim/rmol/rmolgithub/build/test/rmol
    Start 1: UnconstrainerTesttst
1/4 Test #1: UnconstrainerTesttst .............   Passed    0.04 sec
    Start 2: ForecasterTesttst
2/4 Test #2: ForecasterTesttst ................   Passed    0.04 sec
    Start 3: OptimiseTesttst
3/4 Test #3: OptimiseTesttst ..................   Passed    0.44 sec
    Start 4: BOMsForForecasterTesttst
4/4 Test #4: BOMsForForecasterTesttst .........   Passed    0.02 sec

100% tests passed, 0 tests failed out of 4

Total Test time (real) =   0.78 sec
[100%] Built target check_rmoltst
Scanning dependencies of target check
[100%] Built target check
```

Check if all the executed tests PASSED. If not, please contact us by filling a bug-report.

Finally, you should install the compiled and linked library, include files and (optionally) HTML and PDF documentation by typing:

```
make install
```

Depending on the PREFIX settings during configuration, you might need the root (administrator) access to perform this step.

Eventually, you might invoke the following command

```
make clean
```

to remove all files created during compilation process, or even

```
cd ~/dev/sim/rmolgit
rm -rf build && mkdir build
cd build
```

to remove everything.

10 Linking with RMOL

10.1 Table of Contents

10.2 Introduction

There are two convenient methods of linking your programs with the RMOL library. The first one employs the `'pkg-config'` command (see http://pkgconfig.freedesktop.org/), whereas the second one uses `'rmol-config'` script. These methods are shortly described below.

10.3 Using the pkg-config command

`'pkg-config'` is a helper tool used when compiling applications and libraries. It helps you insert the correct compiler and linker options. The syntax of the `'pkg-config'` is as follows:

```
pkg-config <options> <library_name>
```

For instance, assuming that you need to compile an RMOL based program `'my_prog.cpp'`, you should use the following command:

```
g++ `pkg-config --cflags rmol` -o my_prog my_prog.cpp `pkg-config --libs rmol`
```

For more information see the `'pkg-config'` man pages.

10.4 Using the rmol-config script

RMOL provides a shell script called `'rmol-config'`, which is installed by default in `'$prefix/bin'` (`'/usr/local/bin'`) directory. It can be used to simplify compilation and linking of RMOL based programs. The usage of this script is quite similar to the usage of the `'pkg-config'` command.

Assuming that you need to compile the program `'my_prog`.cpp' you can now do that with the following command:

```
g++ `rmol-config --cflags` -o my_prog_opt my_prog.cpp `rmol-config --libs`
```

A list of `'rmol-config'` options can be obtained by typing:

```
rmol-config --help
```

If the `'rmol-config'` command is not found by your shell, you should add its location `'$prefix/bin'` to the `PATH` environment variable, e.g.:

```
export PATH=/usr/local/bin:$PATH
```

10.5 M4 macro for the GNU Autotools

A M4 macro file is delivered with RMOL, namely 'rmol.m4', which can be found in, e.g., '/usr/share/aclocal'. When used by a 'configure' script, thanks to he `'AM_PATH_RMOL'` macro (specified in the M4 macro file), the following Makefile variables are then defined:

- `'RMOL_VERSION'` (e.g., defined to 0.23.0)
- `'RMOL_CFLAGS'` (e.g., defined to `'-I${prefix}/include'`)
- `'RMOL_LIBS'` (e.g., defined to `'-L${prefix}/lib -lrmol'`)

10.6 Using RMOL with dynamic linking

When using static linking some of the library routines in RMOL are copied into your executable program. This can lead to unnecessary large executables. To avoid having too large executable files you may use dynamic linking instead. Dynamic linking means that the actual linking is performed when the program is executed. This requires that the system is able to locate the shared RMOL library file during your program execution. If you install the RMOL library using a non-standard prefix, the `'LD_LIBRARY_PATH'` environment variable might be used to inform the linker of the dynamic library location, e.g.:

```
export LD_LIBRARY_PATH=<RMOL installation prefix>/lib:$LD_LIBRARY_PATH
```

11 Test Rules

This section describes rules how the functionality of the IT++ library should be verified. In the `'tests'` subdirectory test files are provided. All functionality should be tested using these test files.

11.1 The Test File

Each new IT++ module/class should be accompanied with a test file. The test file is an implementation in C++ that tests the functionality of a function/class or a group of functions/classes called modules. The test file should test relevant parameter settings and input/output relations to guarantee correct functionality of the corresponding classes/functions. The test files should be maintained using version control and updated whenever new functionality is added to the IT++ library.

The test file should print relevant data to a standard output that can be used to verify the functionality. All relevant parameter settings should be tested.

The test file should be placed in the `'tests'` subdirectory and should have a name ending with `'_test.cpp'`.

11.2 The Reference File

Consider a test file named `'module_test.cpp'`. A reference file named `'module_test.ref'` should accompany the test file. The reference file contains a reference printout of the standard output generated when running the test program. The reference file should be maintained using version control and updated according to the test file.

11.3 Testing IT++ Library

One can compile and execute all test programs from `'tests'` subdirectory by typing

```
% make check
```

after successful compilation of the IT++ library.

12 Users Guide

12.1 Table of Contents

12.2 Introduction

The RMOL library contains classes for revenue management. This document does not cover all the aspects of the RMOL library. It does however explain the most important things you need to know in order to start using RMOL.

12.3 Get Started

12.3.1 Get the RMOL library

12.3.2 Build the RMOL project

To run the configuration script the first time, go to the top directory (where the RMOL package has been un-packed), and issue the following command:

- `mkdir -p build && cd build && cmake ..`
- `make`

Note

The RMOL project can either be cloned from the `Git Repository` or downloaded as a tar-ball package from the `Sourceforge Web site`.

12.3.3 Build and Run the Tests

12.3.4 Install the RMOL Project (Binaries, Documentation)

12.4 Exploring the Predefined BOM Tree

`RMOL` predefines a BOM (Business Object Model) tree specific to the airline IT arena.

12.4.1 Forecaster BOM Tree

- `RMOL::EMDetruncator`
- `RMOL::Detruncator`
- `RMOL::Forecaster`

12.4.2 Optimiser BOM Tree

- `RMOL::DPOptimiser`
- `RMOL::MCOptimiser`
- `RMOL::Optimiser`

12.5 Extending the BOM Tree

13 Supported Systems

13.1 Table of Contents

13.2 Introduction

This page is intended to provide a list of RMOL supported systems, i.e. the systems on which configuration, installation and testing process of the RMOL library has been sucessful. Results are grouped based on minor release number. Therefore, only the latest tests for bug-fix releases are included. Besides, the information on this page is divided into sections dependent on the operating system.

Where necessary, some extra information is given for each tested configuration, e.g. external libraries installed, configuration commands used, etc.

If you manage to compile, install and test the RMOL library on a system not mentioned below, please let us know, so we could update this database.

13.3 RMOL 0.23.x

13.3.1 Linux Systems

13.3.1.1 Fedora Core 4 with ATLAS

- **Platform**: Intel Pentium 4

- **Operating System**: Fedora Core 4 (x86)
- **Compiler**: g++ (GCC) 4.0.2 20051125
- **RMOL release**: 0.23.0
- **External Libraries**: From FC4 distribution:
  - `fftw3.i386-3.0.1-3`
  - `fftw3-devel.i386-3.0.1-3`
  - `atlas-sse2.i386-3.6.0-8.fc4`
  - `atlas-sse2-devel.i386-3.6.0-8.fc4`
  - `blas.i386-3.0-35.fc4`
  - `lapack.i386-3.0-35.fc4`
- **Tests Status**: All tests PASSED
- **Comments**: RMOL configured with:

```
% CXXFLAGS="-O3 -pipe -march=pentium4" ./configure
```

- **Date**: March 7, 2006
- **Tester**: Tony Ottosson

13.3.1.2 Gentoo Linux with ACML

- **Platform**: AMD Sempron 3000+
- **Operating System**: Gentoo Linux 2006.0 (x86 arch)
- **Compiler(s)**: g++ (GCC) 3.4.5
- **RMOL release**: 0.23.1
- **External Libraries**: Compiled and installed from portage tree:
  - `sci-libs/acml-3.0.0`
- **Tests Status**: All tests PASSED
- **Comments**: BLAS and LAPACK libs set by using the following system commands:

```
% eselect blas set ACML
% eselect lapack set ACML
```

RMOL configured with:

```
% export CPPFLAGS="-I/usr/include/acml"
% ./configure --with-blas="-lblas"
```

- **Date**: March 31, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.1.3 Gentoo Linux with ATLAS

- **Platform**: Intel Pentium M Centrino
- **Operating System**: Gentoo Linux 2006.0 (x86)
- **Compiler**: g++ (GCC) 3.4.5
- **RMOL release**: 0.23.1
- **External Libraries**: Compiled and installed from portage tree:
  - `sci-libs/fftw-3.1`
  - `sci-libs/blas-atlas-3.6.0-r1`
  - `sci-libs/lapack-atlas-3.6.0`
- **Tests Status**: All tests PASSED
- **Comments**: BLAS and LAPACK libs set by using the following system commands:

```
% eselect blas set ATLAS
% eselect lapack set ATLAS
```

RMOL configured with:

```
% ./configure --with-blas="-lblas"
```

- **Date**: March 31, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.1.4 Gentoo Linux with MKL

- **Platform**: Intel Pentium M Centrino
- **Operating System**: Gentoo Linux 2006.0 (x86 arch)
- **Compiler**: g++ (GCC) 3.4.5
- **RMOL release**: 0.23.0
- **External Libraries**: Intel Math Kernel Library (MKL) 8.0.1 installed manually in the following directory: `/opt/intel/mkl/8.0.1`
- **Tests Status**: All tests PASSED
- **Comments**: RMOL configured using the following commands:

```
% export LDFLAGS="-L/opt/intel/mkl/8.0.1/lib/32"
% export CPPFLAGS="-I/opt/intel/mkl/8.0.1/include"
% ./configure
```

- **Date**: February 28, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.1.5 Gentoo Linux with NetLib's BLAS and LAPACK

- **Platform**: Intel Pentium M Centrino
- **Operating System**: Gentoo Linux 2006.0 (x86)
- **Compiler**: g++ (GCC) 3.4.5
- **RMOL release**: 0.23.1
- **External Libraries**: Compiled and installed from portage tree:
  - `sci-libs/fftw-3.1`
  - `sci-libs/blas-reference-19940131-r2`
  - `sci-libs/cblas-reference-20030223`
  - `sci-libs/lapack-reference-3.0-r2`
- **Tests Status**: All tests PASSED
- **Comments**: BLAS and LAPACK libs set by using the following system commands:

```
% blas-config reference
% lapack-config reference
```

  RMOL configured with:

```
% ./configure --with-blas="-lblas"
```

- **Date**: March 31, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.1.6 Red Hat Enterprise Linux with RMOL External

- **Platform**: Intel Pentium 4
- **Operating System**: Red Hat Enterprise Linux AS release 4 (Nahant Update 2)
- **Compiler**: g++ (GCC) 3.4.4 20050721 (Red Hat 3.4.4-2)
- **RMOL release**: 0.23.0
- **External Libraries**: BLAS, CBLAS, LAPACK and FFTW libraries from RMOL External 2.1.1 package
- **Tests Status**: All tests PASSED
- **Date**: March 7, 2006
- **Tester**: Erik G. Larsson

13.3.1.7 SUSE Linux 10.0 with NetLib's BLAS and LAPACK

- **Platform**: Intel Pentium 4 CPU 3.20GHz (64-bit)
- **Operating System**: SUSE Linux 10.0 (x86_64)
- **Compiler(s)**: g++ (GCC) 4.0.2
- **RMOL release**: 0.23.0
- **External Libraries**: BLAS, LAPACK and FFTW libraries installed from OpenSuse 10.0 RPM repository:
  - `blas-3.0-926`
  - `lapack-3.0-926`
  - `fftw3-3.0.1-114`
  - `fftw3-threads-3.0.1-114`
  - `fftw3-devel-3.0.1-114`
- **Tests Status**: All tests PASSED
- **Comments**: RMOL configured with:

```
% export CXXFLAGS="-m64 -march=nocona -O3 -pipe"
% ./configure --with-lapack="/usr/lib64/liblapack.so.3"
```

- **Date**: March 1, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.1.8 SUSE Linux 10.0 with MKL

- **Platform**: Intel Pentium 4 CPU 3.20GHz (64-bit)
- **Operating System**: SUSE Linux 10.0 (x86_64)
- **Compiler(s)**: g++ (GCC) 4.0.2
- **RMOL release**: 0.23.0
- **External Libraries**: Intel Math Kernel Library (MKL) 8.0.1 installed manually in the following directory: `/opt/intel/mkl/8.0.1`
- **Tests Status**: All tests PASSED
- **Comments**: RMOL configured with:

```
% export CXXFLAGS="-m64 -march=nocona -O3 -pipe"
% export LDFLAGS="-L/opt/intel/mkl/8.0.1/lib/em64t"
% export CPPFLAGS="-I/opt/intel/mkl/8.0.1/include"
% ./configure
```

- **Date**: March 1, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.2 Windows Systems

13.3.2.1 Microsoft Windows XP with Cygwin

- **Platform**: AMD Sempron 3000+
- **Operating System**: Microsoft Windows XP SP2, Cygwin 1.5.19-4
- **Compiler(s)**: g++ (GCC) 3.4.4 (cygming special)
- **RMOL release**: 0.23.1
- **External Libraries**: Installed from Cygwin's repository:
  - `fftw-3.0.1-2`
  - `fftw-dev-3.0.1-1`
  - `lapack-3.0-4`
- **Tests Status**: All tests PASSED
- **Comments**: Only static library can be built. RMOL configured with:

```
% ./configure
```

- **Date**: March 31, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.2.2 Microsoft Windows XP with Cygwin and ATLAS

- **Platform**: AMD Sempron 3000+
- **Operating System**: Microsoft Windows XP SP2, Cygwin 1.5.19-4
- **Compiler(s)**: g++ (GCC) 3.4.4 (cygming special)
- **RMOL release**: 0.23.1
- **External Libraries**: Installed from Cygwin's repository:
  - `fftw-3.0.1-2`
  - `fftw-dev-3.0.1-1`

  ATLAS BLAS and LAPACK libraries from RMOL External 2.1.1 package configured using:

```
% ./configure --enable-atlas --disable-fftw
```

- **Tests Status**: All tests PASSED
- **Comments**: Only static library can be built. RMOL configured with:

```
% export LDFLAGS="-L/usr/local/lib"
% ./configure
```

- **Date**: March 31, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.2.3 Microsoft Windows XP with Cygwin and ACML

- **Platform**: AMD Sempron 3000+
- **Operating System**: Microsoft Windows XP SP2, Cygwin 1.5.19-4
- **Compiler(s)**: g++ (GCC) 3.4.4 (cygming special)
- **RMOL release**: 0.23.2
- **External Libraries**: ACML version 3.1.0 (`acml3.1.0-32-win32-g77.exe`) installed into a default directory, i.e. `"c:\Program Files\AMD\acml3.1.0"`
- **Tests Status**: All tests PASSED
- **Comments**: Only static library can be built. RMOL configured with:

```
% export LDFLAGS="-L/cygdrive/c/Progra~1/AMD/acml3.1.0/gnu32/lib"
% export CPPFLAGS="-I/cygdrive/c/Progra~1/AMD/acml3.1.0/gnu32/include"
% ./configure --enable-debug
```

- **Date**: May 15, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.2.4 Microsoft Windows XP with MinGW, MSYS and ACML

- **Platform**: AMD Sempron 3000+
- **Operating System**: Microsoft Windows XP SP2, MinGW 5.0.2, MSYS 1.0.10
- **Compiler(s)**: g++ (GCC) 3.4.4 (mingw special)
- **RMOL release**: 0.23.2
- **External Libraries**: ACML version 3.1.0 (`acml3.1.0-32-win32-g77.exe`) installed into a default directory, i.e. `"c:\Program Files\AMD\acml3.1.0"`
- **Tests Status**: All tests PASSED
- **Comments**: Only static library can be built. RMOL configured with:

```
% export LDFLAGS="-L/c/Progra~1/AMD/acml3.1.0/gnu32/lib"
% export CPPFLAGS="-I/c/Progra~1/AMD/acml3.1.0/gnu32/include"
% ./configure --enable-debug
```

- **Date**: May 15, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.2.5 Microsoft Windows XP with MinGW, MSYS and RMOL External

- **Platform**: AMD Sempron 3000+
- **Operating System**: Microsoft Windows XP SP2, MinGW 5.0.2, MSYS 1.0.10
- **Compiler(s)**: g++ (GCC) 3.4.4 (mingw special)
- **RMOL release**: 0.23.5
- **External Libraries**: BLAS, CBLAS, LAPACK and FFTW libraries from RMOL External 2.2.0 package
- **Tests Status**: All tests PASSED
- **Comments**: Only static library can be built. RMOL configured with:

```
% export LDFLAGS="-L/usr/local/lib"
% export CPPFLAGS="-I/usr/local/include"
% export CXXFLAGS="-Wall -O3 -march=athlon-tbird -pipe"
% ./configure --disable-html-doc
```

- **Date**: August 11, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.2.6 Microsoft Windows XP with MS Visual C++ and Intel MKL

- **Platform**: AMD Sempron 3000+
- **Operating System**: Microsoft Windows XP SP2
- **Compiler(s)**: Microsoft Visual C++ 2005 .NET
- **RMOL release**: 0.23.5
- **External Libraries**: Intel Math Kernel Library (MKL) 8.1 installed manually in the following directory: `"C:\Program Files\Intel\MKL\8.1"`
- **Tests Status**: Not fully tested. Some RMOL based programs compiled and run with success.
- **Comments**: Only static library can be built. RMOL built by opening the `"win32\rmol.vcproj"` project file in MSVC++ and executing `"Build -> Build Solution"` command from menu.
- **Date**: August 11, 2006
- **Tester**: Adam Piatyszek (ediap)

13.3.3 Unix Systems

13.3.3.1 SunOS 5.9 with RMOL External

- **Platform**: SUNW, Sun-Blade-100 (SPARC)
- **Operating System**: SunOS 5.9 Generic_112233-10
- **Compiler(s)**: g++ (GCC) 3.4.5
- **RMOL release**: 0.23.2
- **External Libraries**: BLAS, CBLAS, LAPACK and FFTW libraries from RMOL External 2.1.1 package. The following configuration command has been used:

```
% export CFLAGS="-mcpu=ultrasparc -O2 -pipe -funroll-all-loops"
% ./configure
```

- **Tests Status**: All tests PASSED
- **Comments**: RMOL configured with:

```
% export LDFLAGS="-L/usr/local/lib"
% export CPPFLAGS="-I/usr/local/include"
% export CXXFLAGS="-mcpu=ultrasparc -O2 -pipe"
% ./configure --enable-debug
```

- **Date**: May 15, 2006
- **Tester**: Adam Piatyszek (ediap)

14 RMOL Supported Systems (Previous Releases)

14.1 RMOL 3.9.1

14.2 RMOL 3.9.0

14.3 RMOL 3.8.1

15 BPSK modulation over an AWGN channel

As a first example we will generate a sequence of 500000 random bits {0,1} and BPSK modulate these. Thereafter the BPSK signals will be transmitted over an AWGN channel with a signal-to-noise ratio $E_b/N_0 = 0$ dB. The received signal is then decoded and the number of bit errors are calculated.

```
#include <itpp/itcomm.h>

using namespace itpp;
```

```
//These lines are needed for use of cout and endl
using std::cout;
using std::endl;

int main()
{
  //Scalars
  int N;
  double N0;

  //Vectors
  bvec bits, dec_bits;
  vec symbols, rec;

  //Classes
  BPSK bpsk;  //The BPSK modulator/debodulator class
  BERC berc;  //The Bit Error Rate Counter class

  //Init
  N = 500000; //The number of bits to simulate
  N0 = 1;     //0 dB SNR

  //Randomize the random number generator
  RNG_randomize();

  //Generate the bits:
  bits = randb(N);

  //Do the BPSK modulation
  bpsk.modulate_bits(bits, symbols);

  //Add the AWGN
  rec = symbols + sqrt(N0/2)* randn(N);

  //Decode the received bits
  bpsk.demodulate_bits(rec, dec_bits);

  //Count the number of errors
  berc.count(bits,dec_bits);

  //Print the results
  cout << "There were " << berc.get_errors() << " received bits in error." << end
      l;
  cout << "There were " << berc.get_corrects() << " correctly received bits." <<
      endl;
  cout << "The error probability was " << berc.get_errorrate() << endl;
  cout << "The theoretical error probability is " << 0.5*erfc(1.0) << endl;

  //Exit program:
  return 0;

}
```

When you run this program, the output will look something like this:

```
There were 39224 received bits in error.
There were 460776 correctly received bits.
The error probability was 0.078448
The theoretical error probability is 0.0786496
```

16 Simulation of a convolutional encoder and decoder

In this example we will show how to use the convolutional encoder/decoder class in it++. The Viterbi decoder uses the soft received values.

```
#include <itpp/itcomm.h>

using namespace itpp;

//These lines are needed for use of cout and endl
using std::cout;
using std::endl;

int main()
{
  //Scalars
  int constraint_length, MaxNrofErrors, Nobits, MaxIterations, p, i;
  double Ec, Eb;

  //Vectors
  ivec generators;
  vec EbN0dB, EbN0, N0, ber, trans_symbols, rec_symbols;
  bvec uncoded_bits, coded_bits, decoded_bits;

  //Classes
  BPSK bpsk;
  BERC berc;
  Convolutional_Code conv_code;
  AWGN_Channel channel;

  /*
  Set up the convolutional encoder/decoder class:
  The generators are given in octal form by adding a zero in front of the numbers
      .
  In this example we will simulate a rate 1/3 code that is listed in J. G. Proaki
      s,
  "Digital communications". The encoder has constraint length 7.
  */
  generators.set_size(3,false);
  generators(0) = 0133;
  generators(1) = 0145;
  generators(2) = 0175;
  constraint_length = 7;
  conv_code.set_generator_polynomials(generators, constraint_length);

  //Init: Calculate some simulation specific parameters:
  Ec = 1.0;
  EbN0dB = linspace(-2,6,5);
  EbN0 = inv_dB(EbN0dB);
  Eb = Ec / conv_code.get_rate();
  N0 = Eb * pow(EbN0,-1);
  MaxNrofErrors = 100;
  Nobits = 10000;
  MaxIterations = 10;
  ber.set_size(EbN0dB.length(),false);
  ber.clear();

  //Randomize the random number generators.
  RNG_randomize();

  for (p=0; p<EbN0dB.length(); p++) {
```

```
    cout << "Now simulating point " << p+1 << " out of " << EbN0dB.length() << en
      dl;
    berc.clear();                 //Clear the bit error rate counter.
    channel.set_noise(N0(p)/2.0); //Set the noise value of the AWGN channel.

    for (i=0; i<MaxIterations; i++) {

      uncoded_bits = randb(Nobits);                    //The uncoded bits.
      coded_bits = conv_code.encode(uncoded_bits);     //The convolutional encoder
       function.
      bpsk.modulate_bits(coded_bits, trans_symbols); //The BPSK modulator.
      rec_symbols = channel( trans_symbols );          //The AWGN channel.
      decoded_bits = conv_code.decode(rec_symbols);    //The Viterbi decoder funct
      ion.
      berc.count(uncoded_bits,decoded_bits);           //Count the errors.
      ber(p) = berc.get_errorrate();

      //Break the simulation on this point if sufficient number of bit errors wer
      e observed:
      if (berc.get_errors()>MaxNrofErrors) {
        cout << "Breaking on point " << p+1 << " with " << berc.get_errors() << "
       errors." << endl; break;
      }

    }
  }

  //Print the results:
  cout << "BER    = " << ber  << endl;
  cout << "EbN0dB = " << EbN0dB << endl;

  //Exit program:
  return 0;

}
```

When you run this program, the output will look something like this:

```
Now simulating point 1 out of 5
Breaking on point 1 with 3297 errors.
Now simulating point 2 out of 5
Breaking on point 2 with 781 errors.
Now simulating point 3 out of 5
Breaking on point 3 with 112 errors.
Now simulating point 4 out of 5
Now simulating point 5 out of 5
BER    = [0.330858 0.0783743 0.00280983 0 0]
EbN0dB = [-2 0 2 4 6]
```

17 Interleaving and de-interleaving of data

This example shows how to use one of the interleaving classes.

```
#include <itpp/itcomm.h>

using namespace itpp;
```

```
//These lines are needed for use of cout and endl
using std::cout;
using std::endl;

int main()
{
  //Declare scalars and vectors:
  int rows, cols;
  ivec input, output, deinterleaved;

  //Declare the interleaver. The interleaver classes are templated, and therefore
       we must specify
  //the type of the data elements. In this example we are using integers:
  Block_Interleaver<int> my_interleaver;

  //Initialize the interleaver class. Note that this can be done already in the d
      eclaration by writing
  //Block_Interleaver<int> my_interleaver(rows,cols);
  rows = 4;
  cols = 5;
  my_interleaver.set_rows(rows);
  my_interleaver.set_cols(cols);

  //Define the input to the interleaver:
  input = "1:20";

  //Do the interleaving:
  output = my_interleaver.interleave(input);

  //Do the de-interleaving:
  deinterleaved = my_interleaver.deinterleave(output);

  //Print the results:
  cout << "input = " << input << endl;
  cout << "output = " << output << endl;
  cout << "deinterleaved = " << deinterleaved << endl;

  //Exit program:
  return 0;

}
```

When you run this program, the output will look like this:

```
input = [1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20]
output = [1 5 9 13 17 2 6 10 14 18 3 7 11 15 19 4 8 12 16 20]
deinterleaved = [1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20]
```

18 Writing and reading data from files

Here we will use the `it_file` class to store some data. The program `write_it_file.cpp` looks as follows:

```
#include <itpp/itcomm.h>

using namespace itpp;
```

```
int main()
{
  // Declare the it_file class
  it_file ff;

  // Open a file with the name "it_file_test.it"
  ff.open("it_file_test.it");

  // Create some data to put into the file
  vec a = linspace(1, 20, 20);

  // Put the variable a into the file. The Name("a") tells the file class
  // that the next variable shall be named "a".
  ff << Name("a") << a;

  // Force the file to be written to disc. This is useful when performing
  // iterations and ensures that the information is not stored in any cache
  // memory. In this simple example it is not necessary to flush the file.
  ff.flush();

  // Close the file
  ff.close();

  // Exit program
  return 0;
}
```

When you run this program you will obtain a file called `it_file_test.it` in your current directory. You can read the file into Matlab/Octave to view the data by using the following commands:

```
itload('it_file_test.it')
figure(1); clf;
plot(a)
```

Note: Make sure that `$PREFIX/share/itpp` is in your Matlab/Octave path and that you run the code above from the directory where `it_file_test.it` is located (`$PREFIX` is the IT++ installation prefix; `/usr/local` by default).

The IT++ program `read_it_file.cpp` that reads the file and prints its content can look like this:

```
#include <itpp/itcomm.h>

using namespace itpp;

int main()
{
  // Declare the it_file class
  it_file ff;

  // Open the file "it_file_test.it" for reading
  ff.open("it_file_test.it");

  // Read the variable a from the file. Put result in vector a.
  vec a;
  ff >> Name("a") >> a;
```

```
  // Print the result
  std::cout << "a = " << a << std::endl;

  // Exit the program
  return 0;
}
```

Here is the output of the program:

```
a = [1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20]
```

19 Simulation of LDPC codes the AWGN channel

This program simulates the performance of LDPC codes on the AWGN channel. Since the channel is symmetric, the zero codeword is used.

```
#include <itpp/itcomm.h>

using namespace std;
using namespace itpp;

extern int main(int argc, char **argv)
{
  int Nbits=1000*1000*5000;          // maximum number of bits simulated for any
      SNR point
  int Nbers=2000;                   // target number of bit errors per SNR point
  double BERmin=1e-6;               // BER at which to terminate simulation
  vec EbN0db = "0.6:0.2:5";

  LDPC_Code C(argv[1]);
  bool single_snr_mode=false;
  if (argc==3) {
    double x;
    sscanf(argv[2],"%lf",&x);
    EbN0db.set_size(1);
    EbN0db(0)=x;
    single_snr_mode=true;
  }

  cout << "Running with Eb/N0: " << EbN0db << endl;

  // High performance: 2500 iterations, high resolution LLR algebra
  C.setup_decoder("bp","2500 1 0");

  // Alt. setting -- High speed: 50 iterations, logmax approximation
  // C.setup_decoder("bp","50 1 0",LLR_calc_unit(12,0,7));

  cout << C << endl;

  int N = C.get_nvar();             // number of bits per codeword
  BPSK Mod;
  bvec bitsin = zeros_b(N);
  vec s = Mod.modulate_bits(bitsin);

  RNG_randomize();
  for (int j=0; j<length(EbN0db); j++) {
    // noise variance is N0/2 per dimension
```

```
    double N0 = pow(10.0,-EbN0db(j)/10.0) / C.get_rate();
    AWGN_Channel chan(N0/2);
    BERC berc; // counters for coded and uncoded BER
    BLERC ferc; // counter for coded FER
    ferc.set_blocksize(N);
    for (long int i=0; i<Nbits; i+=C.get_nvar())   {
      // Received data
      vec x = chan(s);

      // Demodulate
      vec softbits=Mod.demodulate_soft_bits(x,N0);

      //Decode the received bits
      bvec bitsout=C.decode(softbits);

      //Count the number of errors
      berc.count(bitsin,bitsout);
      ferc.count(bitsin,bitsout);

      if (single_snr_mode) {
        cout << "Eb/N0=" << EbN0db(j) << "  Simulated "
             << ferc.get_total_blocks() << " frames and "
             << berc.get_total_bits() << " bits. "
             << "Obtained " << berc.get_errors() << " bit errors. "
             << " BER: " << berc.get_errorrate()
             << " FER: " << ferc.get_errorrate() << endl;
        cout.flush();
      }      else       {
          if (berc.get_errors()>Nbers) { break;}
      }
    }

    cout << "Eb/N0=" << EbN0db(j) << "  Simulated "
         << ferc.get_total_blocks() << " frames and "
         << berc.get_total_bits() << " bits. "
         << "Obtained " << berc.get_errors() << " bit errors. "
         << " BER: " << berc.get_errorrate()
         << " FER: " << ferc.get_errorrate() << endl;
    cout.flush();
    if (berc.get_errorrate()<BERmin)  {  break;  }
  }
  return 0;
}
```

To simulate the code "RU_10000.it" over a range of SNR (see Generation of LDPC codes for how to generate codec)

```
./ldpc_bersim_awgn RU_10000.it
```

To simulate at Eb/N0=1.1 dB

```
./ldpc_bersim_awgn RU_10000.it 1.1
```

20 Generation of LDPC codes

```
// Generate some example LDPC codes
```

```
#include <itpp/itcomm.h>

using namespace itpp;
using namespace std;

extern int main(int argc, char **argv)
{
  { // This generates a random regular (3,6) code with 500 bits
    cout << "========= RANDOM (3,6) CODE ==========" << endl;
    LDPC_Parity_Matrix H;
    H.generate_regular_ldpc(500,3,6,
                            "rand",  // random unstructured matrix
                            "500 10");   // optimize girth
    H.display_stats();
    LDPC_Code C1(H);
    C1.save_to_file("random_3_6_code.it");
  }

  { // This is the code "204.33.484 (N=204,K=102,M=102,R=0.5)" from
    // David MacKay's database over sparse-graph code.  It can be
    // obtained with "wget
    // http://www.inference.phy.cam.ac.uk/mackay/codes/EN/C/204.33.484"
    cout << "========= MACKAY CODE ==========" << endl;
    LDPC_Parity_Matrix H("204.33.484","alist");
    H.display_stats();
    LDPC_Generator_Matrix G(H);
    LDPC_Code C(H,G);
    C.save_to_file("mackay_204.33.484.it");

    // Now produce a girth-optimized version of this code by removing
    // cycles. This slightly improves the performance at high SNR.
    H.cycle_removal_MGW(12);
    LDPC_Generator_Matrix G1(H);
    LDPC_Code C1(H,G1);
    C1.save_to_file("mackay_204.33.484_opt.it");
  }

  // Irregular 1/2-rate codes optimized for the AWGN channel. The
  // degree distributions are taken from Richardson & Urbanke,
  // Trans. IT 2001.

  { // 1000 bits
    cout << "========= IRREGULAR CODE 1000 BITS ==========" << endl;
    LDPC_Parity_Matrix H;
    H.generate_irregular_ldpc(1000,
                              "0 0.27684 0.28342 0 0 0 0 0 0.43974",
                              "0 0 0 0 0 0.01568 0.85244 0.13188",
                              "rand",   // random unstructured matrix
                              "500 8"); // optimize girth
    LDPC_Code C(H);
    C.save_to_file("RU_1000.it");
  }

  {  // 10000 bits (takes a few minutes to run)
    cout << "========= IRREGULAR CODE 10000 BITS ==========" << endl;
    LDPC_Parity_Matrix H;
    H.generate_irregular_ldpc(10000,"0 0.21991 0.23328 0.02058 0 0.08543 0.06540
      0.04767 \
                              0.01912 0 0 0 0 0 0 0 0 0.08064 0.22798",
                              "0 0 0 0 0 0 0 0.64854 0.34747 0.00399",
                              "rand",  // random unstructured matrix
                              "150 8"); // optimize
```

```
    LDPC_Code C(H);
    C.save_to_file("RU_10000.it");
  }

  { // 100000 bits (takes a while to run)
    cout << "========= IRREGULAR CODE 100000 BITS ==========" << endl;
    LDPC_Parity_Matrix H;
    H.generate_irregular_ldpc(100000,"0 0.1712 0.21053 0.00273 0 0 0.00009 0.1526
      9 0.09227 \
                              0.02802 0 0 0 0 0.01206 0 0 0 0 0 0 0 0 0 0 0 0 0 0
       0.07212 0 0 0 0 \
                              0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.25830",
                              "0 0 0 0 0 0 0 0 0.33620 0.08883 0.57497",
                              "rand",
                              "40 4");  // less aggressive optimization
    LDPC_Code C(H);
    C.save_to_file("RU_100000.it");
  }

  exit(0);

  { // 1000000 bits (THIS CODE REQUIRES ABOUT 450 MB TO STORE AND 2GB
    // INTERNAL MEMORY TO GENERATE)
    cout << "========= IRREGULAR CODE 1000000 BITS ==========" << endl;
    LDPC_Parity_Matrix H;
    H.generate_irregular_ldpc(1000000,"0 0.1712 0.21053 0.00273 0 0 0.00009 0.152
      69 0.09227 \
                              0.02802 0 0 0 0 0.01206 0 0 0 0 0 0 0 0 0 0 0 0 0 0
       0.07212 0 0 0 0 \
                              0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.25830",
                              "0 0 0 0 0 0 0 0 0.33620 0.08883 0.57497",
                              "rand",
                              "0 0");  // no optimization here
    LDPC_Code C(H);
    C.save_to_file("RU_1000000.it");
  }

}
```

21 Conversion table between IT++ syntax and Matlab/Octave

Here we provide a conversion table between Matlab/Octave and IT++ syntax. This table is intended to help with the transition from Matlab/Octave programming to IT++, but it is not an exhaustive list of possible operations.

In what follows,

- a, b denote vectors (assumed to be column vectors in Matlab/Octave notation),
- A, B denote matrices,
- x is a scalar,
- k, l, n are indices

Vector indexing and manipulation:

```
a.length()                          // length(a)
a(0)                                // a(1)
a(1)                                // a(2)
a(k-1)                              // a(k)
a(k-1)=x;  or a.set(k-1,x);         // a(k)=x;
a.left(k)                           // a(1:k)
a.right(k)                          // a(end-k+1:end)
a.mid(k,l)                          // a(k:k+l-1)
a.del(k);                           // a=[a(1:k-1); a(k+1:end)];
concat(a,b)                         // [a; b] (or [a.' b.'].')
a.clear();                          // a=zeros(size(a));  (or a=complex(zeros(si
      ze(a)));)
to_cmat(a)                          // complex(a)   (assuming a real-valued)
```

Note that indexing in IT++ starts at 0, whereas indexing in Matlab starts at 1. Also note that Matlab/Octave does distinguish between column and row vectors, whereas IT++ does not.

Matrix indexing and manipulation:

```
A.rows()                            // size(A,1)
A.cols()                            // size(A,2)
A(k-1,l-1)                          // A(k,l)
A.set(k-1,l-1,x);                   // A(k,l)=x;
A.get_col(k-1)                      // A(:,k)
A.get_row(k-1)                      // A(k,:)
A.set_col(k-1,a);                   // A(:,k)=a;
A.set_row(k-1,a);                   // A(k,:)=a;
A.append_row(a);                    // A=[A; a.'];
A.append_col(a);                    // A=[A a];
A.transpose()                       // A.'
A.hermitian_transpose()             // A'
A.clear();                          // A=zeros(size(A));  (or A=complex(zeros(si
      ze(A)));)
to_cmat(A)                          // complex(A)   (assuming a real-valued)
```

Some vector and matrix algebra:

```
a+b                                 // a+b
a-b                                 // a-b
elem_mult(a,b)                      // a.*b  (elementwise product)
a*b                                 // a.'*b (inner product)
conj(a)*b                           // a'*b (inner product)
outer_product(a,b)                  // a*b.' (outer product)
elem_div(a,b)                       // a./b
A+B;                                // A+B;
A-B;                                // A-B;
A*B;                                // A*B;
elem_mul(A,B)                       // A.*B
elem_div(A,B)                       // A./B
A\b;                                // ls_solve_od(A,b);    (assuming the system
       is overdetermined)
```

Special matrices and vectors:

```
zeros(n,n)                          // zeros(n,n)
zeros_c(n,n)                        // complex(zeros(n,n))
eye(n)                              // eye(n)
eye_c(n)                            // complex(eye(n))
linspace(alpha,beta,n)              // linspace(alpha,beta,n)
```

Hardcoded initializations:

```
mat X="1.1 1.2; 2.1; 2.2";          // X=[1.1 1.2; 2.1 2.2];
ivec a="1 2 3 4 5";                 // a=[1; 2; 3; 4; 5]; (or a=[1 2 3 4 5].';)
ivec a="1:-3:-8";                   // a=1:-3:-8;
```

22 MIMO (spatial multiplexing) with convolutional coding

This example demonstrates how to use the `Modulator_ND` (MIMO) class for soft-output demodulation. The program simulates a simple convolutionally coded spatial-multiplexing (V-BLAST style) MIMO system with maximum-likelihood, alternatively zero-forcing, demodulation and soft Viterbi decoding, but no iteration between the demodulator and the decoder.

```
#include <itpp/itcomm.h>

using std::cout;
using std::endl;
using namespace itpp;
using namespace std;

/* Zero-forcing detector with ad hoc soft information. This function
   applies the ZF (pseudoinverse) linear filter to the received
   data. This results in effective noise with covariance matrix
   inv(H'H)*sigma2.  The diagonal elements of this noise covariance
   matrix are taken as noise variances per component in the processed
   received data but the noise correlation is ignored.

 */

void ZF_demod(ND_UQAM &channel, ivec &LLR_apr,  ivec &LLR_apost, double sigma2, c
      mat &H, cvec &y)
{
  it_assert(H.rows()>=H.cols(),"ZF_demod() - underdetermined systems not tolerate
      d");
  cvec shat=ls_solve_od(H,y);                     // the ZF solution
  vec Sigma2=real(diag(inv(H.hermitian_transpose()*H)))*sigma2;  // noise covaria
      nce of shat
  cvec h(length(shat));
  for (int i=0; i<length(shat); i++) {
    shat(i) = shat(i)/sqrt(Sigma2(i));
    h(i) = 1.0/sqrt(Sigma2(i));
  }
  channel.map_demod(LLR_apr,LLR_apost,1.0,h,shat);
}


extern int main(int argc, char **argv)
{
  // -- modulation and channel parameters (taken from command line input) --
  int nC;                    // type of constellation  (1=QPSK, 2=16-QAM, 3=64-QA
      M)
  int nRx;                   // number of receive antennas
  int nTx;                   // number of transmit antennas
  int Tc;                    // coherence time (number of channel vectors with sa
      me H)
```

```
if (argc!=5) {
  cout << "Usage: cm nTx nRx nC Tc" << endl << "Example: cm 2 2 1 100000 (2x2 Q
    PSK MIMO on slow fading channel)" << endl;
  exit(1);
} else {
  sscanf(argv[1],"%i",&nTx);
  sscanf(argv[2],"%i",&nRx);
  sscanf(argv[3],"%i",&nC);
  sscanf(argv[4],"%i",&Tc);
}

cout << "Initializing.. " << nTx << " TX antennas, " << nRx << " RX antennas, "

     << (1<<nC) << "-PAM per dimension, coherence time " << Tc << endl;

// -- simulation control parameters --
const vec EbN0db = "-5:0.5:50";        // SNR range
const int Nmethods =2;                 // number of demodulators to try
const long int Nbitsmax=50*1000*1000;  // maximum number of bits to ever simula
    te per SNR point
const int Nu = 1000;                   // length of data packet (before applyin
    g channel coding)

int Nbers, Nfers;              // target number of bit/frame errors per SNR poi
    nt
double BERmin, FERmin;         // BER/FER at which to terminate simulation
if (Tc==1) {           // Fast fading channel, BER is of primary interest
  BERmin = 0.001;      // stop simulating a given method if BER<this value
  FERmin = 1.0e-10;    // stop simulating a given method if FER<this value
  Nbers = 1000;        // move to next SNR point after counting 1000 bit errors

  Nfers = 200;         // do not stop on this condition
} else {               // Slow fading channel, FER is of primary interest here
  BERmin = 1.0e-15;    // stop simulating a given method if BER<this value
  FERmin = 0.01;       // stop simulating a given method if FER<this value
  Nbers = -1;          // do not stop on this condition
  Nfers = 200;         // move to next SNR point after counting 200 frame error
    s
}

// -- Channel code parameters --
Convolutional_Code code;
ivec generator(3);
generator(0)=0133;  // use rate 1/3 code
generator(1)=0165;
generator(2)=0171;
double rate=1.0/3.0;
code.set_generator_polynomials(generator, 7);
bvec dummy;
code.encode_tail(randb(Nu),dummy);
const int Nc = length(dummy);      // find out how long the coded blocks are

// ============= Initialize ====================================

const int Nctx = (int) (2*nC*nTx*ceil(double(Nc)/double(2*nC*nTx)));   // Total
     number of bits to transmit
const int Nvec = Nctx/(2*nC*nTx);          // Number of channel vectors to tran
    smit
const int Nbitspvec = 2*nC*nTx;            // Number of bits per channel vector
```

```
// initialize MIMO channel with uniform QAM per complex dimension and Gray codi
    ng
ND_UQAM chan;
chan.set_Gray_QAM(nTx,1<<(2*nC));
cout << chan << endl;

// initialize interleaver
Sequence_Interleaver<bin> sequence_interleaver_b(Nctx);
Sequence_Interleaver<int> sequence_interleaver_i(Nctx);
sequence_interleaver_b.randomize_interleaver_sequence();
sequence_interleaver_i.set_interleaver_sequence(sequence_interleaver_b.get_inte
    rleaver_sequence());

//  RNG_randomize();

Array<cvec> Y(Nvec);         // received data
Array<cmat> H(Nvec/Tc+1);    // channel matrix (new matrix for each coherence in
    terval)

ivec Contflag = ones_i(Nmethods);   // flag to determine whether to run a given
     demodulator
if (pow(2.0,nC*2.0*nTx)>256) {      // ML decoder too complex..
  Contflag(1)=0;
}
if (nTx>nRx) {
  Contflag(0)=0;                    // ZF not for underdetermined systems
}
cout << "Running methods: " << Contflag << endl;

cout.setf(ios::fixed, ios::floatfield);
cout.setf(ios::showpoint);
cout.precision(5);

// ================== Run simulation ======================
for (int nsnr=0; nsnr<length(EbN0db); nsnr++) {
  const double Eb=1.0; // transmitted energy per information bit
  const double N0 = pow(10.0,-EbN0db(nsnr)/10.0);
  const double sigma2=N0;   // Variance of each scalar complex noise sample
  const double Es=rate*2*nC*Eb; // Energy per complex scalar symbol
  // (Each transmitted scalar complex symbol contains rate*2*nC
  // information bits.)
  const double Ess=sqrt(Es);

  Array<BERC> berc(Nmethods);  // counter for coded BER
  Array<BERC> bercu(Nmethods); // counter for uncoded BER
  Array<BLERC> ferc(Nmethods); // counter for coded FER

  for (int i=0; i<Nmethods; i++) {
    ferc(i).set_blocksize(Nu);
  }

  long int nbits=0;
  while (nbits<Nbitsmax) {
    nbits += Nu;

    // generate and encode random data
    bvec inputbits = randb(Nu);
    bvec txbits;
    code.encode_tail(inputbits, txbits);
    // coded block length is not always a multiple of the number of
    // bits per channel vector
    txbits=concat(txbits,randb(Nctx-Nc));
```

```
txbits = sequence_interleaver_b.interleave(txbits);

// -- generate channel and data ----
for (int k=0; k<Nvec; k++) {
  /* A complex valued channel matrix is used here. An
     alternative (with equivalent result) would be to use a
     real-valued (structured) channel matrix of twice the
     dimension.
  */
  if (k%Tc==0) {       // generate a new channel realization every Tc inter
vals
    H(k/Tc) = Ess*randn_c(nRx,nTx);
  }

  // modulate and transmit bits
  bvec bitstmp = txbits(k*2*nTx*nC,(k+1)*2*nTx*nC-1);
  cvec x=chan.modulate_bits(bitstmp);
  cvec e=sqrt(sigma2)*randn_c(nRx);
  Y(k) = H(k/Tc)*x+e;
}

// -- demodulate --
Array<QLLRvec> LLRin(Nmethods);
for (int i=0; i<Nmethods; i++) {
  LLRin(i) = zeros_i(Nctx);
}

QLLRvec llr_apr =zeros_i(nC*2*nTx);  // no a priori input to demodulator
QLLRvec llr_apost=zeros_i(nC*2*nTx);
for (int k=0; k<Nvec; k++) {
  // zero forcing demodulation
  if (Contflag(0)) {
    ZF_demod(chan,llr_apr,llr_apost,sigma2,H(k/Tc),Y(k));
    LLRin(0).set_subvector(k*Nbitspvec,(k+1)*Nbitspvec-1,llr_apost);
  }

  // ML demodulation
  if (Contflag(1)) {
    chan.map_demod(llr_apr, llr_apost, sigma2, H(k/Tc), Y(k));
    LLRin(1).set_subvector(k*Nbitspvec,(k+1)*Nbitspvec-1,llr_apost);
  }
}

// -- decode and count errors --
for (int i=0; i<Nmethods; i++) {
  bvec decoded_bits;
  if (Contflag(i)) {
    bercu(i).count(txbits(0,Nc-1),LLRin(i)(0,Nc-1)<0);  // uncoded BER
    LLRin(i) = sequence_interleaver_i.deinterleave(LLRin(i),0);
    // QLLR values must be converted to real numbers since the convolutiona
l decoder wants this
    vec llr=chan.get_llrcalc().to_double(LLRin(i).left(Nc));
    //      llr=-llr; // UNCOMMENT THIS LINE IF COMPILING WITH 3.10.5 OR EA
RLIER (BEFORE HARMONIZING LLR CONVENTIONS)
    code.decode_tail(llr,decoded_bits);
    berc(i).count(inputbits(0,Nu-1),decoded_bits(0,Nu-1));  // coded BER
    ferc(i).count(inputbits(0,Nu-1),decoded_bits(0,Nu-1));  // coded FER
  }
}

/* Check whether it is time to terminate the simulation.
 Terminate when all demodulators that are still running have
```

```
       counted at least Nbers or Nfers bit/frame errors. */
      int minber=1000000;
      int minfer=1000000;
      for (int i=0; i<Nmethods; i++) {
        if (Contflag(i)) {
          minber=min(minber,round_i(berc(i).get_errors()));
          minfer=min(minfer,round_i(ferc(i).get_errors()));
        }
      }
      if (Nbers>0 && minber>Nbers) { break;}
      if (Nfers>0 && minfer>Nfers) { break;}
    }

    cout << "-------------------------------------------------------" << endl;
    cout << "Eb/N0: " << EbN0db(nsnr) << " dB. Simulated " << nbits << " bits." <
      < endl;
    cout << " Uncoded BER: " << bercu(0).get_errorrate() << " (ZF);     " << berc
      u(1).get_errorrate() << " (ML)" << endl;
    cout << " Coded BER:   " << berc(0).get_errorrate()  << " (ZF);     " << berc
      (1).get_errorrate()  << " (ML)" << endl;
    cout << " Coded FER:   " << ferc(0).get_errorrate()  << " (ZF);     " << ferc
      (1).get_errorrate()  << " (ML)" << endl;
    cout.flush();

    /* Check wheter it is time to terminate simulation. Stop when all
    methods have reached the min BER/FER of interest. */
    int contflag=0;
    for (int i=0; i<Nmethods; i++) {
      if (Contflag(i)) {
        if (berc(i).get_errorrate()>BERmin)  {  contflag=1;  } else { Contflag(i)
      = 0; }
        if (ferc(i).get_errorrate()>FERmin)  {  contflag=1;  } else { Contflag(i)
      = 0; }
      }
    }
    if (contflag) { continue; } else {break; }
  }

  return 0;
}
```

To run the program,

```
mimoconv nTx nRx nC Tc
```

where

- nTx=number of transmit antennas
- nRx=number of receive antennas
- nC=constellation (1=QPSK, 2=16-QAM, 3=64-QAM)
- Tc=coherence time (channel uses)

23 Using Mixture of Gaussians (MOG) module to model data

This example demonstrates how to find the parameters of a MOG model via using the kmeans and EM based optimisers. Synthetic data is utilised.

```
#include <itpp/itstat.h>

#include <fstream>
#include <iostream>
#include <iomanip>
#include <ios>

using std::cout;
using std::endl;
using std::fixed;
using std::setprecision;

using namespace itpp;

int main() {

  bool print_progress = false;

  //
  // first, let's generate some synthetic data

  int N = 100000;  // number of vectors
  int D = 3;       // number of dimensions
  int K = 5;       // number of Gaussians

  Array<vec> X(N); for(int n=0;n<N;n++) { X(n).set_size(D); X(n) = 0.0; }

  // the means

  Array<vec> mu(K);
  mu(0) = "-6, -4, -2";
  mu(1) = "-4, -2,  0";
  mu(2) = "-2,  0,  2";
  mu(3) = " 0, +2, +4";
  mu(4) = "+2, +4, +6";


  // the diagonal variances

  Array<vec> var(K);
  var(0) = "0.1, 0.2, 0.3";
  var(1) = "0.2, 0.3, 0.1";
  var(2) = "0.3, 0.1, 0.2";
  var(3) = "0.1, 0.2, 0.3";
  var(4) = "0.2, 0.3, 0.1";

  cout << fixed << setprecision(3);
  cout << "user configured means and variances:" << endl;
  cout << "mu = " << mu << endl;
  cout << "var = " << var << endl;

  // randomise the order of Gaussians "generating" the vectors
  I_Uniform_RNG rnd_uniform(0, K-1);
  ivec gaus_id = rnd_uniform(N);

  ivec gaus_count(K); gaus_count = 0;
```

```
Array<vec> mu_test(K);  for(int k=0;k<K;k++) { mu_test(k).set_size(D); mu_test(
    k) = 0.0; }
Array<vec> var_test(K);  for(int k=0;k<K;k++) { var_test(k).set_size(D); var_te
    st(k) = 0.0; }

Normal_RNG rnd_normal;
for(int n=0;n<N;n++) {

  int k = gaus_id(n);
  gaus_count(k)++;

  for(int d=0;d<D;d++) {
    rnd_normal.setup( mu(k)(d), var(k)(d) );
    double tmp = rnd_normal();
    X(n)(d) = tmp;
    mu_test(k)(d) += tmp;
  }
}

//
// find the stats for the generated data

for(int k=0;k<K;k++) mu_test(k) /= gaus_count(k);

for(int n=0;n<N;n++) {
  int k = gaus_id(n);

  for(int d=0;d<D;d++) {
    double tmp = X(n)(d) - mu_test(k)(d);
    var_test(k)(d) += tmp*tmp;
  }
}

for(int k=0;k<K;k++)  var_test(k) /= (gaus_count(k)-1.0);

cout << endl << endl;
cout << fixed << setprecision(3);
cout << "stats for X:" << endl;

for(int k=0;k<K;k++) {
  cout << "k = " << k << "  count = " << gaus_count(k) << "  weight = " << gaus
    _count(k)/double(N) << endl;
  for(int d=0;d<D;d++) cout << "  d = " << d << "  mu_test = " << mu_test(k)(d)
     << "  var_test = " << var_test(k)(d) << endl;
  cout << endl;
}


// make a model with initial values (zero mean and unit variance)
// the number of gaussians and dimensions of the model is specified here

MOG_diag mog(K,D);

cout << endl;
cout << fixed << setprecision(3);
cout << "mog.avg_log_lhood(X) = " << mog.avg_log_lhood(X) << endl;

//
// find initial parameters via k-means (which are then used as seeds for EM bas
    ed optimisation)

cout << endl << endl;
```

```
  cout << "running kmeans optimiser" << endl << endl;

  MOG_diag_kmeans(mog, X, 10, 0.5, true, print_progress);

  cout << fixed << setprecision(3);
  cout << "mog.get_means() = " << endl << mog.get_means() << endl;
  cout << "mog.get_diag_covs() = " << endl << mog.get_diag_covs() << endl;
  cout << "mog.get_weights() = " << endl << mog.get_weights() << endl;

  cout << endl;
  cout << "mog.avg_log_lhood(X) = " << mog.avg_log_lhood(X) << endl;


  //
  // EM ML based optimisation

  cout << endl << endl;
  cout << "running ML optimiser" << endl << endl;

  MOG_diag_ML(mog, X, 10, 0.0, 0.0, print_progress);

  cout << fixed << setprecision(3);
  cout << "mog.get_means() = " << endl << mog.get_means() << endl;
  cout << "mog.get_diag_covs() = " << endl << mog.get_diag_covs() << endl;
  cout << "mog.get_weights() = " << endl << mog.get_weights() << endl;

  cout << endl;
  cout << "mog.avg_log_lhood(X) = " << mog.avg_log_lhood(X) << endl;

  return 0;
}
```

24 Simulation of QPSK modulation on an AWGN channel

In this example we will introduce a few new features compared to the BPSK example. We will use the it_ifile class to store the results of the simulation. We will use the Real_-Timer class to measure the execution time of our program. Furthermore we will use one of the channel classes, the AWGN_Channel. We will also show how to read the results in to Matlab with the load_it function. The program is as follows:

```
#include <itpp/itcomm.h>

using namespace itpp;

//These lines are needed for use of cout and endl
using std::cout;
using std::endl;

int main()
{
  //Declarations of scalars and vectors:
  int i, Number_of_bits;
  double Ec, Eb;
  vec EbN0dB, EbN0, N0, noise_variance, bit_error_rate; //vec is a vector contain
      ing double
  bvec transmitted_bits, received_bits;                 //bvec is a vector contai
      ning bits
  cvec transmitted_symbols, received_symbols;           //cvec is a vector contai
```

```
    ning double_complex

//Declarations of classes:
QPSK qpsk;                      //The QPSK modulator class
AWGN_Channel awgn_channel;      //The AWGN channel class
it_file ff;                     //For saving the results to file
BERC berc;                      //Used to count the bit errors
Real_Timer tt;                  //The timer used to measure the execution time

//Reset and start the timer:
tt.tic();

//Init:
Ec = 1.0;                       //The transmitted energy per QPSK symbol is 1.
Eb = Ec / 2.0;                  //The transmitted energy per bit is 0.5.
EbN0dB = linspace(0.0,9.0,10); //Simulate for 10 Eb/N0 values from 0 to 9 dB.
EbN0 = inv_dB(EbN0dB);          //Calculate Eb/N0 in a linear scale instead of d
    B.
N0 = Eb * pow(EbN0,-1.0);       //N0 is the variance of the (complex valued) noi
    se.
Number_of_bits = 100000;        //One hundred thousand bits is transmitted for e
    ach Eb/N0 value

//Allocate storage space for the result vector.
//The "false" argument means "Do not copy the old content of the vector to the
    new storage area."
bit_error_rate.set_size(EbN0dB.length(),false);

//Randomize the random number generators in it++:
RNG_randomize();

//Iterate over all EbN0dB values:
for (i=0; i<EbN0dB.length(); i++) {

  //Show how the simulation progresses:
  cout << "Now simulating Eb/N0 value number " << i+1 << " of " << EbN0dB.lengt
    h() << endl;

  //Generate a vector of random bits to transmit:
  transmitted_bits = randb(Number_of_bits);

  //Modulate the bits to QPSK symbols:
  transmitted_symbols = qpsk.modulate_bits(transmitted_bits);

  //Set the noise variance of the AWGN channel:
  awgn_channel.set_noise(N0(i));

  //Run the transmited symbols through the channel using the () operator:
  received_symbols = awgn_channel(transmitted_symbols);

  //Demodulate the received QPSK symbols into received bits:
  received_bits = qpsk.demodulate_bits(received_symbols);

  //Calculate the bit error rate:
  berc.clear();                                 //Clear the bit error rate counte
    r
  berc.count(transmitted_bits,received_bits); //Count the bit errors
  bit_error_rate(i) = berc.get_errorrate();   //Save the estimated BER in the r
    esult vector

}
```

```
  tt.toc();

  //Print the results:
  cout << endl;
  cout << "EbN0dB = " << EbN0dB << " [dB]" << endl;
  cout << "BER = " << bit_error_rate << endl;
  cout << "Saving results to ./qpsk_result_file.it" << endl;
  cout << endl;

  //Save the results to file:
  ff.open("qpsk_result_file.it");
  ff << Name("EbN0dB") << EbN0dB;
  ff << Name("ber") << bit_error_rate;
  ff.close();

  //Exit program:
  return 0;

}
```

When you run this program, the output will look something like this:

```
Now simulating Eb/N0 value number 1 of 10
Now simulating Eb/N0 value number 2 of 10
Now simulating Eb/N0 value number 3 of 10
Now simulating Eb/N0 value number 4 of 10
Now simulating Eb/N0 value number 5 of 10
Now simulating Eb/N0 value number 6 of 10
Now simulating Eb/N0 value number 7 of 10
Now simulating Eb/N0 value number 8 of 10
Now simulating Eb/N0 value number 9 of 10
Now simulating Eb/N0 value number 10 of 10
Elapsed time = 0.460899 seconds

EbN0dB = [0 1 2 3 4 5 6 7 8 9] [dB]
BER = [0.07968 0.0559 0.03729 0.02294 0.01243 0.0058 0.0025 0.00076 0.00013 6e-05
      ]
Saving results to ./qpsk_result_file.it
```

Now it is time to plot the simulation results in Matlab and compare with theory using the Matlab code below. The results will be stored in a file called "qpsk_result_file.it". Make sure load_it.m is in your Matlab path (look in /matlab) and that you run the example code below from the directory where qpsk_result_file.it is located

```
figure(1); clf;
load_it qpsk_result_file.it
h1 = semilogy(EbN0dB,ber,'*-r'); hold on
ebn0db = 0:.1:10;
ebn0 = 10.^(ebn0db/10);
Pb = 0.5 * erfc(sqrt(ebn0));
h2 = semilogy(ebn0db,Pb);
set(gca,'fontname','times','fontsize',16);
xlabel('{\it E_b} / {\it N}_0 [dB]');
ylabel('BER')
title('QPSK on an AWGN Channel');
legend([h1 h2],'Simulation','Theory');
grid on;
```

25 Generating a correlated Rayleigh fading process

In this example we will generate a correlated Rayleigh fading process with a normaized Doppler frequency equal to 0.1. The normalized Doppler is defined as the multiplication of the maximum Doppler frequency by the sampling time (i.e. $f_d = F_d T_s$).

```
#include <itpp/itcomm.h>

using namespace itpp;

int main()
{
  // Declare my_channel variable as an instance of the Rayleigh_Channel
  // class
  TDL_Channel my_channel;

  // The normalized Doppler frequency is set to 0.1
  double norm_dopp = 0.1;
  my_channel.set_norm_doppler(norm_dopp);

  // Generate nrof_samples of the fading process and store them in ch_coeffs
  // matrix
  int nrof_samples = 10000;
  cmat ch_coeffs;
  my_channel.generate(nrof_samples, ch_coeffs);

  // Open an output file "rayleigh_test.it"
  it_file ff("rayleigh_test.it");

  // Save channel coefficients to the output file
  ff << Name("ch_coeffs") << ch_coeffs;

  // Close the output file
  ff.close();

  // Exit program
  return 0;
}
```

You can use Matlab or Octave to examine the channel fading process that is stored int the output file `rayleigh_test.it`. Try the followigh code to view a part of the fading process:

```
itload("rayleigh_test.it")
figure(1); clf;
semilogy(abs(ch_coeffs(1:200)))
```

Note: Make sure that the folder `$PREFIX/share/itpp` is included your Matlab/Octave path variable (`$PREFIX` is the IT++ installation prefix: `/usr/local` by default).

26 Simulation of a Reed-Solomon Block Code

A Reed-Solomon code is a q^m-ary BCH code of length $q^m - 1$. The generator polynomial for a t-error correcting code is $g(x) = (x - \alpha)(x - \alpha^1)\ldots(x - \alpha^{2t-1})$. The decoder

uses the Berlkamp-Massey algorithm for decoding as described in: S. B. Wicker, "Error Control Systems for digital communication and storage," Prentice Hall. The following example simulates a binary (i.e. $q = 2$) Reed-Solomon code with parameters m and t:

```
#include <itpp/itcomm.h>

using namespace itpp;

//These lines are needed for use of cout and endl
using std::cout;
using std::endl;

int main()
{

  //Scalars and vectors:
  int m, t, n, k, q, NumBits, NumCodeWords;
  double p;
  bvec uncoded_bits, coded_bits, received_bits, decoded_bits;

  //Set parameters:
  NumCodeWords = 1000;  //Number of Reed-Solomon code-words to simulate
  p = 0.01;             //BSC Error probability
  m = 3;                //Reed-Solomon parameter m
  t = 2;                //Reed-Solomon parameter t

  cout << "Number of Reed-Solomon code-words to simulate: " <<  NumCodeWords << e
      ndl;
  cout << "BSC Error probability : " << p << endl;
  cout << "RS m: " << m << endl;
  cout << "RS t: " << t << endl;

  //Classes:
  Reed_Solomon reed_solomon(m,t);
  BSC bsc(p);
  BERC berc;

  RNG_randomize();

  //Calculate parameters for the Reed-Solomon Code:
  n = round_i(pow(2.0,m)-1);
  k = round_i(pow(2.0,m))-1-2*t;
  q = round_i(pow(2.0,m));

  cout << "Simulating an Reed-Solomon code with the following parameters:" << end
      l;
  cout << "n = " << n << endl;
  cout << "k = " << k << endl;
  cout << "q = " << q << endl;

  NumBits = m * k * NumCodeWords;
  uncoded_bits = randb(NumBits);
  coded_bits = reed_solomon.encode(uncoded_bits);
  received_bits = bsc(coded_bits);
  decoded_bits = reed_solomon.decode(received_bits);

  berc.count(uncoded_bits,decoded_bits);
  cout << "The bit error probability after decoding is " << berc.get_errorrate()
      << endl;

  //Exit program:
  return 0;
```

```
}
```

A typical run of this program can look like this:

```
Number of Reed-Solomon code-words to simulate: 1000
BSC Error probability : 0.01
RS m: 3
RS t: 2
Simulating an Reed-Solomon code with the following parameters:
n = 7
k = 3
q = 8
The bit error probability after decoding is 0.000333333
```

27 Simulation of a Multicode CDMA system on an AWGN channel

In this example we will introduce the multi-code spreading class `Multicode_Spread_2d`. This is the most general spreading class availiable in it++. Different spreading codes may be assigned to the I and Q branches. The number of multiple spreading codes and the spreading factor is determined by the number of rows and collumns respectively that is used when calling the member function set_codes. In this example we will use four Hadamard sequenced of length four, and the same spreading sequences will be used for the I and Q brances.

```
#include <itpp/itcomm.h>

using namespace itpp;

//These lines are needed for use of cout and endl
using std::cout;
using std::endl;

int main()
{
  //Scalars:
  int SF, Ncode, sc, i, j, NumOfBits, MaxIterations, MaxNrOfErrors, MinNrOfErrors
      ;
  double Eb;

  //Vectors and matrixes:
  vec EbN0dB, EbN0, N0, ber;
  smat all_codes, spread_codesI, spread_codesQ;
  bvec transmited_bits, received_bits;
  cvec transmited_symbols, received_symbols, transmited_chips, received_chips;

  //Classes:
  Multicode_Spread_2d mc_spread;
  AWGN_Channel channel;
  QPSK qpsk;
  BERC berc;

  //Initialize the spreading:
  SF = 4;                           //The spreading factor is 4
  Ncode = 4;                        //Use all four codes in the multi-code sprea
      der
```

```
all_codes = to_smat(hadamard(SF)); //Calculate the spreading codes

//Set the spreading codes:
spread_codesI.set_size(Ncode, SF, false);
spread_codesQ.set_size(Ncode, SF, false);
for (sc = 0; sc<Ncode; sc++) {
  spread_codesI.set_row(sc, all_codes.get_row(sc));
  spread_codesQ.set_row(sc, all_codes.get_row(sc));
}
mc_spread.set_codes(to_mat(spread_codesI), to_mat(spread_codesQ));

//Specify simulation specific variables:
EbN0dB = linspace(-2,14,17);
EbN0 = pow(10,EbN0dB/10);
Eb = 1.0;
N0 = Eb * pow(EbN0,-1.0);
NumOfBits = 50000;
MaxIterations = 10;
MaxNrOfErrors = 200;
MinNrOfErrors = 5;
ber.set_size(EbN0dB.size(), false);
ber.clear();

//Randomize the random number generators:
RNG_randomize();

for (i=0; i<EbN0dB.length(); i++) {

  cout << endl << "Simulating point nr " << i+1 << endl;
  berc.clear();
  channel.set_noise(N0(i)/2.0);

  for (j=0; j<MaxIterations; j++) {

    transmited_bits = randb(NumOfBits);
    transmited_symbols  = qpsk.modulate_bits(transmited_bits);

    //This is where we do the multi-code spreading:
    transmited_chips =  mc_spread.spread(transmited_symbols);

    received_chips = channel(transmited_chips);

    //The multi-code despreading:
    //The second argument tells the despreader that the offset is zero chips.
    //This offset is usefull on channels with delay.
    received_symbols = mc_spread.despread(received_chips, 0);

    received_bits = qpsk.demodulate_bits(received_symbols);

    berc.count(transmited_bits,received_bits);
    ber(i) = berc.get_errorrate();

    cout << "   Itteration " << j+1 << ": ber = " << berc.get_errorrate() << en
    dl;
    if (berc.get_errors()>MaxNrOfErrors) {
      cout << "Breaking on point " << i+1 << " with " << berc.get_errors() << "
     errors." << endl; break;
    }

  }

  if (berc.get_errors() < MinNrOfErrors) {
```

```
      cout << "Exiting Simulation on point " << i+1 << endl; break;
    }

  }

  //Print results:
  cout << endl;
  cout << "EbN0dB = " << EbN0dB << endl;
  cout << "ber = " << ber << endl;

  //Exit program:
  return 0;

}
```

A typical run of this program will look like this:

```
Simulating point nr 1
   Itteration 1: ber = 0.13016
Breaking on point 1 with 6508 errors.

Simulating point nr 2
   Itteration 1: ber = 0.103
Breaking on point 2 with 5150 errors.

Simulating point nr 3
   Itteration 1: ber = 0.07886
Breaking on point 3 with 3943 errors.

Simulating point nr 4
   Itteration 1: ber = 0.05534
Breaking on point 4 with 2767 errors.

Simulating point nr 5
   Itteration 1: ber = 0.03822
Breaking on point 5 with 1911 errors.

Simulating point nr 6
   Itteration 1: ber = 0.02388
Breaking on point 6 with 1194 errors.

Simulating point nr 7
   Itteration 1: ber = 0.01316
Breaking on point 7 with 658 errors.

Simulating point nr 8
   Itteration 1: ber = 0.00586
Breaking on point 8 with 293 errors.

Simulating point nr 9
   Itteration 1: ber = 0.0027
   Itteration 2: ber = 0.00247
Breaking on point 9 with 247 errors.

Simulating point nr 10
   Itteration 1: ber = 0.00094
   Itteration 2: ber = 0.00086
   Itteration 3: ber = 0.00076
   Itteration 4: ber = 0.00077
```

```
   Itteration 5: ber = 0.0008
   Itteration 6: ber = 0.000796667
Breaking on point 10 with 239 errors.

Simulating point nr 11
   Itteration 1: ber = 0.00016
   Itteration 2: ber = 0.00016
   Itteration 3: ber = 0.000186667
   Itteration 4: ber = 0.000175
   Itteration 5: ber = 0.000172
   Itteration 6: ber = 0.000173333
   Itteration 7: ber = 0.000162857
   Itteration 8: ber = 0.00017
   Itteration 9: ber = 0.000166667
   Itteration 10: ber = 0.000172

Simulating point nr 12
   Itteration 1: ber = 4e-05
   Itteration 2: ber = 2e-05
   Itteration 3: ber = 2.66667e-05
   Itteration 4: ber = 2.5e-05
   Itteration 5: ber = 2e-05
   Itteration 6: ber = 2e-05
   Itteration 7: ber = 3.14286e-05
   Itteration 8: ber = 2.75e-05
   Itteration 9: ber = 2.44444e-05
   Itteration 10: ber = 2.6e-05

Simulating point nr 13
   Itteration 1: ber = 0
   Itteration 2: ber = 0
   Itteration 3: ber = 0
   Itteration 4: ber = 0
   Itteration 5: ber = 0
   Itteration 6: ber = 0
   Itteration 7: ber = 0
   Itteration 8: ber = 2.5e-06
   Itteration 9: ber = 2.22222e-06
   Itteration 10: ber = 2e-06
Exiting Simulation on point 13

EbN0dB = [-2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14]
ber = [0.13016 0.103 0.07886 0.05534 0.03822 0.02388 0.01316 0.00586 0.00247 0.00
      0796667 0.000172 2.6e-05 2e-06 0 0 0 0]
```

Use copy-and-paste to insert the variables `EbN0dB` and `ber` into Matlab and plot the result.

28 Using timers to measure execution time

In this example we are using the Real_Timer class to measure the execution time of a simple program. The Real_Timer class is included in the itmisc library.

```
#include <itpp/itbase.h>

using namespace itpp;

//These lines are needed for use of cout and endl
```

```
using std::cout;
using std::endl;

int main()
{
  //Declare the scalars used:
  long i, sum, N;

  //Declare tt as an instance of the timer class:
  Real_Timer tt;

  //Initiate the variables:
  N = 1000000;
  sum = 0;

  //Start and reset the timer:
  tt.tic();

  //Do some processing
  for (i=0; i<N; i++) {
    sum += i;
  }

  // Print the elapsed time
  tt.toc_print();

  //Print the result of the processing:
  cout << "The sum of all integers from 0 to " << N-1 << " equals " << sum << end
      l;

  //Exit program:
  return 0;

}
```

When you run this program, the output will look something like this:

```
Elapsed time = 0.000797055 seconds
The sum of all integers from 0 to 999999 equals 1783293664
```

29 Tutorials

29.1 Table of Contents

29.2 Introduction

This page contains some tutorial examples that will help you getting started using StdAir. Most examples show how to construct some simple business objects, i.e., instances of the so-named Business Object Model (BOM).

29.2.1 Preparing the StdAir Project for Development

The source code for these examples can be found in the `batches` and `test/stdair` directories. They are compiled along with the rest of the `StdAir` project. See the User Guide (Users Guide) for more details on how to build the `StdAir` project.

29.3 Build a Predefined BOM Tree

A few steps:

- Instanciate the BOM Root Object
- Instanciate the (Airline) Inventory Object
- Link the Inventory Object with the BOM Root

29.3.1 Instanciate the BOM Root Object

First, a BOM root object (i.e., a root for all the classes in the project) is instantiated by the `stdair::STDAIR_ServiceContext` context object, when the `stdair::STDAIR_Service` is itself instantiated. The corresponding `StdAir` type (class) is `stdair::BomRoot`.

In the following sample, that object is named `ioBomRoot`, and is given as input/output parameter of the `stdair::CmdBomManager::buildSampleBom()` method:

29.3.2 Instanciate the (Airline) Inventory Object

An airline inventory object can then be instantiated. Let us give it the "BA" airline code (corresponding to `British Airways`) as the object key. That is, an object (let us name it `lBAKey`) of type (class) `stdair::InventoryKey` has first to be instantiated.

Thanks to that key, an airline inventory object, i.e. of type (class) `stdair::Inventory`, can be instantiated. Let us name that airline inventory object `lBAInv`.

29.3.3 Link the Inventory Object with the BOM Root

Then, both objects have to be linked: the airline inventory object (`stdair::Inventory`) has to be linked with the root of the BOM tree (`stdair::BomRoot`). That operation is as simple as using the `stdair::FacBomManager::addToListAndMap()` method:

29.3.4 Build Another Airline Inventory

Another airline inventory object, corresponding to the Air France (`Air France`) company, is instantiated the same way:

See the corresponding full program (cmd_bom_manager_cpp) for more details.

29.3.5 Dump The BOM Tree Content

From the `BomRoot` (of type `stdair::BomRoot`) object instance, the list of airline inventories (of type `stdair::Inventory`) can then be retrieved...

... and browsed:

See the corresponding full program (bom_display_cpp) for more details.

29.3.6 Result of the Tutorial Program

When the `stdair.cpp` program is run (with the `-b` option), the output should look like:

See the corresponding full program (batch_stdair_cpp) for more details.

29.4 Extend the Pre-Defined BOM Tree

Now that we master how to instantiate the pre-defined StdAir classes, let us see how to extend that BOM.

29.4.1 Extend an Airline Inventory Object

For instance, let us assume that some (IT) provider (e.g., you) would like to have a specific implementation of the `Inventory` object. The corresponding class has just to extend the `stdair::Inventory` class:

The STL containers have to be defined accordingly too:

See the full class definition (test_archi_inv_hpp) and implementation (test_archi_inv_-cpp) for more details.

29.4.2 Build the Specific BOM Objects

The BOM root object (`stdair::BomRoot`) is instantiated the classical way:

Then, the specific implementation of the airline inventory object (`myprovider::Inventory`) can be instantiated the same way as a standard Inventory (`stdair::Inventory`) would be:

Then, the specific implementation of the airline inventory object (`myprovider::Inventory`) is linked to the root of the BOM tree (`stdair::BomRoot`) the same way as the standard Inventory (`stdair::Inventory`) would be:

Another specific airline inventory object is instantiated the same way:

From the `BomRoot` (of type `stdair::BomRoot`) object instance, the list of specific airline inventories (of type `stdair::Inventory`) can then be retrieved...

... and browsed:

29.4.3 Result of the Tutorial Program

When this program is run, the output should look like:

See the corresponding full program (StandardAirlineITTestSuite_cpp) for more details.

30 A very simple tutorial about vectors and matrixes

Let's start with a really simple example. Try to complile the following program:

```
#include <itpp/itbase.h>

using namespace itpp;

//These lines are needed for use of cout and endl
using std::cout;
using std::endl;

int main()
{
  //Declare vectors and matricies:
  vec a, b, c;
  mat A, B;

  //Use the function linspace to define a vector:
  a = linspace(1.0,2.0,10);

  //Use a string of values to define a vector:
  b = "0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0";

  //Add two vectors:
  c = a + b;

  //Print results:
  cout << "a = " << a << endl;
  cout << "b = " << b << endl;
  cout << "c = " << c << endl;

  //Use a string to define a matrix:
  A = "1.0 2.0;3.0 4.0";

  //Calculate the inverse of matrix A:
  B = inv(A);

  //Print results:
  cout << "A = " << A << endl;
  cout << "B = " << B << endl;

  //Exit program:
  return 0;

}
```

When you run this program, the output shall look like this

```
a = [1 1.11111 1.22222 1.33333 1.44444 1.55556 1.66667 1.77778 1.88889 2]
b = [0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1]
c = [1.1 1.31111 1.52222 1.73333 1.94444 2.15556 2.36667 2.57778 2.78889 3]
A = [[1 2]
 [3 4]]
B = [[-2 1]
 [1.5 -0.5]]
```

If this is what you see, then congratulations! You have managed to compile your first it++ program!

31 Command-Line Test to Demonstrate How To Test the RMOL Project

```
 */
// //////////////////////////////////////////////////////////////////////
// Import section
// //////////////////////////////////////////////////////////////////////
// STL
#include <cassert>
#include <limits>
#include <sstream>
#include <fstream>
#include <string>
// Boost Unit Test Framework (UTF)
#define BOOST_TEST_DYN_LINK
#define BOOST_TEST_MAIN
#define BOOST_TEST_MODULE OptimiseTestSuite
#include <boost/test/unit_test.hpp>
// StdAir
#include <stdair/basic/BasLogParams.hpp>
#include <stdair/basic/BasDBParams.hpp>
#include <stdair/service/Logger.hpp>
// RMOL
#include <rmol/RMOL_Service.hpp>
#include <rmol/config/rmol-paths.hpp>

namespace boost_utf = boost::unit_test;

// (Boost) Unit Test XML Report
std::ofstream utfReportStream ("bomsforforecaster_utfresults.xml");

struct UnitTestConfig {
  UnitTestConfig() {
    boost_utf::unit_test_log.set_stream (utfReportStream);
    boost_utf::unit_test_log.set_format (boost_utf::XML);
    boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
    //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
  }

  ~UnitTestConfig() {
  }
};

namespace RMOL {

  struct BookingClassData {

    // Attributes
```

```
    double _bookingCount;
    double _fare;
    double _sellupFactor;
    bool _censorshipFlag;

    // Constructer
    BookingClassData (const double iBookingCount, const double iFare,
                      const double iSellupFactor, const bool iCensorshipFlag)
      : _bookingCount(iBookingCount), _fare(iFare),
        _sellupFactor(iSellupFactor), _censorshipFlag(iCensorshipFlag) {
    }

    // Getters
    double getFare () const {
      return _fare;
    }

    bool getCensorshipFlag () const {
      return _censorshipFlag;
    }

    // Display
    std::string toString() const {
      std::ostringstream oStr;
      oStr <<  std::endl
           << "[Booking class data information]" << std::endl
           << "Booking counter: " << _bookingCount << std::endl
           << "Fare: " << _fare << std::endl
           << "Sell-up Factor: " << _sellupFactor << std::endl
           << "censorshipFlag: " << _censorshipFlag << std::endl;
      return oStr.str();
    }

  };

  struct BookingClassDataSet {

    typedef std::vector<BookingClassData*> BookingClassDataList_T;

    // Attributes
    int _numberOfClass;
    double _minimumFare;
    bool _censorshipFlag; // true if any of the classes is censored
    BookingClassDataList_T _bookingClassDataList;

    // Constructor
    BookingClassDataSet ()
      : _numberOfClass(0), _minimumFare(0),
        _censorshipFlag(false) {
    }

    // Add BookingClassData
    void addBookingClassData (BookingClassData& ioBookingClassData) {
      _bookingClassDataList.push_back (&ioBookingClassData);
    }

    // Getters
    unsigned int getNumberOfClass () const {
      return _bookingClassDataList.size();
    }

    double getMinimumFare () const {
```

```
  return _minimumFare;
}

bool getCensorshipFlag () const {
  return _censorshipFlag;
}

// Setters
void setMinimumFare (const double iMinFare) {
  _minimumFare = iMinFare;
}

void setCensorshipFlag (const bool iCensorshipFlag) {
  _censorshipFlag = iCensorshipFlag;
}

// compute minimum fare
void updateMinimumFare() {
  double minFare = std::numeric_limits<double>::max();
  BookingClassDataList_T::iterator itBookingClassDataList;
  for (itBookingClassDataList = _bookingClassDataList.begin();
       itBookingClassDataList != _bookingClassDataList.end();
       ++itBookingClassDataList) {
    BookingClassData* lBookingClassData = *itBookingClassDataList;
    assert (lBookingClassData != NULL);

    const double lFare = lBookingClassData->getFare();
    if (lFare < minFare) {
      minFare = lFare;
    }
  }
  //
  setMinimumFare(minFare);
}

// compute censorship flag for the data set
void updateCensorshipFlag () {
  bool censorshipFlag = false;
  BookingClassDataList_T::iterator itBookingClassDataList;
  for (itBookingClassDataList = _bookingClassDataList.begin();
       itBookingClassDataList != _bookingClassDataList.end();
       ++itBookingClassDataList) {
    BookingClassData* lBookingClassData = *itBookingClassDataList;
    assert (lBookingClassData != NULL);

    const bool lCensorshipFlagOfAClass =
      lBookingClassData->getCensorshipFlag();
    if (lCensorshipFlagOfAClass) {
      censorshipFlag = true;
      break;
    }
  }
  //
  setCensorshipFlag(censorshipFlag);
}

// Display
std::string toString() const {
  std::ostringstream oStr;
  oStr << std::endl
       << "[Booking class data set information]" << std::endl
       << "Number of classes: " << _numberOfClass << std::endl
```

```
          << "Minimum fare: " << _minimumFare << std::endl
          << "The data of the class set are sensored: " << _censorshipFlag
          << std::endl;
      return oStr.str();
    }

  };

  // /**--------------- BOM : Q-Forecaster ----------------------- */
  // struct QForecaster {

  //   // Function focused BOM

  //   // 1. calculate sell up probability for Q-eq

  //   // 2. calculate Q-Equivalent Booking
  //   double calculateQEqBooking (BookingClassDataSet& iBookingClassDataSet) {
  //     double lQEqBooking = 0.0;
  //     double lMinFare = iBookingClassDataSet.getMinimumFare();


  //     return lQEqBooking;
  //   }

  //   /* Calculate Q-equivalent demand
  //      [<- performed by unconstrainer if necessary (Using ExpMax BOM)]
  //   */


  //   // 3. Partition to each class

  //   //

  // // };

}

// ///////////////// Main: Unit Test Suite //////////////

// Set the UTF configuration (re-direct the output to a specific file)
BOOST_GLOBAL_FIXTURE (UnitTestConfig);

BOOST_AUTO_TEST_SUITE (master_test_suite)


BOOST_AUTO_TEST_CASE (rmol_forecaster) {

  // Output log File
  std::string lLogFilename ("bomsforforecaster.log");
  std::ofstream logOutputFile;

  // Open and clean the log outputfile
  logOutputFile.open (lLogFilename.c_str());
  logOutputFile.clear();

  // Initialise the RMOL service
  const stdair::BasLogParams lLogParams (stdair::LOG::DEBUG, logOutputFile);

  // Initialise the RMOL service
  RMOL::RMOL_Service rmolService (lLogParams);

  // Build a sample BOM tree
```

```
  rmolService.buildSampleBom();

  // Register BCDataSet
  RMOL::BookingClassDataSet lBookingClassDataSet;

  // Register BookingClassData
  RMOL::BookingClassData QClassData (10, 100, 1, false);
  RMOL::BookingClassData MClassData (5, 150, 0.8, true);
  RMOL::BookingClassData BClassData (0, 200, 0.6, false);
  RMOL::BookingClassData YClassData (0, 300, 0.3, false);

  // Display
  STDAIR_LOG_DEBUG (QClassData.toString());
  STDAIR_LOG_DEBUG (MClassData.toString());
  STDAIR_LOG_DEBUG (BClassData.toString());
  STDAIR_LOG_DEBUG (YClassData.toString());

  // Add BookingClassData into the BCDataSet
  lBookingClassDataSet.addBookingClassData (QClassData);
  lBookingClassDataSet.addBookingClassData (MClassData);
  lBookingClassDataSet.addBookingClassData (BClassData);
  lBookingClassDataSet.addBookingClassData (YClassData);

  // DEBUG
  STDAIR_LOG_DEBUG (lBookingClassDataSet.toString());

  // Number of classes
  const unsigned int lNoOfClass = lBookingClassDataSet.getNumberOfClass();

  // DEBUG
  STDAIR_LOG_DEBUG ("Number of Classes: " << lNoOfClass);

  // Minimum fare
  BOOST_CHECK_NO_THROW (lBookingClassDataSet.updateMinimumFare());
  const double lMinFare = lBookingClassDataSet.getMinimumFare();

  // DEBUG
  STDAIR_LOG_DEBUG ("Minimum fare: " << lMinFare);

  // Censorship flag
  BOOST_CHECK_NO_THROW (lBookingClassDataSet.updateCensorshipFlag());
  const bool lCensorshipFlag = lBookingClassDataSet.getCensorshipFlag();

  // DEBUG
  STDAIR_LOG_DEBUG ("Censorship Flag: " << lCensorshipFlag);

  // Close the log output file
  logOutputFile.close();
}

// End the test suite
BOOST_AUTO_TEST_SUITE_END()

/*!
```

32 Command-Line Test to Demonstrate How To Test the RMOL Project

```
 */
// ////////////////////////////////////////////////////////////////////
// Import section
```

```
// ////////////////////////////////////////////////////////////////////
// STL
#include <sstream>
#include <fstream>
#include <string>
#include <vector>
#include <cmath>
// Boost Unit Test Framework (UTF)
#define BOOST_TEST_DYN_LINK
#define BOOST_TEST_MAIN
#define BOOST_TEST_MODULE ForecasterTestSuite
#include <boost/test/unit_test.hpp>
// StdAir
#include <stdair/basic/BasLogParams.hpp>
#include <stdair/basic/BasDBParams.hpp>
#include <stdair/basic/BasFileMgr.hpp>
#include <stdair/service/Logger.hpp>
// RMOL
#include <rmol/RMOL_Service.hpp>

namespace boost_utf = boost::unit_test;

// (Boost) Unit Test XML Report
std::ofstream utfReportStream ("ForecasterTestSuite_utfresults.xml");

struct UnitTestConfig {
  UnitTestConfig() {
    boost_utf::unit_test_log.set_stream (utfReportStream);
    boost_utf::unit_test_log.set_format (boost_utf::XML);
    boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
    //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
  }

  ~UnitTestConfig() {
  }
};


// ///////////////// Main: Unit Test Suite //////////////

// Set the UTF configuration (re-direct the output to a specific file)
BOOST_GLOBAL_FIXTURE (UnitTestConfig);

BOOST_AUTO_TEST_SUITE (master_test_suite)


BOOST_AUTO_TEST_CASE (rmol_forecaster_q_forecasting) {
  const bool lTestFlag = true; //testForecasterHelper(0);
  BOOST_CHECK_EQUAL (lTestFlag, true);
  BOOST_CHECK_MESSAGE (lTestFlag == true,
                       "The test has failed. Please see the log file for "
                       << "more details");
}

// End the test suite
BOOST_AUTO_TEST_SUITE_END()

/*!
```

33 Command-Line Test to Demonstrate How To Test the RMOL Project

```
 */
// ////////////////////////////////////////////////////////////////////
// Import section
// ////////////////////////////////////////////////////////////////////
// STL
#include <sstream>
#include <fstream>
#include <string>
// Boost Unit Test Framework (UTF)
#define BOOST_TEST_DYN_LINK
#define BOOST_TEST_MAIN
#define BOOST_TEST_MODULE OptimiseTestSuite
#include <boost/test/unit_test.hpp>
// StdAir
#include <stdair/basic/BasLogParams.hpp>
#include <stdair/basic/BasDBParams.hpp>
#include <stdair/basic/BasFileMgr.hpp>
#include <stdair/service/Logger.hpp>
// RMOL
#include <rmol/RMOL_Service.hpp>
#include <rmol/config/rmol-paths.hpp>

namespace boost_utf = boost::unit_test;

// (Boost) Unit Test XML Report
std::ofstream utfReportStream ("OptimiseTestSuite_utfresults.xml");

struct UnitTestConfig {
  UnitTestConfig() {
    boost_utf::unit_test_log.set_stream (utfReportStream);
    boost_utf::unit_test_log.set_format (boost_utf::XML);
    boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
    //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
  }

  ~UnitTestConfig() {
  }
};


// ////////////////////////////////////////////////////////////////////
int testOptimiseHelper (const unsigned short optimisationMethodFlag) {

  // Return value
  int oExpectedBookingLimit = 0;

  // Output log File
  std::ostringstream oStr;
  oStr << "OptimiseTestSuite_" << optimisationMethodFlag << ".log";
  const stdair::Filename_T lLogFilename (oStr.str());

  // Number of random draws to be generated (best if greater than 100)
  const int K = 100000;

  // Methods of optimisation (0 = Monte-Carlo, 1 = Dynamic Programming,
  // 2 = EMSR, 3 = EMSR-a, 4 = EMSR-b, 5 = EMSR-a with sellup prob.)
  const unsigned short METHOD_FLAG = optimisationMethodFlag;

  // Cabin Capacity (it must be greater then 100 here)
```

```
  const double cabinCapacity = 100.0;

  // Input file name
  const stdair::Filename_T lRMInputFileName (STDAIR_SAMPLE_DIR "/rm02.csv");

  // Set the log parameters
  std::ofstream logOutputFile;
  // Open and clean the log outputfile
  logOutputFile.open (lLogFilename.c_str());
  logOutputFile.clear();

  // Initialise the RMOL service
  const stdair::BasLogParams lLogParams (stdair::LOG::DEBUG, logOutputFile);
  RMOL::RMOL_Service rmolService (lLogParams);

  // Parse the optimisation data and build a dummy BOM tree
  rmolService.parseAndLoad (cabinCapacity, lRMInputFileName);

  switch (METHOD_FLAG) {
  case 0: {
    // DEBUG
    STDAIR_LOG_DEBUG ("Optimisation by Monte-Carlo (MC)");

    // Calculate the optimal protections by the Monte Carlo
    // Integration approach
    rmolService.optimalOptimisationByMCIntegration (K);
    break;
  }

  case 1: {
    // DEBUG
    STDAIR_LOG_DEBUG ("Optimisation by Dynamic Programming (DP)");

    // Calculate the optimal protections by DP.
    rmolService.optimalOptimisationByDP ();
    break;
  }

  case 2: {
    // DEBUG
    STDAIR_LOG_DEBUG ("Calculate the Bid-Price Vectors (BPV) by EMSR");

    // Calculate the Bid-Price Vector by EMSR
    rmolService.heuristicOptimisationByEmsr ();
    break;
  }

  case 3: {
    // DEBUG
    STDAIR_LOG_DEBUG ("Calculate the Authorisation Levels (AUs) by EMSRa");

    // Calculate the protections by EMSR-a
    // Test the EMSR-a algorithm implementation
    rmolService.heuristicOptimisationByEmsrA ();

    // Return a cumulated booking limit value to test
    // oExpectedBookingLimit = static_cast<int> (lBookingLimitVector.at(2));
    break;
  }

  case 4: {
    // DEBUG
```

```
    STDAIR_LOG_DEBUG ("Calculate the Authorisation Levels (AUs) by EMSRb");

    // Calculate the protections by EMSR-b
    rmolService.heuristicOptimisationByEmsrB ();
    break;
  }

  default: rmolService.optimalOptimisationByMCIntegration (K);
  }

  // Close the log file
  logOutputFile.close();

  return oExpectedBookingLimit;
}


// ///////////////// Main: Unit Test Suite //////////////

// Set the UTF configuration (re-direct the output to a specific file)
BOOST_GLOBAL_FIXTURE (UnitTestConfig);

// ////////////////////////////////////////////////////////////////////
// Tests are based on the following input values
// price; mean; standard deviation;
// 1050; 17.3; 5.8;
// 567; 45.1; 15.0;
// 534; 39.6; 13.2;
// 520; 34.0; 11.3;
// ////////////////////////////////////////////////////////////////////

BOOST_AUTO_TEST_SUITE (master_test_suite)


BOOST_AUTO_TEST_CASE (rmol_optimisation_monte_carlo) {
  BOOST_CHECK_NO_THROW (testOptimiseHelper(0););
}

BOOST_AUTO_TEST_CASE (rmol_optimisation_dynamic_programming) {
  BOOST_CHECK_NO_THROW (testOptimiseHelper(1););
}

BOOST_AUTO_TEST_CASE (rmol_optimisation_emsr_bpv) {
  BOOST_CHECK_NO_THROW (testOptimiseHelper(2););
}

BOOST_AUTO_TEST_CASE (rmol_optimisation_emsr_a) {
  BOOST_CHECK_NO_THROW (testOptimiseHelper(3););
  // const int lBookingLimit = testOptimiseHelper(3);
  // const int lExpectedBookingLimit = 61;
  // BOOST_CHECK_EQUAL (lBookingLimit, lExpectedBookingLimit);
  // BOOST_CHECK_MESSAGE (lBookingLimit == lExpectedBookingLimit,
  //                      "The booking limit is " << lBookingLimit
  //                      << ", but it is expected to be "
  //                      << lExpectedBookingLimit);
}

BOOST_AUTO_TEST_CASE (rmol_optimisation_emsr_b) {
  BOOST_CHECK_NO_THROW (testOptimiseHelper(4););
}

// End the test suite
```

```
BOOST_AUTO_TEST_SUITE_END()

/*!
```

34 Command-Line Test to Demonstrate How To Test the RMOL Project

```
 */
// ////////////////////////////////////////////////////////////////////
// Import section
// ////////////////////////////////////////////////////////////////////
// STL
#include <sstream>
#include <fstream>
#include <string>
// Boost Unit Test Framework (UTF)
#define BOOST_TEST_DYN_LINK
#define BOOST_TEST_MAIN
#define BOOST_TEST_MODULE UnconstrainerTestSuite
#include <boost/test/unit_test.hpp>
// StdAir
#include <stdair/basic/BasLogParams.hpp>
#include <stdair/basic/BasDBParams.hpp>
#include <stdair/basic/BasFileMgr.hpp>
#include <stdair/service/Logger.hpp>
// RMOL
#include <rmol/RMOL_Service.hpp>

namespace boost_utf = boost::unit_test;

// (Boost) Unit Test XML Report
std::ofstream utfReportStream ("UnconstrainerTestSuite_utfresults.xml");

struct UnitTestConfig {
  UnitTestConfig() {
    boost_utf::unit_test_log.set_stream (utfReportStream);
    boost_utf::unit_test_log.set_format (boost_utf::XML);
    boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
    //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
  }

  ~UnitTestConfig() {
  }
};


// ///////////////// Main: Unit Test Suite //////////////

// Set the UTF configuration (re-direct the output to a specific file)
BOOST_GLOBAL_FIXTURE (UnitTestConfig);

BOOST_AUTO_TEST_SUITE (master_test_suite)


BOOST_AUTO_TEST_CASE (rmol_unconstraining_em) {
  const bool lTestFlag = true;// testUnconstrainerHelper(0);
  BOOST_CHECK_EQUAL (lTestFlag, true);
  BOOST_CHECK_MESSAGE (lTestFlag == true,
                       "The test has failed. Please see the log file for "
                       << "more details");
```

```
}

// End the test suite
BOOST_AUTO_TEST_SUITE_END()

/*!
```

35 Directory Hierarchy

35.1 Directories

This directory hierarchy is sorted roughly, but not completely, alphabetically:

36 Namespace Index

36.1 Namespace List

Here is a list of all namespaces with brief descriptions:

37 Class Index

37.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

std::basic_fstream< char >
std::basic_fstream< wchar_t >
std::basic_ifstream< char >
std::basic_ifstream< wchar_t >
std::basic_ios< char >
std::basic_ios< wchar_t >
std::basic_iostream< char >
std::basic_iostream< wchar_t >
std::basic_istream< char >
std::basic_istream< wchar_t >
std::basic_istringstream< char >
std::basic_istringstream< wchar_t >
std::basic_ofstream< char >
std::basic_ofstream< wchar_t >
std::basic_ostream< char >
std::basic_ostream< wchar_t >
std::basic_ostringstream< char >
std::basic_ostringstream< wchar_t >
std::basic_string< char >
std::basic_string< wchar_t >
std::basic_stringstream< char >
std::basic_stringstream< wchar_t >

38 Class Index

38.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

39 File Index

39.1 File List

Here is a list of all files with brief descriptions:

40 Directory Documentation

40.1 rmol/basic/ Directory Reference

Files

- file BasConst.cpp
- file BasConst_Curves.hpp
- file BasConst_General.hpp
- file BasConst_RMOL_Service.hpp

40.2 rmol/batches/ Directory Reference

Files

- file rmol.cpp

40.3 rmol/bom/ Directory Reference

Directories

- directory old

Files

- file BucketHolderTypes.hpp
- file DistributionParameterList.hpp
- file DPOptimiser.cpp
- file DPOptimiser.hpp
- file EMDetruncator.cpp
- file EMDetruncator.hpp
- file Emsr.cpp
- file Emsr.hpp
- file EmsrUtils.cpp
- file EmsrUtils.hpp
- file GuillotineBlockHelper.cpp
- file GuillotineBlockHelper.hpp
- file HistoricalBooking.cpp
- file HistoricalBooking.hpp
- file HistoricalBookingHolder.cpp
- file HistoricalBookingHolder.hpp
- file MCOptimiser.cpp
- file MCOptimiser.hpp
- file Utilities.cpp
- file Utilities.hpp

40.4 rmol/command/ Directory Reference

Files

- file Detruncator.cpp
- file Detruncator.hpp
- file Forecaster.cpp
- file Forecaster.hpp
- file InventoryParser.cpp
- file InventoryParser.hpp
- file Optimiser.cpp
- file Optimiser.hpp

40.5 rmol/config/ Directory Reference

Files

- file rmol-paths.hpp

40.6 doc/ Directory Reference

Directories

- directory tutorial

40.7 rmol/factory/ Directory Reference

Files

- file FacRmolServiceContext.cpp
- file FacRmolServiceContext.hpp

40.8 rmol/bom/old/ Directory Reference

Files

- file DemandGeneratorList.cpp
- file DemandGeneratorList.hpp

40.9 test/rmol/ Directory Reference

Files

- file bomsforforecaster.cpp
- file ForecasterTestSuite.cpp
- file ForecasterTestSuite.hpp
- file OptimiseTestSuite.cpp
- file OptimiseTestSuite.hpp
- file UnconstrainerTestSuite.cpp
- file UnconstrainerTestSuite.hpp

40.10 rmol/ Directory Reference

Directories

- directory basic
- directory batches

- directory bom
- directory command
- directory config
- directory factory
- directory service

Files

- file RMOL_Service.hpp
- file RMOL_Types.hpp

40.11 rmol/service/ Directory Reference

Files

- file RMOL_Service.cpp
- file RMOL_ServiceContext.cpp
- file RMOL_ServiceContext.hpp

40.12 doc/tutorial/src/ Directory Reference

Files

- file bpsk.cpp
- file convcode.cpp
- file interleaver.cpp
- file ldpc_bersim_awgn.cpp
- file ldpc_gen_codes.cpp
- file mimoconv.cpp
- file mog.cpp
- file qpsk_simulation.cpp
- file rayleigh.cpp
- file read_it_file.cpp
- file reedsolomon.cpp
- file spread.cpp
- file timer.cpp
- file vector_and_matrix.cpp
- file write_it_file.cpp

40.13 test/ Directory Reference

Directories

- directory rmol

40.14 doc/tutorial/ Directory Reference

Directories

- directory src

41 Namespace Documentation

41.1 RMOL Namespace Reference

Classes

- struct DefaultMap
- struct DefaultDCPList
- class DPOptimiser
- class EMDetruncator
- class Emsr
- class EmsrUtils
- class GuillotineBlockHelper
- struct HistoricalBooking

  Structure keeping track, for a given class, of the number of historical bookings and of the censorship flag.
- struct HistoricalBookingHolder
- class MCOptimiser
- class DemandGeneratorList
- class Utilities
- class Detruncator
- class Forecaster
- class InventoryParser

  Class filling the virtual class list (representing a list of classes/buckets) from a given input inventory.
- class Optimiser
- class FacRmolServiceContext

  Factory for the service context.
- class RMOL_Service

  Interface for the RMOL Services.
- class OverbookingException

  Overbooking-related exception.
- class UnconstrainingException

  Unconstraining-related exception.
- class ForecastException

  Forecast-related exception.
- class OptimisationException

  Optimisation-related exception.
- class RMOL_ServiceContext

  Inner class holding the context for the RMOL Service object.

Typedefs

- typedef std::list< BucketHolder * > BucketHolderList_T
- typedef std::list< FldDistributionParameters > DistributionParameterList_T
- typedef std::vector< HistoricalBooking > HistoricalBookingVector_T
- typedef boost::shared_ptr< RMOL_Service > RMOL_ServicePtr_T
- typedef std::vector< stdair::NbOfRequests_T > UnconstrainedDemandVector_T
- typedef std::vector< stdair::NbOfBookings_T > BookingVector_T
- typedef std::vector< stdair::Flag_T > FlagVector_T
- typedef std::map< stdair::BookingClass *, UnconstrainedDemandVector_T > BookingClassUnconstrainedDemar T
- typedef std::map< stdair::BookingClass *, stdair::NbOfRequests_T > BookingClassUnconstrainedDemandMap_ T
- typedef std::map< const stdair::DTD_T, double > FRAT5Curve_T

Variables

- const stdair::AirlineCode_T DEFAULT_RMOL_SERVICE_AIRLINE_CODE = "BA"
- const double DEFAULT_RMOL_SERVICE_CAPACITY = 1.0
- const int DEFAULT_NUMBER_OF_DRAWS_FOR_MC_SIMULATION = 100000
- const int DEFAULT_PRECISION = 10
- const double DEFAULT_EPSILON = 0.0001
- const double DEFAULT_STOPPING_CRITERION = 0.01
- const double DEFAULT_INITIALIZER_DOUBLE_NEGATIVE = -10.0
- const FRAT5Curve_T DEFAULT_CUMULATIVE_FRAT5_CURVE
- const stdair::DCPList_T DEFAULT_DCP_LIST = DefaultDCPList::init()

41.1.1 Typedef Documentation

41.1.1.1 typedef std::list<BucketHolder*> RMOL::BucketHolderList_T

Define a vector (ordered list) of N bucket/classe holders.

Definition at line 16 of file BucketHolderTypes.hpp.

41.1.1.2 typedef std::list<FldDistributionParameters> RMOL::DistributionParameterList_T

Define the set of parameters, each of one wrapping a pair of distribution parameters (i.e., mean and standard deviation).

Definition at line 16 of file DistributionParameterList.hpp.

41.1.1.3 typedef std::vector<HistoricalBooking> RMOL::HistoricalBookingVector_T

Define a vector (ordered list) of N HistoricalBookings.

Definition at line 16 of file HistoricalBookingHolder.hpp.

41.1.1.4 typedef boost::shared_ptr<RMOL_Service> RMOL::RMOL_ServicePtr_T

Pointer on the RMOL Service handler.

Definition at line 73 of file RMOL_Types.hpp.

41.1.1.5 typedef std::vector<stdair::NbOfRequests_T> RMOL::UnconstrainedDemandVector_T

Define the vector of historical unconstrained demand.

Definition at line 76 of file RMOL_Types.hpp.

41.1.1.6 typedef std::vector<stdair::NbOfBookings_T> RMOL::BookingVector_T

Define the vector of historical bookings.

Definition at line 79 of file RMOL_Types.hpp.

41.1.1.7 typedef std::vector<stdair::Flag_T> RMOL::FlagVector_T

Define the vector of censorship flags.

Definition at line 82 of file RMOL_Types.hpp.

41.1.1.8 typedef std::map<stdair::BookingClass*, UnconstrainedDemandVector_T> RMOL::BookingClassUnconstrainedDemandVectorMap_T

Define the map betweent the booking class and it's corresponding unconstrained demand vector.

Definition at line 86 of file RMOL_Types.hpp.

41.1.1.9 typedef std::map<stdair::BookingClass*, stdair::NbOfRequests_T> RMOL::BookingClassUnconstrainedDemandMap_T

Define the map betweent the booking class and it's corresponding unconstrained demand.

Definition at line 90 of file RMOL_Types.hpp.

41.1.1.10 typedef std::map<const stdair::DTD_T, double> RMOL::FRAT5Curve_T

Define the FRAT5 curve.

Definition at line 93 of file RMOL_Types.hpp.

41.1.2 Variable Documentation

41.1.2.1 const stdair::AirlineCode_T RMOL::DEFAULT_RMOL_SERVICE_AIRLINE_CODE = "BA"

Default airline code for the RMOL_Service.

Definition at line 11 of file BasConst.cpp.

41.1.2.2 const double RMOL::DEFAULT_RMOL_SERVICE_CAPACITY = 1.0

Default capacity for the RMOL_Service.

Definition at line 14 of file BasConst.cpp.

41.1.2.3 const int RMOL::DEFAULT_NUMBER_OF_DRAWS_FOR_MC_SIMULATION = 100000

Default value for the number of draws within the Monte-Carlo Integration algorithm.

Definition at line 18 of file BasConst.cpp.

41.1.2.4 const int RMOL::DEFAULT_PRECISION = 10

Default value for the precision of the integral computation in the Dynamic Programming algorithm (100 means that the precision will be 0.01).

Default value for the precision of the integral computation in the Dynamic Programming algorithm.

Definition at line 23 of file BasConst.cpp.

41.1.2.5 const double RMOL::DEFAULT_EPSILON = 0.0001

Default epsilon value to qualify a denominator

Definition at line 26 of file BasConst.cpp.

41.1.2.6 const double RMOL::DEFAULT_STOPPING_CRITERION = 0.01

Default stopping value for an iterative algorithm.

Definition at line 29 of file BasConst.cpp.

41.1.2.7 const double RMOL::DEFAULT_INITIALIZER_DOUBLE_NEGATIVE = -10.0

Default negative value used to initialze a double variable.

Definition at line 32 of file BasConst.cpp.

41.1.2.8 const FRAT5Curve_T RMOL::DEFAULT_CUMULATIVE_FRAT5_CURVE

Initial value:

```
DefaultMap::createCumulativeFRAT5Curve()
```

Default cumulative[for the remaining period] FRAT5 curve for forecasting and optimisation.

Default cumulative (for the remaining period) FRAT5 curve for forecasting and optimisation.

Definition at line 36 of file BasConst.cpp.

41.1.2.9 const stdair::DCPList_T RMOL::DEFAULT_DCP_LIST = DefaultDCPList::init()

Defaut data collection point list.

Definition at line 69 of file BasConst.cpp.

Referenced by RMOL::Utilities::buildRemainingDCPList(), RMOL::Utilities::buildRemainingDCPList2(), RMOL::RMOL_Service::forecastOnD(), RMOL::RMOL_Service::optimiseOnD(), RMOL::RMOL_Service::optimiseOnDUsingAdvancedRMCooperation(), RMOL::RMOL_Service::optimiseOnDUsingRMCooperation(), RMOL::RMOL_Service::projectAggregatedDemandOnLegCabins(), RMOL::RMOL_Service::projectOnDDemandOnLeg RMOL::RMOL_Service::projectOnDDemandOnLegCabinsUsingDYP(), RMOL::RMOL_Service::projectOnDDemandOnLegCabinsUsingYP(), RMOL::RMOL_Service::resetDemandInformation(), and RMOL::RMOL_Service::updateBidPrice().

41.2 stdair Namespace Reference

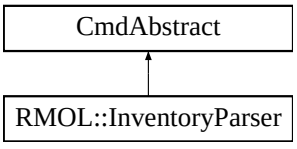
41.2.1 Detailed Description

Forward declarations.

42 Class Documentation

42.1 CmdAbstract Class Reference

Inheritance diagram for CmdAbstract:



The documentation for this class was generated from the following file:

- rmol/command/InventoryParser.hpp

42.2 RMOL::DefaultDCPList Struct Reference

`#include <rmol/basic/BasConst_General.hpp>`

Static Public Member Functions

- static stdair::DCPList_T init ()

42.2.1 Detailed Description

Definition at line 31 of file BasConst_General.hpp.

42.2.2 Member Function Documentation

42.2.2.1 stdair::DCPList_T RMOL::DefaultDCPList::init ( ) [static]

Definition at line 70 of file BasConst.cpp.

The documentation for this struct was generated from the following files:

- rmol/basic/BasConst_General.hpp
- rmol/basic/BasConst.cpp

42.3 RMOL::DefaultMap Struct Reference

`#include <rmol/basic/BasConst_Curves.hpp>`

Static Public Member Functions

- static FRAT5Curve_T createCumulativeFRAT5Curve ()

42.3.1 Detailed Description

Default PoS probability mass.

Definition at line 17 of file BasConst_Curves.hpp.

42.3.2 Member Function Documentation

42.3.2.1 FRAT5Curve_T RMOL::DefaultMap::createCumulativeFRAT5Curve ( ) [static]

Definition at line 38 of file BasConst.cpp.

The documentation for this struct was generated from the following files:

- rmol/basic/BasConst_Curves.hpp
- rmol/basic/BasConst.cpp

42.4 RMOL::DemandGeneratorList Class Reference

`#include <rmol/bom/old/DemandGeneratorList.hpp>`

Public Member Functions

- DemandGeneratorList ()
- DemandGeneratorList (const DemandGeneratorList &)
- DemandGeneratorList (const DistributionParameterList_T &)
- virtual ~DemandGeneratorList ()
- void generateVariateList (VariateList_T &) const

Protected Types

- typedef std::list< Gaussian > DemandGeneratorList_T

42.4.1 Detailed Description

Wrapper around a set of Gaussian Random Generators.

Definition at line 17 of file DemandGeneratorList.hpp.

42.4.2 Member Typedef Documentation

42.4.2.1 typedef std::list<Gaussian> RMOL::DemandGeneratorList::DemandGeneratorList_T [protected]

Define a (ordered) set of Gaussian Random Generators.

Definition at line 20 of file DemandGeneratorList.hpp.

42.4.3 Constructor & Destructor Documentation

42.4.3.1 RMOL::DemandGeneratorList::DemandGeneratorList ( )

Constructors.

Definition at line 10 of file DemandGeneratorList.cpp.

42.4.3.2 RMOL::DemandGeneratorList::DemandGeneratorList (const DemandGeneratorList & *iDemandGeneratorList*)

Definition at line 17 of file DemandGeneratorList.cpp.

42.4.3.3 RMOL::DemandGeneratorList::DemandGeneratorList (const DistributionParameterList_T & *iDistributionParameterList*)

List of distribution parameters (mean, standard deviation).

Definition at line 25 of file DemandGeneratorList.cpp.

42.4.3.4 RMOL::DemandGeneratorList::~DemandGeneratorList ( ) [virtual]

Destructors.

Definition at line 30 of file DemandGeneratorList.cpp.

42.4.4 Member Function Documentation

42.4.4.1 void RMOL::DemandGeneratorList::generateVariateList (VariateList_T & *ioVariateList*) const

Definition at line 50 of file DemandGeneratorList.cpp.

The documentation for this class was generated from the following files:

- rmol/bom/old/DemandGeneratorList.hpp
- rmol/bom/old/DemandGeneratorList.cpp

42.5 RMOL::Detruncator Class Reference

`#include <rmol/command/Detruncator.hpp>`

Static Public Member Functions

- static void unconstrainUsingAdditivePickUp (const stdair::SegmentCabin &, BookingClassUnconstrainedDemandV T &, UnconstrainedDemandVector_T &, const stdair::DCP_T &, const stdair::DCP_- T &, const stdair::Date_T &)
- static void unconstrainUsingMultiplicativePickUp (const stdair::SegmentCabin &, BookingClassUnconstrainedDemandVectorMap_T &, UnconstrainedDemandVector_- T &, const stdair::DCP_T &, const stdair::DCP_T &, const stdair::Date_T &, const stdair::NbOfSegments_T &)
- static void retrieveUnconstrainedDemandForFirstDCP (const stdair::SegmentCabin &, BookingClassUnconstrainedDemandVectorMap_T &, UnconstrainedDemandVector_- T &, const stdair::DCP_T &, const stdair::NbOfSegments_T &, const stdair::NbOfSegments_- T &)
- static void unconstrainUsingMultiplicativePickUp (HistoricalBookingHolder &)

42.5.1 Detailed Description

Class wrapping the principal unconstraining algorithms and some accessory algorithms.

Definition at line 24 of file Detruncator.hpp.

42.5.2 Member Function Documentation

42.5.2.1 void RMOL::Detruncator::unconstrainUsingAdditivePickUp (const stdair::SegmentCabin & *iSegmentCabin*, BookingClassUnconstrainedDemandVectorMap_T & *ioBkgClassUncDemMap*, UnconstrainedDemandVector_T & *ioQEquivalentDemandVector*, const stdair::DCP_T & *iDCPBegin*, const stdair::DCP_T & *iDCPEnd*, const stdair::Date_T & *iCurrentDate*) [static]

Unconstrain booking figures between two DCP's.

Definition at line 25 of file Detruncator.cpp.

References RMOL::GuillotineBlockHelper::getNbOfSegmentAlreadyPassedThisDTD().

42.5.2.2 void RMOL::Detruncator::unconstrainUsingMultiplicativePickUp (const stdair::SegmentCabin & *iSegmentCabin*, BookingClassUnconstrainedDemandVectorMap_T & *ioBkgClassUncDemMap*, UnconstrainedDemandVector_T & *ioQEquivalentDemandVector*, const stdair::DCP_T & *iDCPBegin*, const stdair::DCP_T & *iDCPEnd*, const stdair::Date_T & *iCurrentDate*, const stdair::NbOfSegments_T & *iNbOfDepartedSegments*) [static]

Unconstrain booking figures between two DCP's.

Definition at line 317 of file Detruncator.cpp.

References RMOL::GuillotineBlockHelper::getNbOfSegmentAlreadyPassedThisDTD().

42.5.2.3 void RMOL::Detruncator::retrieveUnconstrainedDemandForFirstDCP (const stdair::SegmentCabin & *iSegmentCabin*, BookingClassUnconstrainedDemandVectorMap_T & *ioBkgClassUncDemVectorMap*, UnconstrainedDemandVector_T & *ioQEquivalentDemandVector*, const stdair::DCP_T & *iFirstDCP*, const stdair::NbOfSegments_T & *iNbOfSegments*, const stdair::NbOfSegments_T & *iNbOfUsedSegments*) [static]

Retrieve unconstrained demand figures for the first DCP.

Definition at line 239 of file Detruncator.cpp.

42.5.2.4 void RMOL::Detruncator::unconstrainUsingMultiplicativePickUp (HistoricalBookingHolder & *ioHBHolder*) [static]

Unconstrain the product-oriented booking figures for a given class ou Q-equivalent class.

Definition at line 558 of file Detruncator.cpp.

References RMOL::HistoricalBookingHolder::getCensorshipFlag(), RMOL::HistoricalBookingHolder::getHistoricalBooki
RMOL::HistoricalBookingHolder::getNbOfFlights(), RMOL::HistoricalBookingHolder::getNbOfUncensoredData(),
and RMOL::HistoricalBookingHolder::setUnconstrainedDemand().

The documentation for this class was generated from the following files:

- rmol/command/Detruncator.hpp
- rmol/command/Detruncator.cpp

42.6 RMOL::DPOptimiser Class Reference

`#include <rmol/bom/DPOptimiser.hpp>`

Static Public Member Functions

- static void optimalOptimisationByDP (stdair::LegCabin &)
- static double cdfGaussianQ (const double, const double)

42.6.1 Detailed Description

Utility methods for the Dynamic Programming algorithms.

Definition at line 17 of file DPOptimiser.hpp.

42.6.2 Member Function Documentation

42.6.2.1 void RMOL::DPOptimiser::optimalOptimisationByDP (stdair::LegCabin & *ioLegCabin*) [static]

Dynamic Programming to compute the cumulative protection levels and booking limits (described in the book Revenue Management - Talluri & Van Ryzin, p.41-42).

Definition at line 22 of file DPOptimiser.cpp.

42.6.2.2 static double RMOL::DPOptimiser::cdfGaussianQ (const double , const double) [static]

Compute the cdf_Q of a gaussian.

The documentation for this class was generated from the following files:

- rmol/bom/DPOptimiser.hpp
- rmol/bom/DPOptimiser.cpp

42.7 RMOL::EMDetruncator Class Reference

`#include <rmol/bom/EMDetruncator.hpp>`

Static Public Member Functions

- static void unconstrainUsingEMMethod (HistoricalBookingHolder &)

42.7.1 Detailed Description

Utility for the Expectation-Maximisation algorithm.

Definition at line 12 of file EMDetruncator.hpp.

42.7.2 Member Function Documentation

42.7.2.1 void RMOL::EMDetruncator::unconstrainUsingEMMethod (HistoricalBookingHolder & *ioHistoricalBookingHolder*) [static]

Unconstrain the censored booking data using the Expection-Maximisation algorithm.

Definition at line 20 of file EMDetruncator.cpp.

References RMOL::HistoricalBookingHolder::getDemandMean(), RMOL::HistoricalBookingHolder::getListOfToBeUncor
RMOL::HistoricalBookingHolder::getNbOfFlights(), RMOL::HistoricalBookingHolder::getNbOfUncensoredBookings(),
RMOL::HistoricalBookingHolder::getNbOfUncensoredData(), RMOL::HistoricalBookingHolder::getStandardDeviation(),
RMOL::HistoricalBookingHolder::getUncensoredStandardDeviation(), RMOL::HistoricalBookingHolder::getUnconstraine
and RMOL::HistoricalBookingHolder::setUnconstrainedDemand().

The documentation for this class was generated from the following files:

- rmol/bom/EMDetruncator.hpp
- rmol/bom/EMDetruncator.cpp

42.8 RMOL::Emsr Class Reference

`#include <rmol/bom/Emsr.hpp>`

Static Public Member Functions

- static void heuristicOptimisationByEmsr (stdair::LegCabin &)
- static void heuristicOptimisationByEmsrA (stdair::LegCabin &)
- static void heuristicOptimisationByEmsrB (stdair::LegCabin &)

42.8.1 Detailed Description

Class Implementing the EMSR algorithm for Bid-Price Vector computing.

Definition at line 18 of file Emsr.hpp.

42.8.2 Member Function Documentation

42.8.2.1 void RMOL::Emsr::heuristicOptimisationByEmsr (stdair::LegCabin & *ioLegCabin*) [static]

Compute the Bid-Price Vector using the EMSR algorithm. Then compute the protection levels and booking limits by using the BPV.

For each class/bucket j with yield pj and demand Dj, compute pj∗Pr(Dj>=x) with x the capacity index. This value is called the EMSR (Expected Marginal Seat Revenue) of the class/bucket j with the remaining capacity of x. Thus, we have for each class/bucket a list of EMSR values. We merge all these lists and sort the values from high to low in order to obtain the BPV.

Definition at line 108 of file Emsr.cpp.

References RMOL::EmsrUtils::computeEmsrValue().

42.8.2.2 void RMOL::Emsr::heuristicOptimisationByEmsrA (stdair::LegCabin & *ioLegCabin*) [static]

Calculate the optimal protections for the set of buckets/classes given in input, and update those buckets accordingly.

Definition at line 21 of file Emsr.cpp.

References RMOL::EmsrUtils::computeProtectionLevel().

42.8.2.3 void RMOL::Emsr::heuristicOptimisationByEmsrB (stdair::LegCabin & *ioLegCabin*) [static]

Complute the protection levels and booking limites by using the EMSR-b algorithm.

Definition at line 64 of file Emsr.cpp.

References RMOL::EmsrUtils::computeAggregatedVirtualClass(), and RMOL::EmsrUtils::computeProtectionLevel().

The documentation for this class was generated from the following files:

- rmol/bom/Emsr.hpp
- rmol/bom/Emsr.cpp

42.9 RMOL::EmsrUtils Class Reference

`#include <rmol/bom/EmsrUtils.hpp>`

Static Public Member Functions

- static void computeAggregatedVirtualClass (stdair::VirtualClassStruct &, stdair::VirtualClassStruct &)
- static const stdair::ProtectionLevel_T computeProtectionLevel (stdair::VirtualClassStruct &, stdair::VirtualClassStruct &)
- static const double computeEmsrValue (double, stdair::VirtualClassStruct &)

42.9.1 Detailed Description

Forward declarations.

Definition at line 19 of file EmsrUtils.hpp.

42.9.2 Member Function Documentation

42.9.2.1 void RMOL::EmsrUtils::computeAggregatedVirtualClass (stdair::VirtualClassStruct & *ioAggregatedVirtualClass,* stdair::VirtualClassStruct & *ioCurrentVirtualClass*) [static]

Compute the aggregated class/bucket of classes/buckets 1,..,j for EMSR-b algorithm.

Definition at line 19 of file EmsrUtils.cpp.

Referenced by RMOL::Emsr::heuristicOptimisationByEmsrB().

42.9.2.2 const stdair::ProtectionLevel_T RMOL::EmsrUtils::computeProtectionLevel (stdair::VirtualClassStruct & *ioAggregatedVirtualClass,* stdair::VirtualClassStruct & *ioNextVirtualClass*) [static]

Compute the protection level using the Little-Wood formular.

Definition at line 53 of file EmsrUtils.cpp.

Referenced by RMOL::Emsr::heuristicOptimisationByEmsrA(), and RMOL::Emsr::heuristicOptimisationByEmsrB().

42.9.2.3 const double RMOL::EmsrUtils::computeEmsrValue (double *iCapacity,* stdair::VirtualClassStruct & *ioVirtualClass*) [static]

Compute the EMSR value of a class/bucket.

Definition at line 80 of file EmsrUtils.cpp.

Referenced by RMOL::Emsr::heuristicOptimisationByEmsr().

The documentation for this class was generated from the following files:

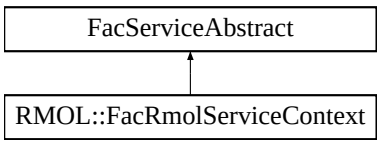
- rmol/bom/EmsrUtils.hpp
- rmol/bom/EmsrUtils.cpp

42.10 RMOL::FacRmolServiceContext Class Reference

Factory for the service context.

`#include <rmol/factory/FacRmolServiceContext.hpp>`

Inheritance diagram for RMOL::FacRmolServiceContext:



Public Member Functions

- ~FacRmolServiceContext ()
- RMOL_ServiceContext & create ()

Static Public Member Functions

- static FacRmolServiceContext & instance ()

Protected Member Functions

- FacRmolServiceContext ()

42.10.1 Detailed Description

Factory for the service context.

Definition at line 22 of file FacRmolServiceContext.hpp.

42.10.2 Constructor & Destructor Documentation

42.10.2.1 RMOL::FacRmolServiceContext::~FacRmolServiceContext ( )

Destructor.

The Destruction put the _instance to NULL in order to be clean for the next FacSimfqt-ServiceContext::instance().

Definition at line 17 of file FacRmolServiceContext.cpp.

42.10.2.2 RMOL::FacRmolServiceContext::FacRmolServiceContext ( ) [inline, protected]

Default Constructor.

This constructor is protected in order to ensure the singleton pattern.

Definition at line 57 of file FacRmolServiceContext.hpp.

Referenced by instance().

42.10.3 Member Function Documentation

42.10.3.1 FacRmolServiceContext & RMOL::FacRmolServiceContext::instance ( ) [static]

Provide the unique instance.

The singleton is instantiated when first used.

Returns

FacServiceContext&

Definition at line 22 of file FacRmolServiceContext.cpp.

References FacRmolServiceContext().

42.10.3.2 RMOL_ServiceContext & RMOL::FacRmolServiceContext::create ( )

Create a new ServiceContext object.

This new object is added to the list of instantiated objects.

Returns

ServiceContext& The newly created object.

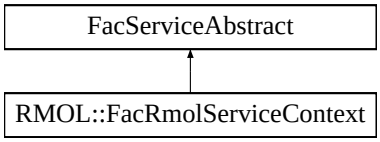
Definition at line 34 of file FacRmolServiceContext.cpp.

The documentation for this class was generated from the following files:

- rmol/factory/FacRmolServiceContext.hpp
- rmol/factory/FacRmolServiceContext.cpp

42.11 FacServiceAbstract Class Reference

Inheritance diagram for FacServiceAbstract:



The documentation for this class was generated from the following file:

- rmol/factory/FacRmolServiceContext.hpp

42.12 RMOL::Forecaster Class Reference

`#include <rmol/command/Forecaster.hpp>`

Static Public Member Functions

- static bool forecastUsingAdditivePickUp (stdair::FlightDate &, const stdair::DateTime_T &)
- static bool forecastUsingMultiplicativePickUp (stdair::FlightDate &, const stdair::DateTime_T &)

42.12.1 Detailed Description

Class wrapping the optimisation algorithms.

Definition at line 23 of file Forecaster.hpp.

42.12.2 Member Function Documentation

42.12.2.1 bool RMOL::Forecaster::forecastUsingAdditivePickUp (stdair::FlightDate & *ioFlightDate,* const stdair::DateTime_T & *iEventTime*) [static]

Forecast demand for a flight-date using additive pick-up method.

Definition at line 35 of file Forecaster.cpp.

References RMOL::Utilities::buildRemainingDCPList(), and RMOL::Utilities::buildRemainingDCPList2().

Referenced by RMOL::RMOL_Service::optimise().

42.12.2.2 bool RMOL::Forecaster::forecastUsingMultiplicativePickUp (stdair::FlightDate & *ioFlightDate,* const stdair::DateTime_T & *iEventTime*) [static]

Forecast demand for a flight-date using multiplicative pick-up method.

Definition at line 276 of file Forecaster.cpp.

Referenced by RMOL::RMOL_Service::optimise().

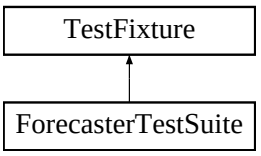
The documentation for this class was generated from the following files:

- rmol/command/Forecaster.hpp
- rmol/command/Forecaster.cpp

42.13 ForecasterTestSuite Class Reference

`#include <test/rmol/ForecasterTestSuite.hpp>`

Inheritance diagram for ForecasterTestSuite:



Public Member Functions

- void testQForecaster ()
- ForecasterTestSuite ()

Protected Attributes

- std::stringstream _describeKey

42.13.1 Detailed Description

Definition at line 6 of file ForecasterTestSuite.hpp.

42.13.2 Constructor & Destructor Documentation

42.13.2.1 ForecasterTestSuite::ForecasterTestSuite ( )

Constructor.

42.13.3 Member Function Documentation

42.13.3.1 void ForecasterTestSuite::testQForecaster ( )

Test Q-forecaster.

42.13.4 Member Data Documentation

42.13.4.1 std::stringstream ForecasterTestSuite::_describeKey [protected]

Definition at line 19 of file ForecasterTestSuite.hpp.

The documentation for this class was generated from the following file:

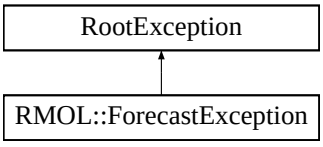
- test/rmol/ForecasterTestSuite.hpp

42.14 RMOL::ForecastException Class Reference

Forecast-related exception.

`#include <rmol/RMOL_Types.hpp>`

Inheritance diagram for RMOL::ForecastException:



Public Member Functions

- ForecastException (const std::string &iWhat)

42.14.1 Detailed Description

Forecast-related exception.

Definition at line 51 of file RMOL_Types.hpp.

42.14.2 Constructor & Destructor Documentation

42.14.2.1 RMOL::ForecastException::ForecastException (const std::string & *iWhat*) [inline]

Constructor.

Definition at line 54 of file RMOL_Types.hpp.

The documentation for this class was generated from the following file:

- rmol/RMOL_Types.hpp

42.15 RMOL::GuillotineBlockHelper Class Reference

`#include <rmol/bom/GuillotineBlockHelper.hpp>`

Static Public Member Functions

- static stdair::NbOfSegments_T getNbOfSegmentAlreadyPassedThisDTD (const stdair::GuillotineBlock &, const stdair::DTD_T &, const stdair::Date_T &)
- static bool hasPassedThisDTD (const stdair::SegmentCabin &, const stdair::DTD_T &, const stdair::Date_T &)

42.15.1 Detailed Description

Class representing the actual business functions for an airline guillotine block.

Definition at line 23 of file GuillotineBlockHelper.hpp.

42.15.2 Member Function Documentation

42.15.2.1 stdair::NbOfSegments_T RMOL::GuillotineBlockHelper::getNbOfSegmentAlreadyPassedThisDTD (const stdair::GuillotineBlock & *iGB*, const stdair::DTD_T & *iDTD*, const stdair::Date_T & *iCurrentDate*) [static]

Retrieve the number of similar segments which already passed the given DTD.

Definition at line 20 of file GuillotineBlockHelper.cpp.

References hasPassedThisDTD().

Referenced by RMOL::Utilities::getNbOfDepartedSimilarSegments(), RMOL::Detruncator::unconstrainUsingAdditivePick and RMOL::Detruncator::unconstrainUsingMultiplicativePickUp().

42.15.2.2 bool RMOL::GuillotineBlockHelper::hasPassedThisDTD (const stdair::SegmentCabin & *iSegmentCabin,* const stdair::DTD_T & *iDTD,* const stdair::Date_T & *iCurrentDate*) [static]

Check if the given segment has passed the given DTD.

Definition at line 42 of file GuillotineBlockHelper.cpp.

Referenced by getNbOfSegmentAlreadyPassedThisDTD().

The documentation for this class was generated from the following files:

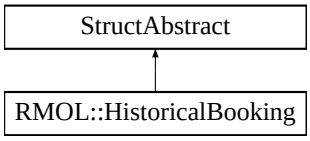
- rmol/bom/GuillotineBlockHelper.hpp
- rmol/bom/GuillotineBlockHelper.cpp

42.16 RMOL::HistoricalBooking Struct Reference

Structure keeping track, for a given class, of the number of historical bookings and of the censorship flag.

`#include <rmol/bom/HistoricalBooking.hpp>`

Inheritance diagram for RMOL::HistoricalBooking:



Public Member Functions

- const stdair::NbOfBookings_T & getNbOfBookings () const
- const stdair::NbOfBookings_T & getUnconstrainedDemand () const
- const stdair::Flag_T & getFlag () const
- void setUnconstrainedDemand (const stdair::NbOfBookings_T &iDemand)
- void setParameters (const stdair::NbOfBookings_T, const stdair::Flag_T)
- void toStream (std::ostream &ioOut) const
- const std::string describe () const
- void display () const
- HistoricalBooking (const stdair::NbOfBookings_T, const stdair::Flag_T)
- HistoricalBooking ()
- HistoricalBooking (const HistoricalBooking &)
- virtual ~HistoricalBooking ()

42.16.1 Detailed Description

Structure keeping track, for a given class, of the number of historical bookings and of the censorship flag.

Definition at line 17 of file HistoricalBooking.hpp.

42.16.2 Constructor & Destructor Documentation

42.16.2.1 RMOL::HistoricalBooking::HistoricalBooking (const stdair::NbOfBookings_T *iNbOfBookings,* const stdair::Flag_T *iFlag*)

Main constructor.

Definition at line 21 of file HistoricalBooking.cpp.

42.16.2.2 RMOL::HistoricalBooking::HistoricalBooking ( )

Default constructor.

Definition at line 15 of file HistoricalBooking.cpp.

42.16.2.3 RMOL::HistoricalBooking::HistoricalBooking (const HistoricalBooking & *iHistoricalBooking*)

Copy constructor.

Definition at line 29 of file HistoricalBooking.cpp.

42.16.2.4 RMOL::HistoricalBooking::~HistoricalBooking ( ) [virtual]

Destructor.

Definition at line 36 of file HistoricalBooking.cpp.

42.16.3 Member Function Documentation

42.16.3.1 const stdair::NbOfBookings_T& RMOL::HistoricalBooking::getNbOfBookings ( ) const [inline]

Getter for the booking.

Definition at line 22 of file HistoricalBooking.hpp.

Referenced by RMOL::HistoricalBookingHolder::calculateExpectedDemand(), RMOL::HistoricalBookingHolder::getHisto RMOL::HistoricalBookingHolder::getNbOfUncensoredBookings(), RMOL::HistoricalBookingHolder::getUncensoredStar RMOL::HistoricalBookingHolder::toStream(), and toStream().

42.16.3.2 const stdair::NbOfBookings_T& RMOL::HistoricalBooking::getUnconstrainedDemand ( ) const [inline]

Getter for the unconstrained bookings.

Definition at line 26 of file HistoricalBooking.hpp.

Referenced by RMOL::HistoricalBookingHolder::getDemandMean(), RMOL::HistoricalBookingHolder::getStandardDevia
RMOL::HistoricalBookingHolder::getUnconstrainedDemand(), RMOL::HistoricalBookingHolder::toStream(),
and toStream().

42.16.3.3 const stdair::Flag_T& RMOL::HistoricalBooking::getFlag ( ) const [inline]

Getter for the flag of censorship: "false" means that the bookings are not censored.

Definition at line 31 of file HistoricalBooking.hpp.

Referenced by RMOL::HistoricalBookingHolder::getCensorshipFlag(), RMOL::HistoricalBookingHolder::getListOfToBeU
RMOL::HistoricalBookingHolder::getNbOfUncensoredBookings(), RMOL::HistoricalBookingHolder::toStream(),
and toStream().

42.16.3.4 void RMOL::HistoricalBooking::setUnconstrainedDemand (const stdair::NbOfBookings_T & *iDemand*) [inline]

Setter for the unconstraining demand.

Definition at line 38 of file HistoricalBooking.hpp.

42.16.3.5 void RMOL::HistoricalBooking::setParameters (const stdair::NbOfBookings_T *iNbOfBookings*, const stdair::Flag_T *iFlag*)

Setter for all parameters.

Definition at line 41 of file HistoricalBooking.cpp.

42.16.3.6 void RMOL::HistoricalBooking::toStream (std::ostream & *ioOut*) const

Dump a Business Object into an output stream.

Parameters

ostream&	the output stream

Returns

ostream& the output stream.

Definition at line 57 of file HistoricalBooking.cpp.

References getFlag(), getNbOfBookings(), and getUnconstrainedDemand().

Referenced by display().

42.16.3.7 const std::string RMOL::HistoricalBooking::describe ( ) const

Give a description of the structure (for display purposes).

Definition at line 48 of file HistoricalBooking.cpp.

42.16.3.8 void RMOL::HistoricalBooking::display ( ) const

Display on standard output.

Definition at line 66 of file HistoricalBooking.cpp.

References toStream().

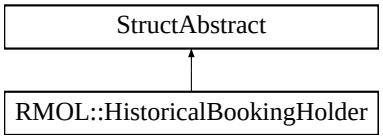
The documentation for this struct was generated from the following files:

- rmol/bom/HistoricalBooking.hpp
- rmol/bom/HistoricalBooking.cpp

42.17 RMOL::HistoricalBookingHolder Struct Reference

`#include <rmol/bom/HistoricalBookingHolder.hpp>`

Inheritance diagram for RMOL::HistoricalBookingHolder:



Public Member Functions

- const short getNbOfFlights () const
- const short getNbOfUncensoredData () const
- const stdair::NbOfBookings_T getNbOfUncensoredBookings () const
- const double getUncensoredStandardDeviation (const double &iMeanOfUncensoredBookings, const short iNbOfUncensoredData) const
- const double getDemandMean () const
- const double getStandardDeviation (const double) const
- const std::vector< bool > getListOfToBeUnconstrainedFlags () const
- const stdair::NbOfBookings_T & getHistoricalBooking (const short i) const
- const stdair::NbOfBookings_T & getUnconstrainedDemand (const short i) const
- const stdair::Flag_T & getCensorshipFlag (const short i) const
- const stdair::NbOfBookings_T & getUnconstrainedDemandOnFirstElement () const
- const stdair::NbOfBookings_T calculateExpectedDemand (const double, const double, const short, const stdair::NbOfBookings_T) const
- void setUnconstrainedDemand (const stdair::NbOfBookings_T &iExpectedDemand, const short i)
- void addHistoricalBooking (const HistoricalBooking &iHistoricalBooking)
- void toStream (std::ostream &ioOut) const
- const std::string describe () const
- void display () const
- virtual ~HistoricalBookingHolder ()
- HistoricalBookingHolder ()

42.17.1 Detailed Description

Holder of a HistoricalBookingList object (for memory allocation and recollection purposes).

Definition at line 23 of file HistoricalBookingHolder.hpp.

42.17.2 Constructor & Destructor Documentation

42.17.2.1 RMOL::HistoricalBookingHolder::~HistoricalBookingHolder ( ) [virtual]

Destructor.

Definition at line 23 of file HistoricalBookingHolder.cpp.

42.17.2.2 RMOL::HistoricalBookingHolder::HistoricalBookingHolder ( )

Constructor.

Protected to force the use of the Factory.

Definition at line 19 of file HistoricalBookingHolder.cpp.

42.17.3 Member Function Documentation

42.17.3.1 const short RMOL::HistoricalBookingHolder::getNbOfFlights ( ) const

Get number of flights.

Definition at line 28 of file HistoricalBookingHolder.cpp.

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod(), and RMOL::Detruncator::unconstrainUsingMultip

42.17.3.2 const short RMOL::HistoricalBookingHolder::getNbOfUncensoredData ( ) const

Get number of uncensored booking data.

Definition at line 33 of file HistoricalBookingHolder.cpp.

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod(), and RMOL::Detruncator::unconstrainUsingMultip

42.17.3.3 const stdair::NbOfBookings_T RMOL::HistoricalBookingHolder::getNbOfUncensoredBookings ( ) const

Get number of uncensored bookings.

Definition at line 49 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getFlag(), and RMOL::HistoricalBooking::getNbOfBookings().

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod().

42.17.3.4 const double RMOL::HistoricalBookingHolder::getUncensoredStandardDeviation (const double & *iMeanOfUncensoredBookings*, const short *iNbOfUncensoredData*) const

Get standard deviation of uncensored bookings.

Definition at line 69 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getNbOfBookings().

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod().

42.17.3.5 const double RMOL::HistoricalBookingHolder::getDemandMean ( ) const

Get mean of historical demand.

Definition at line 95 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getUnconstrainedDemand().

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod().

42.17.3.6 const double RMOL::HistoricalBookingHolder::getStandardDeviation (const double *iDemandMean*) const

Get standard deviation of demand.

Definition at line 116 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getUnconstrainedDemand().

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod().

42.17.3.7 const std::vector< bool > RMOL::HistoricalBookingHolder::getListOfToBeUnconstrainedFlags ( ) const

Get the list of flags of need to be unconstrained.

Definition at line 140 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getFlag().

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod().

42.17.3.8 const stdair::NbOfBookings_T & RMOL::HistoricalBookingHolder::getHistoricalBooking (const short *i*) const

Get the historical booking of the (i+1)-th flight.

Definition at line 161 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getNbOfBookings().

Referenced by RMOL::Detruncator::unconstrainUsingMultiplicativePickUp().

42.17.3.9 const stdair::NbOfBookings_T & RMOL::HistoricalBookingHolder::getUnconstrainedDemand (const short *i*) const

Get the unconstraining demand of the (i+1)-th flight.

Definition at line 169 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getUnconstrainedDemand().

Referenced by getUnconstrainedDemandOnFirstElement(), and RMOL::EMDetruncator::unconstrainUsingEMMethod().

42.17.3.10 const stdair::Flag_T & RMOL::HistoricalBookingHolder::getCensorshipFlag (const short *i*) const

Get the flag of the (i+1)-th flight.

Definition at line 177 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getFlag().

Referenced by RMOL::Detruncator::unconstrainUsingMultiplicativePickUp().

42.17.3.11 const stdair::NbOfBookings_T& RMOL::HistoricalBookingHolder::getUnconstrainedDemandOnFirstElement ( ) const [inline]

Get the unconstraining demand of the first flight.

Definition at line 60 of file HistoricalBookingHolder.hpp.

References getUnconstrainedDemand().

42.17.3.12 const stdair::NbOfBookings_T RMOL::HistoricalBookingHolder::calculateExpectedDemand (const double *iMean,* const double *iSD,* const short *i,* const stdair::NbOfBookings_T *iDemand*) const

Calculate the expected demand.

Definition at line 191 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getNbOfBookings().

42.17.3.13 void RMOL::HistoricalBookingHolder::setUnconstrainedDemand (const stdair::NbOfBookings_T & *iExpectedDemand,* const short *i*)

Set the expected historical demand of the (i+1)-th flight.

Definition at line 185 of file HistoricalBookingHolder.cpp.

Referenced by RMOL::EMDetruncator::unconstrainUsingEMMethod(), and RMOL::Detruncator::unconstrainUsingMultip

42.17.3.14 void RMOL::HistoricalBookingHolder::addHistoricalBooking (const HistoricalBooking & *iHistoricalBooking*)

Add a HistoricalBooking object to the holder.

Definition at line 236 of file HistoricalBookingHolder.cpp.

42.17.3.15 void RMOL::HistoricalBookingHolder::toStream (std::ostream & *ioOut*) const

Dump a Business Object into an output stream.

Parameters

ostream&	the output stream

Returns

ostream& the output stream.

Definition at line 241 of file HistoricalBookingHolder.cpp.

References RMOL::HistoricalBooking::getFlag(), RMOL::HistoricalBooking::getNbOfBookings(), and RMOL::HistoricalBooking::getUnconstrainedDemand().

Referenced by display().

42.17.3.16 const std::string RMOL::HistoricalBookingHolder::describe ( ) const

Give a description of the structure (for display purposes).

Definition at line 265 of file HistoricalBookingHolder.cpp.

42.17.3.17 void RMOL::HistoricalBookingHolder::display ( ) const

Display on standard output.

Definition at line 273 of file HistoricalBookingHolder.cpp.

References toStream().

The documentation for this struct was generated from the following files:

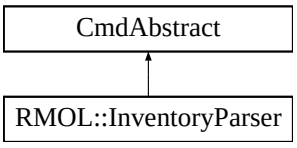
- rmol/bom/HistoricalBookingHolder.hpp
- rmol/bom/HistoricalBookingHolder.cpp

42.18 RMOL::InventoryParser Class Reference

Class filling the virtual class list (representing a list of classes/buckets) from a given input inventory.

`#include <rmol/command/InventoryParser.hpp>`

Inheritance diagram for RMOL::InventoryParser:



Static Public Member Functions

- static stdair::LegCabin & getSampleLegCabin (stdair::BomRoot &)
- static stdair::SegmentCabin & getSampleSegmentCabin (stdair::BomRoot &)

- static bool parseInputFileAndBuildBom (const std::string &iInputFileName, stdair::BomRoot &)

42.18.1 Detailed Description

Class filling the virtual class list (representing a list of classes/buckets) from a given input inventory.

Definition at line 25 of file InventoryParser.hpp.

42.18.2 Member Function Documentation

42.18.2.1 stdair::LegCabin & RMOL::InventoryParser::getSampleLegCabin (stdair::BomRoot & *ioBomRoot*) [static]

Get the sample leg-cabin (for optimisation).

Parameters

stdair::BomRo	The BOM tree.

Definition at line 36 of file InventoryParser.cpp.

Referenced by RMOL::RMOL_Service::heuristicOptimisationByEmsr(), RMOL::RMOL_Service::heuristicOptimisationByEmsrA(), RMOL::RMOL_Service::heuristicOptimisationByEmsrB(), RMOL::RMOL_Service::optimalOptimisationByMCIntegration(), and parseInputFileAndBuildBom().

42.18.2.2 stdair::SegmentCabin & RMOL::InventoryParser::getSampleSegmentCabin (stdair::BomRoot & *ioBomRoot*) [static]

Get the sample leg-cabin (for optimisation).

Parameters

stdair::BomRo	The BOM tree.

Definition at line 92 of file InventoryParser.cpp.

Referenced by parseInputFileAndBuildBom().

42.18.2.3 bool RMOL::InventoryParser::parseInputFileAndBuildBom (const std::string & *iInputFileName*, stdair::BomRoot & *ioBomRoot*) [static]

Parse the input values from a CSV-formatted inventory file.

Parameters

const	std::string& iInputFileName Inventory file to be parsed.

stdair::BomRo	The BOM tree.

Returns

bool Whether or not the parsing was successful.

Definition at line 131 of file InventoryParser.cpp.

References getSampleLegCabin(), and getSampleSegmentCabin().

Referenced by RMOL::RMOL_Service::parseAndLoad().

The documentation for this class was generated from the following files:

- rmol/command/InventoryParser.hpp
- rmol/command/InventoryParser.cpp

42.19 RMOL::MCOptimiser Class Reference

`#include <rmol/bom/MCOptimiser.hpp>`

Static Public Member Functions

- static void optimalOptimisationByMCIntegration (stdair::LegCabin &)
- static stdair::GeneratedDemandVector_T generateDemandVector (const stdair::MeanValue_-T &, const stdair::StdDevValue_T &, const unsigned int &)
- static void optimisationByMCIntegration (stdair::LegCabin &)

42.19.1 Detailed Description

Utility methods for the Monte-Carlo algorithms.

Definition at line 19 of file MCOptimiser.hpp.

42.19.2 Member Function Documentation

42.19.2.1 void RMOL::MCOptimiser::optimalOptimisationByMCIntegration (stdair::LegCabin & *ioLegCabin*) [static]

Calculate the optimal protections for the set of buckets/classes given in input, and update those buckets accordingly.

The Monte Carlo Integration algorithm (see The Theory and Practice of Revenue Management, by Kalyan T. Talluri and Garret J. van Ryzin, Kluwer Academic Publishers, for the details) is used.

Definition at line 28 of file MCOptimiser.cpp.

42.19.2.2 stdair::GeneratedDemandVector_T RMOL::MCOptimiser::generateDemandVector (const stdair::MeanValue_T & *iMean,* const stdair::StdDevValue_T & *iStdDev,* const unsigned int & *K*) [static]

Monte-Carlo

Definition at line 154 of file MCOptimiser.cpp.

Referenced by optimisationByMCIntegration().

42.19.2.3 void RMOL::MCOptimiser::optimisationByMCIntegration (stdair::LegCabin & *ioLegCabin*) [static]

Definition at line 175 of file MCOptimiser.cpp.

References generateDemandVector().

Referenced by RMOL::Optimiser::optimiseUsingOnDForecast().

The documentation for this class was generated from the following files:

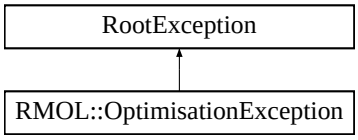
- rmol/bom/MCOptimiser.hpp
- rmol/bom/MCOptimiser.cpp

42.20 RMOL::OptimisationException Class Reference

Optimisation-related exception.

`#include <rmol/RMOL_Types.hpp>`

Inheritance diagram for RMOL::OptimisationException:



Public Member Functions

- OptimisationException (const std::string &iWhat)

42.20.1 Detailed Description

Optimisation-related exception.

Definition at line 61 of file RMOL_Types.hpp.

42.20.2 Constructor & Destructor Documentation

42.20.2.1 RMOL::OptimisationException::OptimisationException (const std::string & *iWhat*) [inline]

Constructor.

Definition at line 64 of file RMOL_Types.hpp.

The documentation for this class was generated from the following file:

- rmol/RMOL_Types.hpp

42.21 RMOL::Optimiser Class Reference

`#include <rmol/command/Optimiser.hpp>`

Static Public Member Functions

- static void optimalOptimisationByMCIntegration (const int K, stdair::LegCabin &)
- static void optimalOptimisationByDP (stdair::LegCabin &)
- static void heuristicOptimisationByEmsr (stdair::LegCabin &)
- static void heuristicOptimisationByEmsrA (stdair::LegCabin &)
- static void heuristicOptimisationByEmsrB (stdair::LegCabin &)
- static void optimise (stdair::FlightDate &)
- static void buildVirtualClassListForLegBasedOptimisation (stdair::LegCabin &)
- static double optimiseUsingOnDForecast (stdair::FlightDate &, const bool &iReduceFluctuations=false)

42.21.1 Detailed Description

Class wrapping the optimisation algorithms.

Definition at line 18 of file Optimiser.hpp.

42.21.2 Member Function Documentation

42.21.2.1 void RMOL::Optimiser::optimalOptimisationByMCIntegration (const int *K,* stdair::LegCabin & *ioLegCabin*) [static]

Monte Carlo Integration algorithm.

Calculate the optimal protections for the set of buckets/classes given in input, and update those buckets accordingly.

The Monte Carlo Integration algorithm (see The Theory and Practice of Revenue Management, by Kalyan T. Talluri and Garret J. van Ryzin, Kluwer Academic Publishers, for the details) is used. Hence, K is the number of random draws to perform. 100 is a minimum for K, as statistics must be drawn from those random generations.

Definition at line 29 of file Optimiser.cpp.

Referenced by optimise().

42.21.2.2 void RMOL::Optimiser::optimalOptimisationByDP (stdair::LegCabin & *ioLegCabin*) [static]

Dynamic Programming.

Definition at line 63 of file Optimiser.cpp.

42.21.2.3 void RMOL::Optimiser::heuristicOptimisationByEmsr (stdair::LegCabin & *ioLegCabin*) [static]

EMRS algorithm.

Definition at line 68 of file Optimiser.cpp.

42.21.2.4 void RMOL::Optimiser::heuristicOptimisationByEmsrA (stdair::LegCabin & *ioLegCabin*) [static]

EMRS-a algorithm.

Definition at line 73 of file Optimiser.cpp.

42.21.2.5 void RMOL::Optimiser::heuristicOptimisationByEmsrB (stdair::LegCabin & *ioLegCabin*) [static]

EMRS-b algorithm.

Definition at line 78 of file Optimiser.cpp.

42.21.2.6 void RMOL::Optimiser::optimise (stdair::FlightDate & *ioFlightDate*) [static]

Optimise a flight-date using leg-based Monte Carlo Integration.

Definition at line 83 of file Optimiser.cpp.

References buildVirtualClassListForLegBasedOptimisation(), and optimalOptimisationByMCIntegration().

42.21.2.7 void RMOL::Optimiser::buildVirtualClassListForLegBasedOptimisation (stdair::LegCabin & *ioLegCabin*) [static]

Build the virtual class list for the given leg-cabin.

Definition at line 112 of file Optimiser.cpp.

Referenced by optimise().

42.21.2.8 double RMOL::Optimiser::optimiseUsingOnDForecast (stdair::FlightDate & *ioFlightDate*, const bool & *iReduceFluctuations* = false) [static]

Optimiser

Definition at line 156 of file Optimiser.cpp.

References RMOL::MCOptimiser::optimisationByMCIntegration().

Referenced by RMOL::RMOL_Service::optimiseOnD(), RMOL::RMOL_Service::optimiseOnDUsingAdvancedRMCoope and RMOL::RMOL_Service::optimiseOnDUsingRMCooperation().

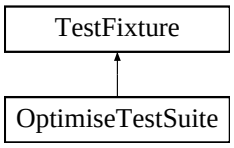
The documentation for this class was generated from the following files:

- rmol/command/Optimiser.hpp
- rmol/command/Optimiser.cpp

42.22 OptimiseTestSuite Class Reference

`#include <test/rmol/OptimiseTestSuite.hpp>`

Inheritance diagram for OptimiseTestSuite:



Public Member Functions

- void testOptimiseMC ()
- void testOptimiseDP ()
- void testOptimiseEMSR ()
- void testOptimiseEMSRa ()
- void testOptimiseEMSRb ()
- OptimiseTestSuite ()

Protected Attributes

- std::stringstream _describeKey

42.22.1 Detailed Description

Definition at line 6 of file OptimiseTestSuite.hpp.

42.22.2 Constructor & Destructor Documentation

42.22.2.1 OptimiseTestSuite::OptimiseTestSuite ( )

Test some error detection functionalities. Constructor.

42.22.3 Member Function Documentation

42.22.3.1 void OptimiseTestSuite::testOptimiseMC ( )

Test the Monte-Carlo (MC) Optimisation functionality.

42.22.3.2 void OptimiseTestSuite::testOptimiseDP ( )

Test the Dynamic Programming (DP) Optimisation functionality.

42.22.3.3 void OptimiseTestSuite::testOptimiseEMSR ( )

Test the Expected Marginal Seat Revenue (EMSR) Optimisation functionality.

42.22.3.4 void OptimiseTestSuite::testOptimiseEMSRa ( )

Test the Expected Marginal Seat Revenue, variant a (EMSR-a), Optimisation functionality.

42.22.3.5 void OptimiseTestSuite::testOptimiseEMSRb ( )

Test the Expected Marginal Seat Revenue, variant b (EMSR-b), Optimisation functionality.

42.22.4 Member Data Documentation

42.22.4.1 std::stringstream OptimiseTestSuite::_describeKey [protected]

Definition at line 43 of file OptimiseTestSuite.hpp.

The documentation for this class was generated from the following file:

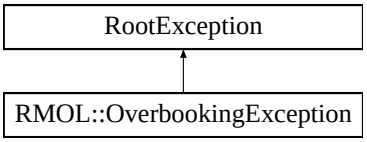
- test/rmol/OptimiseTestSuite.hpp

42.23 RMOL::OverbookingException Class Reference

Overbooking-related exception.

`#include <rmol/RMOL_Types.hpp>`

Inheritance diagram for RMOL::OverbookingException:



Public Member Functions

- OverbookingException (const std::string &iWhat)

42.23.1 Detailed Description

Overbooking-related exception.

Definition at line 31 of file RMOL_Types.hpp.

42.23.2 Constructor & Destructor Documentation

42.23.2.1 RMOL::OverbookingException::OverbookingException (const std::string & *iWhat*) [inline]

Constructor.

Definition at line 34 of file RMOL_Types.hpp.

The documentation for this class was generated from the following file:

- rmol/RMOL_Types.hpp

42.24 RMOL::RMOL_Service Class Reference

Interface for the RMOL Services.

`#include <rmol/RMOL_Service.hpp>`

Public Member Functions

- RMOL_Service (const stdair::BasLogParams &, const stdair::BasDBParams &)
- RMOL_Service (const stdair::BasLogParams &)
- RMOL_Service (stdair::STDAIR_ServicePtr_T)
- void parseAndLoad (const stdair::CabinCapacity_T &iCabinCapacity, const stdair::Filename_T &iDemandAndClassDataFile)
- void setUpStudyStatManager ()
- ~RMOL_Service ()
- void buildSampleBom ()
- void optimalOptimisationByMCIntegration (const int K)
- void optimalOptimisationByDP ()
- void heuristicOptimisationByEmsr ()
- void heuristicOptimisationByEmsrA ()
- void heuristicOptimisationByEmsrB ()
- bool optimise (stdair::FlightDate &, const stdair::DateTime_T &, const stdair::ForecastingMethod &, const stdair::PartnershipTechnique &)
- void forecastOnD (const stdair::DateTime_T &)
- stdair::YieldFeatures * getYieldFeatures (const stdair::OnDDate &, const stdair::CabinCode_T &, stdair::BomRoot &)
- void forecastOnD (const stdair::YieldFeatures &, stdair::OnDDate &, const stdair::CabinCode_T &, const stdair::DTD_T &, stdair::BomRoot &)
- void setOnDForecast (const stdair::AirlineClassList &, const stdair::MeanValue_T &, const stdair::StdDevValue_T &, stdair::OnDDate &, const stdair::CabinCode_T &, stdair::BomRoot &)

- void setOnDForecast (const stdair::AirlineCode_T &, const stdair::Date_T &, const stdair::AirportCode_T &, const stdair::AirportCode_T &, const stdair::CabinCode_T &, const stdair::ClassCode_T &, const stdair::MeanValue_T &, const stdair::StdDevValue_T &, const stdair::Yield_T &, stdair::BomRoot &)
- void setOnDForecast (const stdair::AirlineCodeList_T &, const stdair::AirlineCode_T &, const stdair::Date_T &, const stdair::AirportCode_T &, const stdair::AirportCode_T &, const stdair::CabinCode_T &, const stdair::ClassCodeList_T &, const stdair::MeanValue_T &, const stdair::StdDevValue_T &, const stdair::Yield_T &, stdair::BomRoot &)
- void resetDemandInformation (const stdair::DateTime_T &)
- void resetDemandInformation (const stdair::DateTime_T &, const stdair::Inventory &)
- void projectAggregatedDemandOnLegCabins (const stdair::DateTime_T &)
- void projectOnDDemandOnLegCabinsUsingYP (const stdair::DateTime_T &)
- void projectOnDDemandOnLegCabinsUsingDA (const stdair::DateTime_T &)
- void projectOnDDemandOnLegCabinsUsingDYP (const stdair::DateTime_T &)
- void projectOnDDemandOnLegCabinsUsingDYP (const stdair::DateTime_T &, const stdair::Inventory &)
- void optimiseOnD (const stdair::DateTime_T &)
- void optimiseOnDUsingRMCooperation (const stdair::DateTime_T &)
- void optimiseOnDUsingAdvancedRMCooperation (const stdair::DateTime_T &)
- void updateBidPrice (const stdair::DateTime_T &)
- void updateBidPrice (const stdair::FlightDate &, stdair::BomRoot &)
- std::string jsonExport (const stdair::AirlineCode_T &, const stdair::FlightNumber_T &, const stdair::Date_T &iDepartureDate) const
- std::string csvDisplay () const

42.24.1 Detailed Description

Interface for the RMOL Services.

Definition at line 39 of file RMOL_Service.hpp.

42.24.2 Constructor & Destructor Documentation

42.24.2.1 RMOL::RMOL_Service::RMOL_Service (const stdair::BasLogParams & *iLogParams*, const stdair::BasDBParams & *iDBParams*)

Constructor.

The initRmolService() method is called; see the corresponding documentation for more details.

A reference on an output stream is given, so that log outputs can be directed onto that stream.

Moreover, database connection parameters are given, so that a session can be created on the corresponding database.

Parameters

const	stdair::BasLogParams& Parameters for the output log stream.
const	stdair::BasDBParams& Parameters for the database access.

Definition at line 83 of file RMOL_Service.cpp.

42.24.2.2 RMOL::RMOL_Service::RMOL_Service (const stdair::BasLogParams & *iLogParams*)

Constructor.

The initRmolService() method is called; see the corresponding documentation for more details.

Moreover, a reference on an output stream is given, so that log outputs can be directed onto that stream.

Parameters

const	stdair::BasLogParams& Parameters for the output log stream.

Definition at line 62 of file RMOL_Service.cpp.

42.24.2.3 RMOL::RMOL_Service::RMOL_Service (stdair::STDAIR_ServicePtr_T *ioSTDAIRServicePtr*)

Constructor.

The initRmolService() method is called; see the corresponding documentation for more details.

Moreover, as no reference on any output stream is given, it is assumed that the StdAir log service has already been initialised with the proper log output stream by some other methods in the calling chain (for instance, when the RMOL_Service is itself being initialised by another library service such as AIRINV_Service).

Parameters

STDAIR_ServicePtr_T	the shared pointer of stdair service.

Definition at line 105 of file RMOL_Service.cpp.

42.24.2.4 RMOL::RMOL_Service::~RMOL_Service ( )

Destructor.

Definition at line 122 of file RMOL_Service.cpp.

42.24.3 Member Function Documentation

42.24.3.1 void RMOL::RMOL_Service::parseAndLoad (const stdair::CabinCapacity_T & *iCabinCapacity,* const stdair::Filename_T & *iDemandAndClassDataFile*)

Parse the optimisation-related data and load them into memory.

First, the STDAIR_Service::buildDummyInventory() method is called, for RMOL and with the given cabin capacity, in order to build the miminum required flight-date structure in order to perform an optimisation on a leg-cabin.

The CSV input file describes the problem to be optimised, i.e.:

- the demand specifications for all the booking classes (mean and standard deviations for the demand distribution); the yields corresponding to those booking classes.

That CSV file is parsed and instantiated in memory accordingly. The leg-cabin capacity has been set at the initialisation of the (RMOL) service.

Parameters

const	stdair::CabinCapacity& Capacity of the leg-cabin to be optimised.
const	stdair::Filename_T& (CSV) input file.

Definition at line 199 of file RMOL_Service.cpp.

References RMOL::InventoryParser::parseInputFileAndBuildBom().

Referenced by main().

42.24.3.2 void RMOL::RMOL_Service::setUpStudyStatManager ( )

Set up the StudyStatManager.

42.24.3.3 void RMOL::RMOL_Service::buildSampleBom ( )

Build a sample BOM tree, and attach it to the BomRoot instance.

See also

stdair::CmdBomManager::buildSampleBom() for more details.

Definition at line 223 of file RMOL_Service.cpp.

Referenced by main().

42.24.3.4 void RMOL::RMOL_Service::optimalOptimisationByMCIntegration (const int *K*)

Single resource optimization using the Monte Carlo algorithm.

Definition at line 271 of file RMOL_Service.cpp.

References RMOL::InventoryParser::getSampleLegCabin().

Referenced by optimise().

42.24.3.5 void RMOL::RMOL_Service::optimalOptimisationByDP ( )

Single resource optimization using dynamic programming.

Definition at line 310 of file RMOL_Service.cpp.

Referenced by optimise().

42.24.3.6 void RMOL::RMOL_Service::heuristicOptimisationByEmsr ( )

Single resource optimization using EMSR heuristic.

Definition at line 314 of file RMOL_Service.cpp.

References RMOL::InventoryParser::getSampleLegCabin().

Referenced by optimise().

42.24.3.7 void RMOL::RMOL_Service::heuristicOptimisationByEmsrA ( )

Single resource optimization using EMSR-a heuristic.

Definition at line 354 of file RMOL_Service.cpp.

References RMOL::InventoryParser::getSampleLegCabin().

Referenced by optimise().

42.24.3.8 void RMOL::RMOL_Service::heuristicOptimisationByEmsrB ( )

Single resource optimization using EMSR-b heuristic.

Definition at line 374 of file RMOL_Service.cpp.

References RMOL::InventoryParser::getSampleLegCabin().

Referenced by optimise().

42.24.3.9 bool RMOL::RMOL_Service::optimise (stdair::FlightDate & *ioFlightDate,* const stdair::DateTime_T & *iRMEventTime,* const stdair::ForecastingMethod & *iForecastingMethod,* const stdair::PartnershipTechnique & *iPartnershipTechnique*)

Optimise (revenue management) an flight-date/network-date

Definition at line 394 of file RMOL_Service.cpp.

References forecastOnD(), RMOL::Forecaster::forecastUsingAdditivePickUp(), RMOL::Forecaster::forecastUsingMultipl optimiseOnD(), optimiseOnDUsingAdvancedRMCooperation(), optimiseOnDUsingRM-Cooperation(), projectAggregatedDemandOnLegCabins(), projectOnDDemandOnLeg-CabinsUsingDYP(), projectOnDDemandOnLegCabinsUsingYP(), resetDemandInforma-tion(), and updateBidPrice().

42.24.3.10 void RMOL::RMOL_Service::forecastOnD (const stdair::DateTime_T & *iRMEventTime*)

Forecaster

Definition at line 495 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST, and getYieldFeatures().

Referenced by optimise().

42.24.3.11 stdair::YieldFeatures * RMOL::RMOL_Service::getYieldFeatures (const stdair::OnDDate & *iOnDDate,* const stdair::CabinCode_T & *iCabinCode,* stdair::BomRoot & *iBomRoot*)

Definition at line 568 of file RMOL_Service.cpp.

Referenced by forecastOnD().

42.24.3.12 void RMOL::RMOL_Service::forecastOnD (const stdair::YieldFeatures & *iYieldFeatures,* stdair::OnDDate & *iOnDDate,* const stdair::CabinCode_T & *iCabinCode,* const stdair::DTD_T & *iDTD,* stdair::BomRoot & *iBomRoot*)

Definition at line 641 of file RMOL_Service.cpp.

References setOnDForecast().

42.24.3.13 void RMOL::RMOL_Service::setOnDForecast (const stdair::AirlineClassList & *iAirlineClassList,* const stdair::MeanValue_T & *iMeanValue,* const stdair::StdDevValue_T & *iStdDevValue,* stdair::OnDDate & *iOnDDate,* const stdair::CabinCode_T & *iCabinCode,* stdair::BomRoot & *iBomRoot*)

Definition at line 756 of file RMOL_Service.cpp.

Referenced by forecastOnD().

42.24.3.14 void RMOL::RMOL_Service::setOnDForecast (const stdair::AirlineCode_T & *iAirlineCode,* const stdair::Date_T & *iDepartureDate,* const stdair::AirportCode_T & *iOrigin,* const stdair::AirportCode_T & *iDestination,* const stdair::CabinCode_T & *iCabinCode,* const stdair::ClassCode_T & *iClassCode,* const stdair::MeanValue_T & *iMeanValue,* const stdair::StdDevValue_T & *iStdDevValue,* const stdair::Yield_T & *iYield,* stdair::BomRoot & *iBomRoot*)

Definition at line 815 of file RMOL_Service.cpp.

42.24.3.15 void RMOL::RMOL_Service::setOnDForecast (const stdair::AirlineCodeList_T & *iAirlineCodeList,* const stdair::AirlineCode_T & *iAirlineCode,* const stdair::Date_T & *iDepartureDate,* const stdair::AirportCode_T & *iOrigin,* const stdair::AirportCode_T & *iDestination,* const stdair::CabinCode_T & *iCabinCode,* const stdair::ClassCodeList_T & *iClassCodeList,* const stdair::MeanValue_T & *iMeanValue,* const stdair::StdDevValue_T & *iStdDevValue,* const stdair::Yield_T & *iYield,* stdair::BomRoot & *iBomRoot*)

Definition at line 877 of file RMOL_Service.cpp.

42.24.3.16 void RMOL::RMOL_Service::resetDemandInformation (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 992 of file RMOL_Service.cpp.

Referenced by optimise(), optimiseOnDUsingAdvancedRMCooperation(), and optimiseOn-

DUsingRMCooperation().

42.24.3.17 void RMOL::RMOL_Service::resetDemandInformation (const stdair::DateTime_T & *iRMEventTime,* const stdair::Inventory & *ilInventory*)

Definition at line 1018 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST.

42.24.3.18 void RMOL::RMOL_Service::projectAggregatedDemandOnLegCabins (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 1066 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST.

Referenced by optimise().

42.24.3.19 void RMOL::RMOL_Service::projectOnDDemandOnLegCabinsUsingYP (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 1169 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST.

Referenced by optimise().

42.24.3.20 void RMOL::RMOL_Service::projectOnDDemandOnLegCabinsUsingDA (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 1442 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST.

42.24.3.21 void RMOL::RMOL_Service::projectOnDDemandOnLegCabinsUsingDYP (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 1603 of file RMOL_Service.cpp.

Referenced by optimise(), optimiseOnDUsingAdvancedRMCooperation(), and optimiseOnDUsingRMCooperation().

42.24.3.22 void RMOL::RMOL_Service::projectOnDDemandOnLegCabinsUsingDYP (const stdair::DateTime_T & *iRMEventTime,* const stdair::Inventory & *ilInventory*)

Definition at line 1629 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST.

42.24.3.23 void RMOL::RMOL_Service::optimiseOnD (const stdair::DateTime_T & *iRMEventTime*)

Optimiser

Definition at line 1266 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST, and RMOL::Optimiser::optimiseUsingOnDForecast().

Referenced by optimise().

42.24.3.24 void RMOL::RMOL_Service::optimiseOnDUsingRMCooperation (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 1750 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST, RMOL::Optimiser::optimiseUsingOnDForecast(), projectOnDDemandOnLegCabinsUsingDYP(), and resetDemandInformation().

Referenced by optimise().

42.24.3.25 void RMOL::RMOL_Service::optimiseOnDUsingAdvancedRMCooperation (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 1810 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST, RMOL::Optimiser::optimiseUsingOnDForecast(), projectOnDDemandOnLegCabinsUsingDYP(), resetDemandInformation(), and updateBidPrice().

Referenced by optimise().

42.24.3.26 void RMOL::RMOL_Service::updateBidPrice (const stdair::DateTime_T & *iRMEventTime*)

Definition at line 1315 of file RMOL_Service.cpp.

References RMOL::DEFAULT_DCP_LIST.

Referenced by optimise(), and optimiseOnDUsingAdvancedRMCooperation().

42.24.3.27 void RMOL::RMOL_Service::updateBidPrice (const stdair::FlightDate & *iFlightDate,* stdair::BomRoot & *iBomRoot*)

Definition at line 1363 of file RMOL_Service.cpp.

42.24.3.28 std::string RMOL::RMOL_Service::jsonExport (const stdair::AirlineCode_T & , const stdair::FlightNumber_T & , const stdair::Date_T & *iDepartureDate*) const

Recursively dump, in the returned string and in JSON format, the flight-date corresponding to the parameters given as input.

Parameters

const	stdair::AirlineCode_T& Airline code of the flight to dump.
const	stdair::FlightNumber_T& Flight number of the flight to dump.
const	stdair::Date_T& Departure date of a flight to dump.

Returns

std::string Output string in which the BOM tree is JSON-ified.

42.24.3.29 std::string RMOL::RMOL_Service::csvDisplay ( ) const

Recursively display (dump in the returned string) the objects of the BOM tree.

Returns

std::string Output string in which the BOM tree is logged/dumped.

The documentation for this class was generated from the following files:

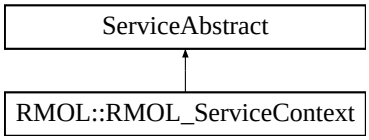
- rmol/RMOL_Service.hpp
- rmol/service/RMOL_Service.cpp

42.25 RMOL::RMOL_ServiceContext Class Reference

Inner class holding the context for the RMOL Service object.

`#include <rmol/service/RMOL_ServiceContext.hpp>`

Inheritance diagram for RMOL::RMOL_ServiceContext:



Friends

- class RMOL_Service
- class FacRmolServiceContext

42.25.1 Detailed Description

Inner class holding the context for the RMOL Service object.

Definition at line 29 of file RMOL_ServiceContext.hpp.

42.25.2 Friends And Related Function Documentation

42.25.2.1 friend class RMOL_Service [friend]

The RMOL_Service class should be the sole class to get access to ServiceContext content: general users do not want to bother with a context interface.

Definition at line 35 of file RMOL_ServiceContext.hpp.

42.25.2.2 friend class FacRmolServiceContext [friend]

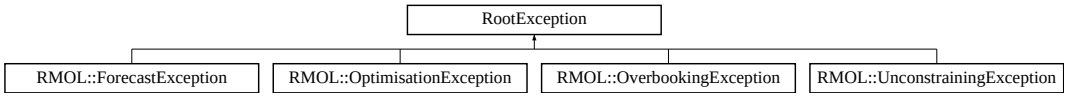
Definition at line 36 of file RMOL_ServiceContext.hpp.

The documentation for this class was generated from the following files:

- rmol/service/RMOL_ServiceContext.hpp
- rmol/service/RMOL_ServiceContext.cpp

42.26 RootException Class Reference

Inheritance diagram for RootException:

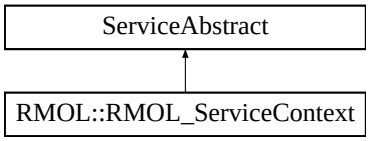


The documentation for this class was generated from the following file:

- rmol/RMOL_Types.hpp

42.27 ServiceAbstract Class Reference

Inheritance diagram for ServiceAbstract:

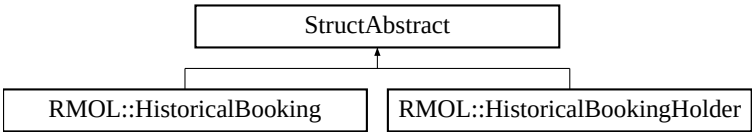


The documentation for this class was generated from the following file:

- rmol/service/RMOL_ServiceContext.hpp

42.28 StructAbstract Class Reference

Inheritance diagram for StructAbstract:

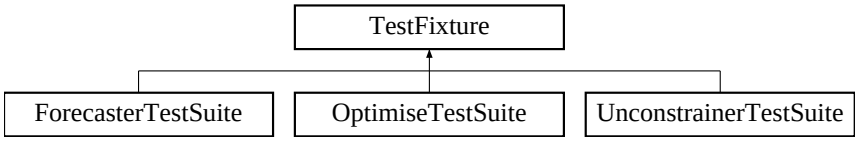


The documentation for this class was generated from the following file:

- rmol/bom/HistoricalBooking.hpp

42.29 TestFixture Class Reference

Inheritance diagram for TestFixture:



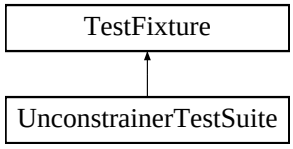
The documentation for this class was generated from the following file:

- test/rmol/OptimiseTestSuite.hpp

42.30 UnconstrainerTestSuite Class Reference

`#include <test/rmol/UnconstrainerTestSuite.hpp>`

Inheritance diagram for UnconstrainerTestSuite:



Public Member Functions

- void testUnconstrainingByEM ()
- UnconstrainerTestSuite ()

Protected Attributes

- std::stringstream _describeKey

42.30.1 Detailed Description

Definition at line 6 of file UnconstrainerTestSuite.hpp.

42.30.2 Constructor & Destructor Documentation

42.30.2.1 UnconstrainerTestSuite::UnconstrainerTestSuite ( )

Constructor.

42.30.3 Member Function Documentation

42.30.3.1 void UnconstrainerTestSuite::testUnconstrainingByEM ( )

Test data unconstraining by Expectation Maximization.

42.30.4 Member Data Documentation

42.30.4.1 std::stringstream UnconstrainerTestSuite::_describeKey [protected]

Definition at line 19 of file UnconstrainerTestSuite.hpp.

The documentation for this class was generated from the following file:

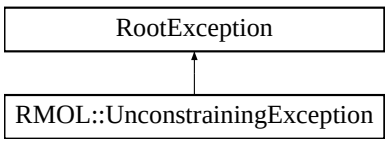
- test/rmol/UnconstrainerTestSuite.hpp

42.31 RMOL::UnconstrainingException Class Reference

Unconstraining-related exception.

`#include <rmol/RMOL_Types.hpp>`

Inheritance diagram for RMOL::UnconstrainingException:



Public Member Functions

- UnconstrainingException (const std::string &iWhat)

42.31.1 Detailed Description

Unconstraining-related exception.

Definition at line 41 of file RMOL_Types.hpp.

42.31.2 Constructor & Destructor Documentation

42.31.2.1 RMOL::UnconstrainingException::UnconstrainingException (const std::string & *iWhat*) [inline]

Constructor.

Definition at line 44 of file RMOL_Types.hpp.

The documentation for this class was generated from the following file:

- rmol/RMOL_Types.hpp

42.32 RMOL::Utilities Class Reference

`#include <rmol/bom/Utilities.hpp>`

Static Public Member Functions

- static void computeDistributionParameters (const UnconstrainedDemandVector_T &, double &, double &)
- static stdair::DCPList_T buildRemainingDCPList (const stdair::DTD_T &)
- static stdair::DCPList_T buildRemainingDCPList2 (const stdair::DTD_T &)
- static stdair::NbOfSegments_T getNbOfDepartedSimilarSegments (const stdair::SegmentCabin &, const stdair::Date_T &)

42.32.1 Detailed Description

Class holding helper methods.

Definition at line 19 of file Utilities.hpp.

42.32.2 Member Function Documentation

42.32.2.1 void RMOL::Utilities::computeDistributionParameters (const UnconstrainedDemandVector_T & *iVector,* double & *ioMean,* double & *ioStdDev*) [static]

Compute the mean and the standard deviation from a set of samples.

Definition at line 24 of file Utilities.cpp.

42.32.2.2 stdair::DCPList_T RMOL::Utilities::buildRemainingDCPList (const stdair::DTD_T & *iDTD*) [static]

Build the list of remaining DCP's for the segment-date.

Definition at line 55 of file Utilities.cpp.

References RMOL::DEFAULT_DCP_LIST.

Referenced by RMOL::Forecaster::forecastUsingAdditivePickUp().

42.32.2.3 stdair::DCPList_T RMOL::Utilities::buildRemainingDCPList2 (const stdair::DTD_T & *iDTD*) [static]

Definition at line 80 of file Utilities.cpp.

References RMOL::DEFAULT_DCP_LIST.

Referenced by RMOL::Forecaster::forecastUsingAdditivePickUp().

42.32.2.4 stdair::NbOfSegments_T RMOL::Utilities::getNbOfDepartedSimilarSegments (const stdair::SegmentCabin & *iSegmentCabin,* const stdair::Date_T & *iEventDate*) [static]

Retrieve the number of departed similar segments.

Definition at line 105 of file Utilities.cpp.

References RMOL::GuillotineBlockHelper::getNbOfSegmentAlreadyPassedThisDTD().

The documentation for this class was generated from the following files:

- rmol/bom/Utilities.hpp
- rmol/bom/Utilities.cpp

43 File Documentation

43.1 doc/local/authors.doc File Reference

43.2 doc/local/codingrules.doc File Reference

43.3 doc/local/copyright.doc File Reference

43.4 doc/local/documentation.doc File Reference

43.5 doc/local/features.doc File Reference

43.6 doc/local/help_wanted.doc File Reference

43.7 doc/local/howto_release.doc File Reference

43.8 doc/local/index.doc File Reference

43.9 doc/local/installation.doc File Reference

43.10 doc/local/linking.doc File Reference

```
#include <itpp/itcomm.h>
```

Functions

- int main ()

43.27.1 Function Documentation

43.27.1.1 int main ( )

Definition at line 9 of file bpsk.cpp.

43.28 bpsk.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011   //Scalars
00012   int N;
00013   double N0;
00014
00015   //Vectors
00016   bvec bits, dec_bits;
00017   vec symbols, rec;
00018
00019   //Classes
00020   BPSK bpsk;  //The BPSK modulator/debodulator class
00021   BERC berc;  //The Bit Error Rate Counter class
00022
00023   //Init
00024   N = 500000; //The number of bits to simulate
00025   N0 = 1;     //0 dB SNR
00026
00027   //Randomize the random number generator
00028   RNG_randomize();
00029
00030   //Generate the bits:
00031   bits = randb(N);
00032
00033   //Do the BPSK modulation
00034   bpsk.modulate_bits(bits, symbols);
00035
00036   //Add the AWGN
00037   rec = symbols + sqrt(N0/2)* randn(N);
00038
00039   //Decode the received bits
00040   bpsk.demodulate_bits(rec, dec_bits);
00041
00042   //Count the number of errors
00043   berc.count(bits,dec_bits);
00044
00045   //Print the results
00046   cout << "There were " << berc.get_errors() << " received bits in error." << end
      l;
00047   cout << "There were " << berc.get_corrects() << " correctly received bits." <<
      endl;
00048   cout << "The error probability was " << berc.get_errorrate() << endl;
00049   cout << "The theoretical error probability is " << 0.5*erfc(1.0) << endl;
00050
00051   //Exit program:
00052   return 0;
00053
00054 }
```

43.29 doc/tutorial/src/convcode.cpp File Reference

```
#include <itpp/itcomm.h>
```

Functions

- int main ()

43.29.1 Function Documentation

43.29.1.1 int main ( )

Definition at line 9 of file convcode.cpp.

43.30 convcode.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011   //Scalars
00012   int constraint_length, MaxNrofErrors, Nobits, MaxIterations, p, i;
00013   double Ec, Eb;
00014
00015   //Vectors
00016   ivec generators;
00017   vec EbN0dB, EbN0, N0, ber, trans_symbols, rec_symbols;
00018   bvec uncoded_bits, coded_bits, decoded_bits;
00019
00020   //Classes
00021   BPSK bpsk;
00022   BERC berc;
00023   Convolutional_Code conv_code;
00024   AWGN_Channel channel;
00025
00026   /*
00027   Set up the convolutional encoder/decoder class:
00028   The generators are given in octal form by adding a zero in front of the numbers
      .
00029   In this example we will simulate a rate 1/3 code that is listed in J. G. Proaki
      s,
00030   "Digital communications". The encoder has constraint length 7.
00031   */
00032   generators.set_size(3,false);
00033   generators(0) = 0133;
00034   generators(1) = 0145;
00035   generators(2) = 0175;
00036   constraint_length = 7;
00037   conv_code.set_generator_polynomials(generators, constraint_length);
00038
```

```
00039   //Init: Calculate some simulation specific parameters:
00040   Ec = 1.0;
00041   EbN0dB = linspace(-2,6,5);
00042   EbN0 = inv_dB(EbN0dB);
00043   Eb = Ec / conv_code.get_rate();
00044   N0 = Eb * pow(EbN0,-1);
00045   MaxNrofErrors = 100;
00046   Nobits = 10000;
00047   MaxIterations = 10;
00048   ber.set_size(EbN0dB.length(),false);
00049   ber.clear();
00050
00051   //Randomize the random number generators.
00052   RNG_randomize();
00053
00054   for (p=0; p<EbN0dB.length(); p++) {
00055
00056     cout << "Now simulating point " << p+1 << " out of " << EbN0dB.length() << en
      dl;
00057     berc.clear();                 //Clear the bit error rate counter.
00058     channel.set_noise(N0(p)/2.0); //Set the noise value of the AWGN channel.
00059
00060     for (i=0; i<MaxIterations; i++) {
00061
00062       uncoded_bits = randb(Nobits);                    //The uncoded bits.
00063       coded_bits = conv_code.encode(uncoded_bits);     //The convolutional encoder
       function.
00064       bpsk.modulate_bits(coded_bits, trans_symbols); //The BPSK modulator.
00065       rec_symbols = channel( trans_symbols );          //The AWGN channel.
00066       decoded_bits = conv_code.decode(rec_symbols);    //The Viterbi decoder funct
      ion.
00067       berc.count(uncoded_bits,decoded_bits);           //Count the errors.
00068       ber(p) = berc.get_errorrate();
00069
00070       //Break the simulation on this point if sufficient number of bit errors wer
      e observed:
00071       if (berc.get_errors()>MaxNrofErrors) {
00072         cout << "Breaking on point " << p+1 << " with " << berc.get_errors() << "
       errors." << endl; break;
00073       }
00074
00075     }
00076   }
00077
00078   //Print the results:
00079   cout << "BER    = " << ber  << endl;
00080   cout << "EbN0dB = " << EbN0dB << endl;
00081
00082   //Exit program:
00083   return 0;
00084
00085 }
```

43.31 doc/tutorial/src/interleaver.cpp File Reference

```
#include <itpp/itcomm.h>
```

Functions

- int main ()

43.31.1 Function Documentation

43.31.1.1 int main ( )

Definition at line 9 of file interleaver.cpp.

43.32 interleaver.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011   //Declare scalars and vectors:
00012   int rows, cols;
00013   ivec input, output, deinterleaved;
00014
00015   //Declare the interleaver. The interleaver classes are templated, and therefore
       we must specify
00016   //the type of the data elements. In this example we are using integers:
00017   Block_Interleaver<int> my_interleaver;
00018
00019   //Initialize the interleaver class. Note that this can be done already in the d
      eclaration by writing
00020   //Block_Interleaver<int> my_interleaver(rows,cols);
00021   rows = 4;
00022   cols = 5;
00023   my_interleaver.set_rows(rows);
00024   my_interleaver.set_cols(cols);
00025
00026   //Define the input to the interleaver:
00027   input = "1:20";
00028
00029   //Do the interleaving:
00030   output = my_interleaver.interleave(input);
00031
00032   //Do the de-interleaving:
00033   deinterleaved = my_interleaver.deinterleave(output);
00034
00035   //Print the results:
00036   cout << "input = " << input << endl;
00037   cout << "output = " << output << endl;
00038   cout << "deinterleaved = " << deinterleaved << endl;
00039
00040   //Exit program:
00041   return 0;
00042
00043 }
```

43.33 doc/tutorial/src/ldpc_bersim_awgn.cpp File Reference

```
#include <itpp/itcomm.h>
```

Functions

- int main (int argc, char **argv)

43.33.1 Function Documentation

43.33.1.1 int main (int *argc*, char ** *argv*)

Definition at line 6 of file ldpc_bersim_awgn.cpp.

43.34 ldpc_bersim_awgn.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace std;
00004 using namespace itpp;
00005
00006 extern int main(int argc, char **argv)
00007 {
00008   int Nbits=1000*1000*5000;          // maximum number of bits simulated for any
      SNR point
00009   int Nbers=2000;                   // target number of bit errors per SNR point
00010   double BERmin=1e-6;               // BER at which to terminate simulation
00011   vec EbN0db = "0.6:0.2:5";
00012
00013   LDPC_Code C(argv[1]);
00014   bool single_snr_mode=false;
00015   if (argc==3) {
00016     double x;
00017     sscanf(argv[2],"%lf",&x);
00018     EbN0db.set_size(1);
00019     EbN0db(0)=x;
00020     single_snr_mode=true;
00021   }
00022
00023   cout << "Running with Eb/N0: " << EbN0db << endl;
00024
00025   // High performance: 2500 iterations, high resolution LLR algebra
00026   C.setup_decoder("bp","2500 1 0");
00027
00028   // Alt. setting -- High speed: 50 iterations, logmax approximation
00029   // C.setup_decoder("bp","50 1 0",LLR_calc_unit(12,0,7));
00030
00031   cout << C << endl;
00032
00033   int N = C.get_nvar();             // number of bits per codeword
00034   BPSK Mod;
00035   bvec bitsin = zeros_b(N);
00036   vec s = Mod.modulate_bits(bitsin);
00037
00038   RNG_randomize();
00039   for (int j=0; j<length(EbN0db); j++) {
```

```
00040     // noise variance is N0/2 per dimension
00041     double N0 = pow(10.0,-EbN0db(j)/10.0) / C.get_rate();
00042     AWGN_Channel chan(N0/2);
00043     BERC berc; // counters for coded and uncoded BER
00044     BLERC ferc; // counter for coded FER
00045     ferc.set_blocksize(N);
00046     for (long int i=0; i<Nbits; i+=C.get_nvar())   {
00047       // Received data
00048       vec x = chan(s);
00049
00050       // Demodulate
00051       vec softbits=Mod.demodulate_soft_bits(x,N0);
00052
00053       //Decode the received bits
00054       bvec bitsout=C.decode(softbits);
00055
00056       //Count the number of errors
00057       berc.count(bitsin,bitsout);
00058       ferc.count(bitsin,bitsout);
00059
00060       if (single_snr_mode) {
00061         cout << "Eb/N0=" << EbN0db(j) << "  Simulated "
00062              << ferc.get_total_blocks() << " frames and "
00063              << berc.get_total_bits() << " bits. "
00064              << "Obtained " << berc.get_errors() << " bit errors. "
00065              << " BER: " << berc.get_errorrate()
00066              << " FER: " << ferc.get_errorrate() << endl;
00067         cout.flush();
00068       }      else       {
00069           if (berc.get_errors()>Nbers) { break;}
00070       }
00071     }
00072
00073     cout << "Eb/N0=" << EbN0db(j) << "  Simulated "
00074          << ferc.get_total_blocks() << " frames and "
00075          << berc.get_total_bits() << " bits. "
00076          << "Obtained " << berc.get_errors() << " bit errors. "
00077          << " BER: " << berc.get_errorrate()
00078          << " FER: " << ferc.get_errorrate() << endl;
00079     cout.flush();
00080     if (berc.get_errorrate()<BERmin)  {  break;  }
00081   }
00082   return 0;
00083 }
```

43.35 doc/tutorial/src/ldpc_gen_codes.cpp File Reference

`#include <itpp/itcomm.h>`

Functions

- int main (int argc, char **argv)

43.35.1 Function Documentation

43.35.1.1 int main (int *argc*, char ** *argv*)

Definition at line 8 of file ldpc_gen_codes.cpp.

43.36 ldpc_gen_codes.cpp

```
00001 // Generate some example LDPC codes
00002
00003 #include <itpp/itcomm.h>
00004
00005 using namespace itpp;
00006 using namespace std;
00007
00008 extern int main(int argc, char **argv)
00009 {
00010   { // This generates a random regular (3,6) code with 500 bits
00011     cout << "========= RANDOM (3,6) CODE ==========" << endl;
00012     LDPC_Parity_Matrix H;
00013     H.generate_regular_ldpc(500,3,6,
00014                             "rand",  // random unstructured matrix
00015                             "500 10");   // optimize girth
00016     H.display_stats();
00017     LDPC_Code C1(H);
00018     C1.save_to_file("random_3_6_code.it");
00019   }
00020
00021   { // This is the code "204.33.484 (N=204,K=102,M=102,R=0.5)" from
00022     // David MacKay's database over sparse-graph code.  It can be
00023     // obtained with "wget
00024     // http://www.inference.phy.cam.ac.uk/mackay/codes/EN/C/204.33.484"
00025     cout << "========= MACKAY CODE ==========" << endl;
00026     LDPC_Parity_Matrix H("204.33.484","alist");
00027     H.display_stats();
00028     LDPC_Generator_Matrix G(H);
00029     LDPC_Code C(H,G);
00030     C.save_to_file("mackay_204.33.484.it");
00031
00032     // Now produce a girth-optimized version of this code by removing
00033     // cycles. This slightly improves the performance at high SNR.
00034     H.cycle_removal_MGW(12);
00035     LDPC_Generator_Matrix G1(H);
00036     LDPC_Code C1(H,G1);
00037     C1.save_to_file("mackay_204.33.484_opt.it");
00038   }
00039
00040   // Irregular 1/2-rate codes optimized for the AWGN channel. The
00041   // degree distributions are taken from Richardson & Urbanke,
00042   // Trans. IT 2001.
00043
00044   { // 1000 bits
00045     cout << "========= IRREGULAR CODE 1000 BITS ==========" << endl;
00046     LDPC_Parity_Matrix H;
00047     H.generate_irregular_ldpc(1000,
00048                               "0 0.27684 0.28342 0 0 0 0 0 0.43974",
00049                               "0 0 0 0 0 0.01568 0.85244 0.13188",
00050                               "rand",   // random unstructured matrix
00051                               "500 8"); // optimize girth
00052     LDPC_Code C(H);
00053     C.save_to_file("RU_1000.it");
00054   }
```

```
00055
00056   {  // 10000 bits (takes a few minutes to run)
00057     cout << "========== IRREGULAR CODE 10000 BITS ==========" << endl;
00058     LDPC_Parity_Matrix H;
00059     H.generate_irregular_ldpc(10000,"0 0.21991 0.23328 0.02058 0 0.08543 0.06540
      0.04767 \
00060                                0.01912 0 0 0 0 0 0 0 0 0 0.08064 0.22798",
00061                                "0 0 0 0 0 0 0 0.64854 0.34747 0.00399",
00062                                "rand",  // random unstructured matrix
00063                                "150 8"); // optimize
00064     LDPC_Code C(H);
00065     C.save_to_file("RU_10000.it");
00066   }
00067
00068   { // 100000 bits (takes a while to run)
00069     cout << "========== IRREGULAR CODE 100000 BITS ==========" << endl;
00070     LDPC_Parity_Matrix H;
00071     H.generate_irregular_ldpc(100000,"0 0.1712 0.21053 0.00273 0 0 0.00009 0.1526
      9 0.09227 \
00072                                0.02802 0 0 0 0 0.01206 0 0 0 0 0 0 0 0 0 0 0 0 0
       0.07212 0 0 0 0 \
00073                                0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.25830",
00074                                "0 0 0 0 0 0 0 0 0.33620 0.08883 0.57497",
00075                                "rand",
00076                                "40 4");  // less aggressive optimization
00077     LDPC_Code C(H);
00078     C.save_to_file("RU_100000.it");
00079   }
00080
00081   exit(0);
00082
00083   { // 1000000 bits (THIS CODE REQUIRES ABOUT 450 MB TO STORE AND 2GB
00084     // INTERNAL MEMORY TO GENERATE)
00085     cout << "========== IRREGULAR CODE 1000000 BITS ==========" << endl;
00086     LDPC_Parity_Matrix H;
00087     H.generate_irregular_ldpc(1000000,"0 0.1712 0.21053 0.00273 0 0 0.00009 0.152
      69 0.09227 \
00088                                0.02802 0 0 0 0 0.01206 0 0 0 0 0 0 0 0 0 0 0 0 0
       0.07212 0 0 0 0 \
00089                                0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.25830",
00090                                "0 0 0 0 0 0 0 0 0.33620 0.08883 0.57497",
00091                                "rand",
00092                                "0 0");  // no optimization here
00093     LDPC_Code C(H);
00094     C.save_to_file("RU_1000000.it");
00095   }
00096
00097 }
```

43.37 doc/tutorial/src/mimoconv.cpp File Reference

```
#include <itpp/itcomm.h>
```

Functions

- void ZF_demod (ND_UQAM &channel, ivec &LLR_apr, ivec &LLR_apost, double sigma2, cmat &H, cvec &y)
- int main (int argc, char **argv)

43.37.1 Function Documentation

43.37.1.1 void ZF_demod (ND_UQAM & *channel,* ivec & *LLR_apr,* ivec & *LLR_apost,* double *sigma2,* cmat & *H,* cvec & *y*)

Definition at line 18 of file mimoconv.cpp.

Referenced by main().

43.37.1.2 int main (int *argc,* char ** *argv*)

Definition at line 32 of file mimoconv.cpp.

References ZF_demod().

43.38 mimoconv.cpp

```
00001
00002 #include <itpp/itcomm.h>
00003
00004 using std::cout;
00005 using std::endl;
00006 using namespace itpp;
00007 using namespace std;
00008
00009 /* Zero-forcing detector with ad hoc soft information. This function
00010    applies the ZF (pseudoinverse) linear filter to the received
00011    data. This results in effective noise with covariance matrix
00012    inv(H'H)*sigma2.  The diagonal elements of this noise covariance
00013    matrix are taken as noise variances per component in the processed
00014    received data but the noise correlation is ignored.
00015
00016  */
00017
00018 void ZF_demod(ND_UQAM &channel, ivec &LLR_apr,  ivec &LLR_apost, double sigma2, c
      mat &H, cvec &y)
00019 {
00020   it_assert(H.rows()>=H.cols(),"ZF_demod() - underdetermined systems not tolerate
      d");
00021   cvec shat=ls_solve_od(H,y);                    // the ZF solution
00022   vec Sigma2=real(diag(inv(H.hermitian_transpose()*H)))*sigma2;  // noise covaria
      nce of shat
00023   cvec h(length(shat));
00024   for (int i=0; i<length(shat); i++) {
00025     shat(i) = shat(i)/sqrt(Sigma2(i));
00026     h(i) = 1.0/sqrt(Sigma2(i));
00027   }
00028   channel.map_demod(LLR_apr,LLR_apost,1.0,h,shat);
00029 }
00030
00031
00032 extern int main(int argc, char **argv)
00033 {
00034   // -- modulation and channel parameters (taken from command line input) --
00035   int nC;                    // type of constellation  (1=QPSK, 2=16-QAM, 3=64-QA
      M)
00036   int nRx;                   // number of receive antennas
00037   int nTx;                   // number of transmit antennas
00038   int Tc;                    // coherence time (number of channel vectors with sa
```

```
me H)
00039
00040   if (argc!=5) {
00041     cout << "Usage: cm nTx nRx nC Tc" << endl << "Example: cm 2 2 1 100000 (2x2 Q
PSK MIMO on slow fading channel)" << endl;
00042     exit(1);
00043   } else {
00044     sscanf(argv[1],"%i",&nTx);
00045     sscanf(argv[2],"%i",&nRx);
00046     sscanf(argv[3],"%i",&nC);
00047     sscanf(argv[4],"%i",&Tc);
00048   }
00049
00050   cout << "Initializing.. " << nTx << " TX antennas, " << nRx << " RX antennas, "

00051        << (1<<nC) << "-PAM per dimension, coherence time " << Tc << endl;
00052
00053   // -- simulation control parameters --
00054   const vec EbN0db = "-5:0.5:50";        // SNR range
00055   const int Nmethods =2;                 // number of demodulators to try
00056   const long int Nbitsmax=50*1000*1000;  // maximum number of bits to ever simula
te per SNR point
00057   const int Nu = 1000;                   // length of data packet (before applyin
g channel coding)
00058
00059   int Nbers, Nfers;              // target number of bit/frame errors per SNR poi
nt
00060   double BERmin, FERmin;         // BER/FER at which to terminate simulation
00061   if (Tc==1) {           // Fast fading channel, BER is of primary interest
00062     BERmin = 0.001;      // stop simulating a given method if BER<this value
00063     FERmin = 1.0e-10;    // stop simulating a given method if FER<this value
00064     Nbers = 1000;        // move to next SNR point after counting 1000 bit errors

00065     Nfers = 200;         // do not stop on this condition
00066   } else {               // Slow fading channel, FER is of primary interest here
00067     BERmin = 1.0e-15;    // stop simulating a given method if BER<this value
00068     FERmin = 0.01;       // stop simulating a given method if FER<this value
00069     Nbers = -1;          // do not stop on this condition
00070     Nfers = 200;         // move to next SNR point after counting 200 frame error
s
00071   }
00072
00073   // -- Channel code parameters --
00074   Convolutional_Code code;
00075   ivec generator(3);
00076   generator(0)=0133;  // use rate 1/3 code
00077   generator(1)=0165;
00078   generator(2)=0171;
00079   double rate=1.0/3.0;
00080   code.set_generator_polynomials(generator, 7);
00081   bvec dummy;
00082   code.encode_tail(randb(Nu),dummy);
00083   const int Nc = length(dummy);      // find out how long the coded blocks are
00084
00085   // ============= Initialize ====================================
00086
00087   const int Nctx = (int) (2*nC*nTx*ceil(double(Nc)/double(2*nC*nTx)));   // Total
 number of bits to transmit
00088   const int Nvec = Nctx/(2*nC*nTx);          // Number of channel vectors to tran
smit
00089   const int Nbitspvec = 2*nC*nTx;            // Number of bits per channel vector
```

```
00090
00091   // initialize MIMO channel with uniform QAM per complex dimension and Gray codi
      ng
00092   ND_UQAM chan;
00093   chan.set_Gray_QAM(nTx,1<<(2*nC));
00094   cout << chan << endl;
00095
00096   // initialize interleaver
00097   Sequence_Interleaver<bin> sequence_interleaver_b(Nctx);
00098   Sequence_Interleaver<int> sequence_interleaver_i(Nctx);
00099   sequence_interleaver_b.randomize_interleaver_sequence();
00100   sequence_interleaver_i.set_interleaver_sequence(sequence_interleaver_b.get_inte
      rleaver_sequence());
00101
00102   //  RNG_randomize();
00103
00104   Array<cvec> Y(Nvec);         // received data
00105   Array<cmat> H(Nvec/Tc+1);    // channel matrix (new matrix for each coherence in
      terval)
00106
00107   ivec Contflag = ones_i(Nmethods);   // flag to determine whether to run a given
       demodulator
00108   if (pow(2.0,nC*2.0*nTx)>256) {      // ML decoder too complex..
00109     Contflag(1)=0;
00110   }
00111   if (nTx>nRx) {
00112     Contflag(0)=0;                    // ZF not for underdetermined systems
00113   }
00114   cout << "Running methods: " << Contflag << endl;
00115
00116   cout.setf(ios::fixed, ios::floatfield);
00117   cout.setf(ios::showpoint);
00118   cout.precision(5);
00119
00120   // ================== Run simulation =======================
00121   for (int nsnr=0; nsnr<length(EbN0db); nsnr++) {
00122     const double Eb=1.0; // transmitted energy per information bit
00123     const double N0 = pow(10.0,-EbN0db(nsnr)/10.0);
00124     const double sigma2=N0;   // Variance of each scalar complex noise sample
00125     const double Es=rate*2*nC*Eb; // Energy per complex scalar symbol
00126     // (Each transmitted scalar complex symbol contains rate*2*nC
00127     // information bits.)
00128     const double Ess=sqrt(Es);
00129
00130     Array<BERC> berc(Nmethods);  // counter for coded BER
00131     Array<BERC> bercu(Nmethods); // counter for uncoded BER
00132     Array<BLERC> ferc(Nmethods); // counter for coded FER
00133
00134     for (int i=0; i<Nmethods; i++) {
00135       ferc(i).set_blocksize(Nu);
00136     }
00137
00138     long int nbits=0;
00139     while (nbits<Nbitsmax) {
00140       nbits += Nu;
00141
00142       // generate and encode random data
00143       bvec inputbits = randb(Nu);
00144       bvec txbits;
00145       code.encode_tail(inputbits, txbits);
00146       // coded block length is not always a multiple of the number of
00147       // bits per channel vector
```

```
00148       txbits=concat(txbits,randb(Nctx-Nc));
00149       txbits = sequence_interleaver_b.interleave(txbits);
00150 
00151       // -- generate channel and data ----
00152       for (int k=0; k<Nvec; k++) {
00153         /* A complex valued channel matrix is used here. An
00154            alternative (with equivalent result) would be to use a
00155            real-valued (structured) channel matrix of twice the
00156            dimension.
00157         */
00158         if (k%Tc==0) {       // generate a new channel realization every Tc inter
     vals
00159           H(k/Tc) = Ess*randn_c(nRx,nTx);
00160         }
00161 
00162         // modulate and transmit bits
00163         bvec bitstmp = txbits(k*2*nTx*nC,(k+1)*2*nTx*nC-1);
00164         cvec x=chan.modulate_bits(bitstmp);
00165         cvec e=sqrt(sigma2)*randn_c(nRx);
00166         Y(k) = H(k/Tc)*x+e;
00167       }
00168 
00169       // -- demodulate --
00170       Array<QLLRvec> LLRin(Nmethods);
00171       for (int i=0; i<Nmethods; i++) {
00172         LLRin(i) = zeros_i(Nctx);
00173       }
00174 
00175       QLLRvec llr_apr =zeros_i(nC*2*nTx);  // no a priori input to demodulator
00176       QLLRvec llr_apost=zeros_i(nC*2*nTx);
00177       for (int k=0; k<Nvec; k++) {
00178         // zero forcing demodulation
00179         if (Contflag(0)) {
00180           ZF_demod(chan,llr_apr,llr_apost,sigma2,H(k/Tc),Y(k));
00181           LLRin(0).set_subvector(k*Nbitspvec,(k+1)*Nbitspvec-1,llr_apost);
00182         }
00183 
00184         // ML demodulation
00185         if (Contflag(1)) {
00186           chan.map_demod(llr_apr, llr_apost, sigma2, H(k/Tc), Y(k));
00187           LLRin(1).set_subvector(k*Nbitspvec,(k+1)*Nbitspvec-1,llr_apost);
00188         }
00189       }
00190 
00191       // -- decode and count errors --
00192       for (int i=0; i<Nmethods; i++) {
00193         bvec decoded_bits;
00194         if (Contflag(i)) {
00195           bercu(i).count(txbits(0,Nc-1),LLRin(i)(0,Nc-1)<0);  // uncoded BER
00196           LLRin(i) = sequence_interleaver_i.deinterleave(LLRin(i),0);
00197           // QLLR values must be converted to real numbers since the convolutiona
     l decoder wants this
00198           vec llr=chan.get_llrcalc().to_double(LLRin(i).left(Nc));
00199           //      llr=-llr; // UNCOMMENT THIS LINE IF COMPILING WITH 3.10.5 OR EA
     RLIER (BEFORE HARMONIZING LLR CONVENTIONS)
00200           code.decode_tail(llr,decoded_bits);
00201           berc(i).count(inputbits(0,Nu-1),decoded_bits(0,Nu-1));  // coded BER
00202           ferc(i).count(inputbits(0,Nu-1),decoded_bits(0,Nu-1));  // coded FER
00203         }
00204       }
00205 
00206       /* Check whether it is time to terminate the simulation.
```

```
00207         Terminate when all demodulators that are still running have
00208         counted at least Nbers or Nfers bit/frame errors. */
00209       int minber=1000000;
00210       int minfer=1000000;
00211       for (int i=0; i<Nmethods; i++) {
00212         if (Contflag(i)) {
00213           minber=min(minber,round_i(berc(i).get_errors()));
00214           minfer=min(minfer,round_i(ferc(i).get_errors()));
00215         }
00216       }
00217       if (Nbers>0 && minber>Nbers) { break;}
00218       if (Nfers>0 && minfer>Nfers) { break;}
00219     }
00220
00221     cout << "-----------------------------------------------------" << endl;
00222     cout << "Eb/N0: " << EbN0db(nsnr) << " dB. Simulated " << nbits << " bits." <
      < endl;
00223     cout << " Uncoded BER: " << bercu(0).get_errorrate() << " (ZF);     " << berc
      u(1).get_errorrate() << " (ML)" << endl;
00224     cout << " Coded BER:   " << berc(0).get_errorrate()  << " (ZF);     " << berc
      (1).get_errorrate()  << " (ML)" << endl;
00225     cout << " Coded FER:   " << ferc(0).get_errorrate()  << " (ZF);     " << ferc
      (1).get_errorrate()  << " (ML)" << endl;
00226     cout.flush();
00227
00228     /* Check wheter it is time to terminate simulation. Stop when all
00229     methods have reached the min BER/FER of interest. */
00230     int contflag=0;
00231     for (int i=0; i<Nmethods; i++) {
00232       if (Contflag(i)) {
00233         if (berc(i).get_errorrate()>BERmin)  {  contflag=1;  } else { Contflag(i)
      = 0; }
00234         if (ferc(i).get_errorrate()>FERmin)  {  contflag=1;  } else { Contflag(i)
      = 0; }
00235       }
00236     }
00237     if (contflag) { continue; } else {break; }
00238   }
00239
00240   return 0;
00241 }
```

43.39 doc/tutorial/src/mog.cpp File Reference

```
#include <itpp/itstat.h>
#include <fstream>
#include <iostream>
#include <iomanip>
#include <ios>
```

Functions

- int main ()

43.39.1 Function Documentation

43.39.1.1 int main ( )

Definition at line 15 of file mog.cpp.

43.40 mog.cpp

```
00001 #include <itpp/itstat.h>
00002
00003 #include <fstream>
00004 #include <iostream>
00005 #include <iomanip>
00006 #include <ios>
00007
00008 using std::cout;
00009 using std::endl;
00010 using std::fixed;
00011 using std::setprecision;
00012
00013 using namespace itpp;
00014
00015 int main() {
00016
00017   bool print_progress = false;
00018
00019   //
00020   // first, let's generate some synthetic data
00021
00022   int N = 100000;  // number of vectors
00023   int D = 3;       // number of dimensions
00024   int K = 5;       // number of Gaussians
00025
00026   Array<vec> X(N); for(int n=0;n<N;n++) { X(n).set_size(D); X(n) = 0.0; }
00027
00028   // the means
00029
00030   Array<vec> mu(K);
00031   mu(0) = "-6, -4, -2";
00032   mu(1) = "-4, -2,  0";
00033   mu(2) = "-2,  0,  2";
00034   mu(3) = " 0, +2, +4";
00035   mu(4) = "+2, +4, +6";
00036
00037
00038   // the diagonal variances
00039
00040   Array<vec> var(K);
00041   var(0) = "0.1, 0.2, 0.3";
00042   var(1) = "0.2, 0.3, 0.1";
00043   var(2) = "0.3, 0.1, 0.2";
00044   var(3) = "0.1, 0.2, 0.3";
00045   var(4) = "0.2, 0.3, 0.1";
00046
00047   cout << fixed << setprecision(3);
00048   cout << "user configured means and variances:" << endl;
00049   cout << "mu = " << mu << endl;
00050   cout << "var = " << var << endl;
00051
00052   // randomise the order of Gaussians "generating" the vectors
```

```
00053   I_Uniform_RNG rnd_uniform(0, K-1);
00054   ivec gaus_id = rnd_uniform(N);
00055
00056   ivec gaus_count(K); gaus_count = 0;
00057   Array<vec> mu_test(K);  for(int k=0;k<K;k++) { mu_test(k).set_size(D); mu_test(
      k) = 0.0; }
00058   Array<vec> var_test(K);  for(int k=0;k<K;k++) { var_test(k).set_size(D); var_te
      st(k) = 0.0; }
00059
00060   Normal_RNG rnd_normal;
00061   for(int n=0;n<N;n++) {
00062
00063     int k = gaus_id(n);
00064     gaus_count(k)++;
00065
00066     for(int d=0;d<D;d++) {
00067       rnd_normal.setup( mu(k)(d), var(k)(d) );
00068       double tmp = rnd_normal();
00069       X(n)(d) = tmp;
00070       mu_test(k)(d) += tmp;
00071     }
00072   }
00073
00074   //
00075   // find the stats for the generated data
00076
00077   for(int k=0;k<K;k++) mu_test(k) /= gaus_count(k);
00078
00079   for(int n=0;n<N;n++) {
00080     int k = gaus_id(n);
00081
00082     for(int d=0;d<D;d++) {
00083       double tmp = X(n)(d) - mu_test(k)(d);
00084       var_test(k)(d) += tmp*tmp;
00085     }
00086   }
00087
00088   for(int k=0;k<K;k++)  var_test(k) /= (gaus_count(k)-1.0);
00089
00090   cout << endl << endl;
00091   cout << fixed << setprecision(3);
00092   cout << "stats for X:" << endl;
00093
00094   for(int k=0;k<K;k++) {
00095     cout << "k = " << k << "  count = " << gaus_count(k) << "  weight = " << gaus
      _count(k)/double(N) << endl;
00096     for(int d=0;d<D;d++) cout << "  d = " << d << "  mu_test = " << mu_test(k)(d)
       << "  var_test = " << var_test(k)(d) << endl;
00097     cout << endl;
00098   }
00099
00100
00101   // make a model with initial values (zero mean and unit variance)
00102   // the number of gaussians and dimensions of the model is specified here
00103
00104   MOG_diag mog(K,D);
00105
00106   cout << endl;
00107   cout << fixed << setprecision(3);
00108   cout << "mog.avg_log_lhood(X) = " << mog.avg_log_lhood(X) << endl;
00109
00110   //
```

```
00111   // find initial parameters via k-means (which are then used as seeds for EM bas
      ed optimisation)
00112
00113   cout << endl << endl;
00114   cout << "running kmeans optimiser" << endl << endl;
00115
00116   MOG_diag_kmeans(mog, X, 10, 0.5, true, print_progress);
00117
00118   cout << fixed << setprecision(3);
00119   cout << "mog.get_means() = " << endl << mog.get_means() << endl;
00120   cout << "mog.get_diag_covs() = " << endl << mog.get_diag_covs() << endl;
00121   cout << "mog.get_weights() = " << endl << mog.get_weights() << endl;
00122
00123   cout << endl;
00124   cout << "mog.avg_log_lhood(X) = " << mog.avg_log_lhood(X) << endl;
00125
00126
00127   //
00128   // EM ML based optimisation
00129
00130   cout << endl << endl;
00131   cout << "running ML optimiser" << endl << endl;
00132
00133   MOG_diag_ML(mog, X, 10, 0.0, 0.0, print_progress);
00134
00135   cout << fixed << setprecision(3);
00136   cout << "mog.get_means() = " << endl << mog.get_means() << endl;
00137   cout << "mog.get_diag_covs() = " << endl << mog.get_diag_covs() << endl;
00138   cout << "mog.get_weights() = " << endl << mog.get_weights() << endl;
00139
00140   cout << endl;
00141   cout << "mog.avg_log_lhood(X) = " << mog.avg_log_lhood(X) << endl;
00142
00143   return 0;
00144 }
```

43.41 doc/tutorial/src/qpsk_simulation.cpp File Reference

```
#include <itpp/itcomm.h>
```

Functions

- int main ()

43.41.1 Function Documentation

43.41.1.1 int main ( )

Definition at line 9 of file qpsk_simulation.cpp.

43.42 qpsk_simulation.cpp

```
00001 #include <itpp/itcomm.h>
00002
```

```
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011   //Declarations of scalars and vectors:
00012   int i, Number_of_bits;
00013   double Ec, Eb;
00014   vec EbN0dB, EbN0, N0, noise_variance, bit_error_rate; //vec is a vector contain
      ing double
00015   bvec transmitted_bits, received_bits;                //bvec is a vector contai
      ning bits
00016   cvec transmitted_symbols, received_symbols;          //cvec is a vector contai
      ning double_complex
00017
00018   //Declarations of classes:
00019   QPSK qpsk;                      //The QPSK modulator class
00020   AWGN_Channel awgn_channel;      //The AWGN channel class
00021   it_file ff;                     //For saving the results to file
00022   BERC berc;                      //Used to count the bit errors
00023   Real_Timer tt;                  //The timer used to measure the execution time
00024
00025   //Reset and start the timer:
00026   tt.tic();
00027
00028   //Init:
00029   Ec = 1.0;                       //The transmitted energy per QPSK symbol is 1.
00030   Eb = Ec / 2.0;                  //The transmitted energy per bit is 0.5.
00031   EbN0dB = linspace(0.0,9.0,10); //Simulate for 10 Eb/N0 values from 0 to 9 dB.
00032   EbN0 = inv_dB(EbN0dB);          //Calculate Eb/N0 in a linear scale instead of d
      B.
00033   N0 = Eb * pow(EbN0,-1.0);       //N0 is the variance of the (complex valued) noi
      se.
00034   Number_of_bits = 100000;        //One hundred thousand bits is transmitted for e
      ach Eb/N0 value
00035
00036   //Allocate storage space for the result vector.
00037   //The "false" argument means "Do not copy the old content of the vector to the
      new storage area."
00038   bit_error_rate.set_size(EbN0dB.length(),false);
00039
00040   //Randomize the random number generators in it++:
00041   RNG_randomize();
00042
00043   //Iterate over all EbN0dB values:
00044   for (i=0; i<EbN0dB.length(); i++) {
00045
00046     //Show how the simulation progresses:
00047     cout << "Now simulating Eb/N0 value number " << i+1 << " of " << EbN0dB.lengt
      h() << endl;
00048
00049     //Generate a vector of random bits to transmit:
00050     transmitted_bits = randb(Number_of_bits);
00051
00052     //Modulate the bits to QPSK symbols:
00053     transmitted_symbols = qpsk.modulate_bits(transmitted_bits);
00054
00055     //Set the noise variance of the AWGN channel:
00056     awgn_channel.set_noise(N0(i));
```

```
00057
00058     //Run the transmited symbols through the channel using the () operator:
00059     received_symbols = awgn_channel(transmitted_symbols);
00060
00061     //Demodulate the received QPSK symbols into received bits:
00062     received_bits = qpsk.demodulate_bits(received_symbols);
00063
00064     //Calculate the bit error rate:
00065     berc.clear();                                //Clear the bit error rate counte
      r
00066     berc.count(transmitted_bits,received_bits); //Count the bit errors
00067     bit_error_rate(i) = berc.get_errorrate();   //Save the estimated BER in the r
      esult vector
00068
00069   }
00070
00071   tt.toc();
00072
00073   //Print the results:
00074   cout << endl;
00075   cout << "EbN0dB = " << EbN0dB << " [dB]" << endl;
00076   cout << "BER = " << bit_error_rate << endl;
00077   cout << "Saving results to ./qpsk_result_file.it" << endl;
00078   cout << endl;
00079
00080   //Save the results to file:
00081   ff.open("qpsk_result_file.it");
00082   ff << Name("EbN0dB") << EbN0dB;
00083   ff << Name("ber") << bit_error_rate;
00084   ff.close();
00085
00086   //Exit program:
00087   return 0;
00088
00089 }
00090
```

43.43 doc/tutorial/src/rayleigh.cpp File Reference

```
#include <itpp/itcomm.h>
```

Functions

- int main ()

43.43.1 Function Documentation

43.43.1.1 int main ( )

Definition at line 5 of file rayleigh.cpp.

43.44 rayleigh.cpp

```
00001 #include <itpp/itcomm.h>
```

```
00002
00003 using namespace itpp;
00004
00005 int main()
00006 {
00007   // Declare my_channel variable as an instance of the Rayleigh_Channel
00008   // class
00009   TDL_Channel my_channel;
00010
00011   // The normalized Doppler frequency is set to 0.1
00012   double norm_dopp = 0.1;
00013   my_channel.set_norm_doppler(norm_dopp);
00014
00015   // Generate nrof_samples of the fading process and store them in ch_coeffs
00016   // matrix
00017   int nrof_samples = 10000;
00018   cmat ch_coeffs;
00019   my_channel.generate(nrof_samples, ch_coeffs);
00020
00021   // Open an output file "rayleigh_test.it"
00022   it_file ff("rayleigh_test.it");
00023
00024   // Save channel coefficients to the output file
00025   ff << Name("ch_coeffs") << ch_coeffs;
00026
00027   // Close the output file
00028   ff.close();
00029
00030   // Exit program
00031   return 0;
00032 }
```

43.45 doc/tutorial/src/read_it_file.cpp File Reference

`#include <itpp/itcomm.h>`

Functions

- int main ()

43.45.1 Function Documentation

43.45.1.1 int main ( )

Definition at line 5 of file read_it_file.cpp.

43.46 read_it_file.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace itpp;
00004
00005 int main()
00006 {
```

```
00007   // Declare the it_file class
00008   it_file ff;
00009
00010   // Open the file "it_file_test.it" for reading
00011   ff.open("it_file_test.it");
00012
00013   // Read the variable a from the file. Put result in vector a.
00014   vec a;
00015   ff >> Name("a") >> a;
00016
00017   // Print the result
00018   std::cout << "a = " << a << std::endl;
00019
00020   // Exit the program
00021   return 0;
00022 }
```

43.47 doc/tutorial/src/reedsolomon.cpp File Reference

`#include <itpp/itcomm.h>`

Functions

- int main ()

43.47.1 Function Documentation

43.47.1.1 int main ( )

Definition at line 9 of file reedsolomon.cpp.

43.48 reedsolomon.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011
00012   //Scalars and vectors:
00013   int m, t, n, k, q, NumBits, NumCodeWords;
00014   double p;
00015   bvec uncoded_bits, coded_bits, received_bits, decoded_bits;
00016
00017   //Set parameters:
00018   NumCodeWords = 1000;  //Number of Reed-Solomon code-words to simulate
00019   p = 0.01;             //BSC Error probability
00020   m = 3;                //Reed-Solomon parameter m
00021   t = 2;                //Reed-Solomon parameter t
```

```
00022
00023   cout << "Number of Reed-Solomon code-words to simulate: " <<  NumCodeWords << e
      ndl;
00024   cout << "BSC Error probability : " << p << endl;
00025   cout << "RS m: " << m << endl;
00026   cout << "RS t: " << t << endl;
00027
00028   //Classes:
00029   Reed_Solomon reed_solomon(m,t);
00030   BSC bsc(p);
00031   BERC berc;
00032
00033   RNG_randomize();
00034
00035   //Calculate parameters for the Reed-Solomon Code:
00036   n = round_i(pow(2.0,m)-1);
00037   k = round_i(pow(2.0,m))-1-2*t;
00038   q = round_i(pow(2.0,m));
00039
00040   cout << "Simulating an Reed-Solomon code with the following parameters:" << end
      l;
00041   cout << "n = " << n << endl;
00042   cout << "k = " << k << endl;
00043   cout << "q = " << q << endl;
00044
00045   NumBits = m * k * NumCodeWords;
00046   uncoded_bits = randb(NumBits);
00047   coded_bits = reed_solomon.encode(uncoded_bits);
00048   received_bits = bsc(coded_bits);
00049   decoded_bits = reed_solomon.decode(received_bits);
00050
00051   berc.count(uncoded_bits,decoded_bits);
00052   cout << "The bit error probability after decoding is " << berc.get_errorrate()
      << endl;
00053
00054   //Exit program:
00055   return 0;
00056
00057 }
```

43.49 doc/tutorial/src/spread.cpp File Reference

`#include <itpp/itcomm.h>`

Functions

- int main ()

43.49.1 Function Documentation

43.49.1.1 int main ( )

Definition at line 9 of file spread.cpp.

43.50 spread.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011   //Scalars:
00012   int SF, Ncode, sc, i, j, NumOfBits, MaxIterations, MaxNrOfErrors, MinNrOfErrors
      ;
00013   double Eb;
00014
00015   //Vectors and matrixes:
00016   vec EbN0dB, EbN0, N0, ber;
00017   smat all_codes, spread_codesI, spread_codesQ;
00018   bvec transmited_bits, received_bits;
00019   cvec transmited_symbols, received_symbols, transmited_chips, received_chips;
00020
00021   //Classes:
00022   Multicode_Spread_2d mc_spread;
00023   AWGN_Channel channel;
00024   QPSK qpsk;
00025   BERC berc;
00026
00027   //Initialize the spreading:
00028   SF = 4;                           //The spreading factor is 4
00029   Ncode = 4;                        //Use all four codes in the multi-code sprea
      der
00030   all_codes = to_smat(hadamard(SF)); //Calculate the spreading codes
00031
00032   //Set the spreading codes:
00033   spread_codesI.set_size(Ncode, SF, false);
00034   spread_codesQ.set_size(Ncode, SF, false);
00035   for (sc = 0; sc<Ncode; sc++) {
00036     spread_codesI.set_row(sc, all_codes.get_row(sc));
00037     spread_codesQ.set_row(sc, all_codes.get_row(sc));
00038   }
00039   mc_spread.set_codes(to_mat(spread_codesI), to_mat(spread_codesQ));
00040
00041   //Specify simulation specific variables:
00042   EbN0dB = linspace(-2,14,17);
00043   EbN0 = pow(10,EbN0dB/10);
00044   Eb = 1.0;
00045   N0 = Eb * pow(EbN0,-1.0);
00046   NumOfBits = 50000;
00047   MaxIterations = 10;
00048   MaxNrOfErrors = 200;
00049   MinNrOfErrors = 5;
00050   ber.set_size(EbN0dB.size(), false);
00051   ber.clear();
00052
00053   //Randomize the random number generators:
00054   RNG_randomize();
00055
00056   for (i=0; i<EbN0dB.length(); i++) {
00057
00058     cout << endl << "Simulating point nr " << i+1 << endl;
```

```
00059     berc.clear();
00060     channel.set_noise(N0(i)/2.0);
00061
00062     for (j=0; j<MaxIterations; j++) {
00063
00064       transmited_bits = randb(NumOfBits);
00065       transmited_symbols  = qpsk.modulate_bits(transmited_bits);
00066
00067       //This is where we do the multi-code spreading:
00068       transmited_chips =  mc_spread.spread(transmited_symbols);
00069
00070       received_chips = channel(transmited_chips);
00071
00072       //The multi-code despreading:
00073       //The second argument tells the despreader that the offset is zero chips.
00074       //This offset is usefull on channels with delay.
00075       received_symbols = mc_spread.despread(received_chips, 0);
00076
00077       received_bits = qpsk.demodulate_bits(received_symbols);
00078
00079       berc.count(transmited_bits,received_bits);
00080       ber(i) = berc.get_errorrate();
00081
00082       cout << "   Itteration " << j+1 << ": ber = " << berc.get_errorrate() << en
      dl;
00083       if (berc.get_errors()>MaxNrOfErrors) {
00084         cout << "Breaking on point " << i+1 << " with " << berc.get_errors() << "
       errors." << endl; break;
00085       }
00086
00087     }
00088
00089     if (berc.get_errors() < MinNrOfErrors) {
00090       cout << "Exiting Simulation on point " << i+1 << endl; break;
00091     }
00092
00093   }
00094
00095   //Print results:
00096   cout << endl;
00097   cout << "EbN0dB = " << EbN0dB << endl;
00098   cout << "ber = " << ber << endl;
00099
00100   //Exit program:
00101   return 0;
00102
00103 }
00104
```

43.51 doc/tutorial/src/timer.cpp File Reference

`#include <itpp/itbase.h>`

Functions

- int main ()

43.51.1 Function Documentation

43.51.1.1 int main ( )

Definition at line 9 of file timer.cpp.

43.52 timer.cpp

```
00001 #include <itpp/itbase.h>
00002
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011   //Declare the scalars used:
00012   long i, sum, N;
00013
00014   //Declare tt as an instance of the timer class:
00015   Real_Timer tt;
00016
00017   //Initiate the variables:
00018   N = 1000000;
00019   sum = 0;
00020
00021   //Start and reset the timer:
00022   tt.tic();
00023
00024   //Do some processing
00025   for (i=0; i<N; i++) {
00026     sum += i;
00027   }
00028
00029   // Print the elapsed time
00030   tt.toc_print();
00031
00032   //Print the result of the processing:
00033   cout << "The sum of all integers from 0 to " << N-1 << " equals " << sum << end
      l;
00034
00035   //Exit program:
00036   return 0;
00037
00038 }
```

43.53 doc/tutorial/src/vector_and_matrix.cpp File Reference

```
#include <itpp/itbase.h>
```

Functions

- int main ()

43.53.1 Function Documentation

43.53.1.1 int main ( )

Definition at line 9 of file vector_and_matrix.cpp.

43.54 vector_and_matrix.cpp

```
00001 #include <itpp/itbase.h>
00002
00003 using namespace itpp;
00004
00005 //These lines are needed for use of cout and endl
00006 using std::cout;
00007 using std::endl;
00008
00009 int main()
00010 {
00011   //Declare vectors and matricies:
00012   vec a, b, c;
00013   mat A, B;
00014
00015   //Use the function linspace to define a vector:
00016   a = linspace(1.0,2.0,10);
00017
00018   //Use a string of values to define a vector:
00019   b = "0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0";
00020
00021   //Add two vectors:
00022   c = a + b;
00023
00024   //Print results:
00025   cout << "a = " << a << endl;
00026   cout << "b = " << b << endl;
00027   cout << "c = " << c << endl;
00028
00029   //Use a string to define a matrix:
00030   A = "1.0 2.0;3.0 4.0";
00031
00032   //Calculate the inverse of matrix A:
00033   B = inv(A);
00034
00035   //Print results:
00036   cout << "A = " << A << endl;
00037   cout << "B = " << B << endl;
00038
00039   //Exit program:
00040   return 0;
00041
00042 }
```

43.55 doc/tutorial/src/write_it_file.cpp File Reference

```
#include <itpp/itcomm.h>
```

Functions

- int main ()

43.55.1 Function Documentation

43.55.1.1 int main ( )

Definition at line 5 of file write_it_file.cpp.

43.56 write_it_file.cpp

```
00001 #include <itpp/itcomm.h>
00002
00003 using namespace itpp;
00004
00005 int main()
00006 {
00007   // Declare the it_file class
00008   it_file ff;
00009
00010   // Open a file with the name "it_file_test.it"
00011   ff.open("it_file_test.it");
00012
00013   // Create some data to put into the file
00014   vec a = linspace(1, 20, 20);
00015
00016   // Put the variable a into the file. The Name("a") tells the file class
00017   // that the next variable shall be named "a".
00018   ff << Name("a") << a;
00019
00020   // Force the file to be written to disc. This is useful when performing
00021   // iterations and ensures that the information is not stored in any cache
00022   // memory. In this simple example it is not necessary to flush the file.
00023   ff.flush();
00024
00025   // Close the file
00026   ff.close();
00027
00028   // Exit program
00029   return 0;
00030 }
```

43.57 doc/tutorial/timer.doc File Reference

43.58 doc/tutorial/tutorial.doc File Reference

43.59 doc/tutorial/vector_and_matrix.doc File Reference

43.60 rmol/basic/BasConst.cpp File Reference

```
#include <rmol/basic/BasConst_General.hpp>
```

```
#include <rmol/basic/BasConst_Curves.hpp>
#include <rmol/basic/BasConst_RMOL_Service.hpp>
```

Namespaces

- namespace RMOL

Variables

- const stdair::AirlineCode_T RMOL::DEFAULT_RMOL_SERVICE_AIRLINE_CODE = "BA"
- const double RMOL::DEFAULT_RMOL_SERVICE_CAPACITY = 1.0
- const int RMOL::DEFAULT_NUMBER_OF_DRAWS_FOR_MC_SIMULATION = 100000
- const int RMOL::DEFAULT_PRECISION = 10
- const double RMOL::DEFAULT_EPSILON = 0.0001
- const double RMOL::DEFAULT_STOPPING_CRITERION = 0.01
- const double RMOL::DEFAULT_INITIALIZER_DOUBLE_NEGATIVE = -10.0
- const FRAT5Curve_T RMOL::DEFAULT_CUMULATIVE_FRAT5_CURVE
- const stdair::DCPList_T RMOL::DEFAULT_DCP_LIST = DefaultDCPList::init()

43.61 BasConst.cpp

```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 #include <rmol/basic/BasConst_General.hpp>
00005 #include <rmol/basic/BasConst_Curves.hpp>
00006 #include <rmol/basic/BasConst_RMOL_Service.hpp>
00007
00008 namespace RMOL {
00009
00011   const stdair::AirlineCode_T DEFAULT_RMOL_SERVICE_AIRLINE_CODE = "BA";
00012
00014   const double DEFAULT_RMOL_SERVICE_CAPACITY = 1.0;
00015
00018   const int DEFAULT_NUMBER_OF_DRAWS_FOR_MC_SIMULATION = 100000;
00019
00023   const int DEFAULT_PRECISION = 10;
00024
00026   const double DEFAULT_EPSILON = 0.0001;
00027
00029   const double DEFAULT_STOPPING_CRITERION = 0.01;
00030
00032   const double DEFAULT_INITIALIZER_DOUBLE_NEGATIVE = -10.0;
00033
00036   const FRAT5Curve_T DEFAULT_CUMULATIVE_FRAT5_CURVE =
00037     DefaultMap::createCumulativeFRAT5Curve();
00038   FRAT5Curve_T DefaultMap::createCumulativeFRAT5Curve() {
00039     FRAT5Curve_T oCurve;
00040     // oCurve[63] = 1.4;  oCurve[56] = 1.45;
00041     // oCurve[49] = 1.5;  oCurve[42] = 1.55; oCurve[35] = 1.6;
00042     // oCurve[31] = 1.7;  oCurve[27] = 1.8;  oCurve[23] = 2.0;
```

```
00043     // oCurve[19] = 2.3;  oCurve[16] = 2.6;  oCurve[13] = 3.0;
00044     // oCurve[10] = 3.3;  oCurve[7]  = 3.4;  oCurve[5]  = 3.44;
00045     // oCurve[3] = 3.47;  oCurve[1]  = 3.5;
00046     oCurve[63] = 1.1;   oCurve[56] = 1.11;
00047     oCurve[49] = 1.17;  oCurve[42] = 1.27;
00048     oCurve[35] = 1.28;  oCurve[31] = 1.28; oCurve[27] = 1.28;
00049     oCurve[23] = 1.37;  oCurve[19] = 1.37;
00050     oCurve[16] = 1.6;  oCurve[13] = 1.6;
00051     oCurve[10] = 1.8;  oCurve[7]  = 1.8;
00052     oCurve[5]  = 2.23; oCurve[3] = 2.23;
00053     oCurve[1]  = 2.5;
00054     // oCurve[63] = 1.05;  oCurve[56] = 1.07;
00055     // oCurve[49] = 1.09;  oCurve[42] = 1.11; oCurve[35] = 1.14;
00056     // oCurve[31] = 1.16;  oCurve[27] = 1.18;  oCurve[23] = 1.21;
00057     // oCurve[19] = 1.24;  oCurve[16] = 1.27;  oCurve[13] = 1.3;
00058     // oCurve[10] = 1.33;  oCurve[7]  = 1.37;  oCurve[5]  = 1.4;
00059     // oCurve[3] = 1.45;  oCurve[1]  = 1.5;
00060     // oCurve[63] = 1.4;
00061     // oCurve[49] = 1.5;  oCurve[35] = 1.6;
00062     // oCurve[23] = 2.0;  oCurve[16] = 2.6;
00063     // oCurve[10] = 3.3;  oCurve[5]  = 3.44;
00064     // oCurve[1]  = 3.5;
00065     return oCurve;
00066   };
00067
00069   const stdair::DCPList_T DEFAULT_DCP_LIST = DefaultDCPList::init();
00070   stdair::DCPList_T DefaultDCPList::init() {
00071     stdair::DCPList_T oDCPList;
00072     oDCPList.push_back (63); oDCPList.push_back (49);
00073     oDCPList.push_back (35); oDCPList.push_back (23);
00074     oDCPList.push_back (16); oDCPList.push_back (10);
00075     oDCPList.push_back (5);  oDCPList.push_back (1);
00076     oDCPList.push_back (0);
00077     return oDCPList;
00078   }
00079
00080 }
```

43.62 rmol/basic/BasConst_Curves.hpp File Reference

```
#include <rmol/RMOL_Types.hpp>
```

Classes

- struct RMOL::DefaultMap

Namespaces

- namespace RMOL

43.63 BasConst_Curves.hpp

```
00001 #ifndef __RMOL_BAS_BASCONST_CURVES_HPP
00002 #define __RMOL_BAS_BASCONST_CURVES_HPP
```

```
00003
00004 // ////////////////////////////////////////////////////////////////////
00005 // Import section
00006 // ////////////////////////////////////////////////////////////////////
00007 // RMOL
00008 #include <rmol/RMOL_Types.hpp>
00009
00010 namespace RMOL {
00011
00014   extern const FRAT5Curve_T DEFAULT_CUMULATIVE_FRAT5_CURVE;
00015
00017   struct DefaultMap {
00018     static FRAT5Curve_T createCumulativeFRAT5Curve();
00019   };
00020 }
00021 #endif // __RMOL_BAS_BASCONST_CURVES_HPP
```

43.64 rmol/basic/BasConst_General.hpp File Reference

`#include <stdair/stdair_types.hpp>`

Classes

- struct RMOL::DefaultDCPList

Namespaces

- namespace RMOL

43.65 BasConst_General.hpp

```
00001 #ifndef __RMOL_BAS_BASCONST_GENERAL_HPP
00002 #define __RMOL_BAS_BASCONST_GENERAL_HPP
00003
00004 // ////////////////////////////////////////////////////////////////////
00005 // Import section
00006 // ////////////////////////////////////////////////////////////////////
00007 // StdAir
00008 #include <stdair/stdair_types.hpp>
00009
00010 namespace RMOL {
00011
00014   extern const int DEFAULT_NUMBER_OF_DRAWS_FOR_MC_SIMULATION;
00015
00018   extern const int DEFAULT_PRECISION;
00019
00021   extern const double DEFAULT_EPSILON;
00022
00024   extern const double DEFAULT_STOPPING_CRITERION;
00025
00027   extern const double DEFAULT_INITIALIZER_DOUBLE_NEGATIVE;
00028
00030   extern const stdair::DCPList_T DEFAULT_DCP_LIST;
00031   struct DefaultDCPList { static stdair::DCPList_T init(); };
```

```
00032 }
00033 #endif // __RMOL_BAS_BASCONST_GENERAL_HPP
```

43.66 rmol/basic/BasConst_RMOL_Service.hpp File Reference

```
#include <vector>
#include <stdair/stdair_basic_types.hpp>
#include <rmol/RMOL_Types.hpp>
```

Namespaces

- namespace RMOL

43.67 BasConst_RMOL_Service.hpp

```
00001 #ifndef __RMOL_BAS_BASCONST_RMOL_SERVICE_HPP
00002 #define __RMOL_BAS_BASCONST_RMOL_SERVICE_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <vector>
00009 // StdAir
00010 #include <stdair/stdair_basic_types.hpp>
00011 // RMOL
00012 #include <rmol/RMOL_Types.hpp>
00013
00014 namespace RMOL {
00015
00017   extern const stdair::AirlineCode_T DEFAULT_RMOL_SERVICE_AIRLINE_CODE;
00018
00020   extern const double DEFAULT_RMOL_SERVICE_CAPACITY;
00021
00022 }
00023 #endif // __RMOL_BAS_BASCONST_RMOL_SERVICE_HPP
```

43.68 rmol/batches/rmol.cpp File Reference

```
#include <cassert>
#include <iostream>
#include <sstream>
#include <fstream>
#include <string>
#include <boost/date_time/posix_time/posix_time.hpp>
#include <boost/date_time/gregorian/gregorian.hpp>
```

```
#include <boost/program_options.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/RMOL_Service.hpp>
#include <rmol/config/rmol-paths.hpp>
```

Functions

- const std::string K_RMOL_DEFAULT_LOG_FILENAME ("rmol.log")
- const std::string K_RMOL_DEFAULT_INPUT_FILENAME (STDAIR_SAMPLE_DIR"/rm01.csv")
- template<class T >
  std::ostream & operator<< (std::ostream &os, const std::vector< T > &v)
- int readConfiguration (int argc, char *argv[], int &ioRandomDraws, double &ioCapacity, short &ioMethod, bool &ioIsBuiltin, std::string &ioInputFilename, std::string &ioLogFilename)
- void optimise (RMOL::RMOL_Service &rmolService, const short &iMethod, const int &iRandomDraws)
- int main (int argc, char *argv[])

Variables

- const bool K_RMOL_DEFAULT_BUILT_IN_INPUT = false
- const int K_RMOL_DEFAULT_RANDOM_DRAWS = 100000
- const double K_RMOL_DEFAULT_CAPACITY = 500.0
- const short K_RMOL_DEFAULT_METHOD = 0
- const int K_RMOL_EARLY_RETURN_STATUS = 99

43.68.1 Function Documentation

43.68.1.1 const std::string K_RMOL_DEFAULT_LOG_FILENAME ("rmol.log")

Default name and location for the log file.

Referenced by readConfiguration().

43.68.1.2 const std::string K_RMOL_DEFAULT_INPUT_FILENAME (STDAIR_SAMPLE_DIR"/rm01.csv")

Default name and location for the (CSV) input file.

Referenced by readConfiguration().

43.68.1.3 template<class T > std::ostream& operator<< (std::ostream & *os*, const std::vector< T > & *v*)

Definition at line 47 of file rmol.cpp.

43.68.1.4 int readConfiguration (int *argc,* char * *argv[],* int & *ioRandomDraws,* double & *ioCapacity,* short & *ioMethod,* bool & *ioIsBuiltin,* std::string & *ioInputFilename,* std::string & *ioLogFilename*)

Read and parse the command line options.

Definition at line 57 of file rmol.cpp.

References K_RMOL_DEFAULT_BUILT_IN_INPUT, K_RMOL_DEFAULT_CAPACITY, K_RMOL_DEFAULT_INPUT_FILENAME(), K_RMOL_DEFAULT_LOG_FILENAME(), K_RMOL_DEFAULT_METHOD, K_RMOL_DEFAULT_RANDOM_DRAWS, K_RMOL_EARLY_RETURN_STATUS, PACKAGE_NAME, PACKAGE_VERSION, and PREFIXDIR.

Referenced by main().

43.68.1.5 void optimise (RMOL::RMOL_Service & *rmolService,* const short & *iMethod,* const int & *iRandomDraws*)

Definition at line 167 of file rmol.cpp.

References RMOL::RMOL_Service::heuristicOptimisationByEmsr(), RMOL::RMOL_Service::heuristicOptimisationByEmsrB(), RMOL::RMOL_Service::optimalOptimisationByDP(), and RMOL::RMOL_Service::optimalOptimisationByMCIntegration().

Referenced by main().

43.68.1.6 int main (int *argc,* char * *argv[]*)

Definition at line 204 of file rmol.cpp.

References RMOL::RMOL_Service::buildSampleBom(), K_RMOL_EARLY_RETURN_STATUS, optimise(), RMOL::RMOL_Service::parseAndLoad(), and readConfiguration().

43.68.2 Variable Documentation

43.68.2.1 const bool K_RMOL_DEFAULT_BUILT_IN_INPUT = false

Default for the input type. It can be either built-in or provided by an input file. That latter must then be given with the -i/--input option.

Definition at line 23 of file rmol.cpp.

Referenced by readConfiguration().

43.68.2.2 const int K_RMOL_DEFAULT_RANDOM_DRAWS = 100000

Default number of random draws to be generated (best if over 100).

Definition at line 29 of file rmol.cpp.

Referenced by readConfiguration().

43.68.2.3 const double K_RMOL_DEFAULT_CAPACITY = 500.0

Default value for the capacity of the resource (e.g., a flight cabin).

Definition at line 32 of file rmol.cpp.

Referenced by readConfiguration().

43.68.2.4 const short K_RMOL_DEFAULT_METHOD = 0

Default name and location for the Revenue Management method to be used.

- 0 = Monte-Carlo
- 1 = Dynamic Programming
- 2 = EMSR
- 3 = EMSR-a
- 4 = EMSR-b

Definition at line 43 of file rmol.cpp.

Referenced by readConfiguration().

43.68.2.5 const int K_RMOL_EARLY_RETURN_STATUS = 99

Early return status (so that it can be differentiated from an error).

Definition at line 54 of file rmol.cpp.

Referenced by main(), and readConfiguration().

43.69 rmol.cpp

```
00001 // STL
00002 #include <cassert>
00003 #include <iostream>
00004 #include <sstream>
00005 #include <fstream>
00006 #include <string>
00007 // Boost (Extended STL)
00008 #include <boost/date_time/posix_time/posix_time.hpp>
00009 #include <boost/date_time/gregorian/gregorian.hpp>
00010 #include <boost/program_options.hpp>
00011 // StdAir
00012 #include <stdair/service/Logger.hpp>
00013 // RMOL
00014 #include <rmol/RMOL_Service.hpp>
00015 #include <rmol/config/rmol-paths.hpp>
00016
00017 // //////// Constants //////
00019 const std::string K_RMOL_DEFAULT_LOG_FILENAME ("rmol.log");
00020
00023 const bool K_RMOL_DEFAULT_BUILT_IN_INPUT = false;
00024
00026 const std::string K_RMOL_DEFAULT_INPUT_FILENAME (STDAIR_SAMPLE_DIR "/rm01.csv");
00027
00029 const int K_RMOL_DEFAULT_RANDOM_DRAWS = 100000;
00030
00032 const double K_RMOL_DEFAULT_CAPACITY = 500.0;
```

```
00033
00043 const short K_RMOL_DEFAULT_METHOD = 0;
00044
00045 // ///////// Parsing of Options & Configuration /////////
00046 // A helper function to simplify the main part.
00047 template<class T> std::ostream& operator<< (std::ostream& os,
00048                                             const std::vector<T>& v) {
00049   std::copy (v.begin(), v.end(), std::ostream_iterator<T> (std::cout, " "));
00050   return os;
00051 }
00052
00054 const int K_RMOL_EARLY_RETURN_STATUS = 99;
00055
00057 int readConfiguration(int argc, char* argv[],
00058                       int& ioRandomDraws, double& ioCapacity,
00059                       short& ioMethod, bool& ioIsBuiltin,
00060                       std::string& ioInputFilename, std::string& ioLogFilename){
00061
00062   // Default for the built-in input
00063   ioIsBuiltin = K_RMOL_DEFAULT_BUILT_IN_INPUT;
00064
00065   // Declare a group of options that will be allowed only on command line
00066   boost::program_options::options_description generic ("Generic options");
00067   generic.add_options()
00068     ("prefix", "print installation prefix")
00069     ("version,v", "print version string")
00070     ("help,h", "produce help message");
00071
00072   // Declare a group of options that will be allowed both on command
00073   // line and in config file
00074   boost::program_options::options_description config ("Configuration");
00075   config.add_options()
00076     ("draws,d",
00077      boost::program_options::value<int>(&ioRandomDraws)->default_value(
      K_RMOL_DEFAULT_RANDOM_DRAWS),
00078      "Number of to-be-generated random draws")
00079     ("capacity,c",
00080      boost::program_options::value<double>(&ioCapacity)->default_value(
      K_RMOL_DEFAULT_CAPACITY),
00081      "Resource capacity (e.g., for a flight leg)")
00082     ("method,m",
00083      boost::program_options::value<short>(&ioMethod)->default_value(
      K_RMOL_DEFAULT_METHOD),
00084      "Revenue Management method to be used (0 = Monte-Carlo, 1 = Dynamic Programm
      ing, 2 = EMSR, 3 = EMSR-a, 4 = EMSR-b)")
00085     ("builtin,b",
00086      "The cabin set up can be either built-in or parsed from an input file. That
      latter must then be given with the -i/--input option")
00087     ("input,i",
00088      boost::program_options::value< std::string >(&ioInputFilename)->default_valu
      e(K_RMOL_DEFAULT_INPUT_FILENAME),
00089      "(CSV) input file for the demand distribution parameters and resource (leg-c
      abin) capacities")
00090     ("log,l",
00091      boost::program_options::value< std::string >(&ioLogFilename)->default_value(
      K_RMOL_DEFAULT_LOG_FILENAME),
00092      "Filename for the logs")
00093     ;
00094
00095   // Hidden options, will be allowed both on command line and
00096   // in config file, but will not be shown to the user.
00097   boost::program_options::options_description hidden ("Hidden options");
```

```
00098   hidden.add_options()
00099     ("copyright",
00100      boost::program_options::value< std::vector<std::string> >(),
00101      "Show the copyright (license)");
00102
00103   boost::program_options::options_description cmdline_options;
00104   cmdline_options.add(generic).add(config).add(hidden);
00105
00106   boost::program_options::options_description config_file_options;
00107   config_file_options.add(config).add(hidden);
00108
00109   boost::program_options::options_description visible ("Allowed options");
00110   visible.add(generic).add(config);
00111
00112   boost::program_options::positional_options_description p;
00113   p.add ("copyright", -1);
00114
00115   boost::program_options::variables_map vm;
00116   boost::program_options::
00117     store (boost::program_options::command_line_parser (argc, argv).
00118            options (cmdline_options).positional(p).run(), vm);
00119
00120   std::ifstream ifs ("rmol.cfg");
00121   boost::program_options::store (parse_config_file (ifs, config_file_options),
00122                                  vm);
00123   boost::program_options::notify (vm);
00124
00125   if (vm.count ("help")) {
00126     std::cout << visible << std::endl;
00127     return K_RMOL_EARLY_RETURN_STATUS;
00128   }
00129
00130   if (vm.count ("version")) {
00131     std::cout << PACKAGE_NAME << ", version " << PACKAGE_VERSION << std::endl;
00132     return K_RMOL_EARLY_RETURN_STATUS;
00133   }
00134
00135   if (vm.count ("prefix")) {
00136     std::cout << "Installation prefix: " << PREFIXDIR << std::endl;
00137     return K_RMOL_EARLY_RETURN_STATUS;
00138   }
00139
00140   if (vm.count ("builtin")) {
00141     ioIsBuiltin = true;
00142   }
00143   const std::string isBuiltinStr = (ioIsBuiltin == true)?"yes":"no";
00144   std::cout << "The BOM should be built-in? " << isBuiltinStr << std::endl;
00145
00146   if (ioIsBuiltin == false) {
00147     if (vm.count ("input")) {
00148       ioInputFilename = vm["input"].as< std::string >();
00149       std::cout << "Input filename is: " << ioInputFilename << std::endl;
00150     }
00151   }
00152
00153   if (vm.count ("log")) {
00154     ioLogFilename = vm["log"].as< std::string >();
00155     std::cout << "Log filename is: " << ioLogFilename << std::endl;
00156   }
00157
00158   std::cout << "The number of random draws is: " << ioRandomDraws << std::endl;
00159   std::cout << "The resource capacity is: " << ioCapacity << std::endl;
```

```
00160   std::cout << "The optimisation method is: " << ioMethod << std::endl;
00161   std::cout << std::endl;
00162
00163   return 0;
00164 }
00165
00166 // ////////////////////////////////////////////////
00167 void optimise (RMOL::RMOL_Service& rmolService,
00168                const short& iMethod, const int& iRandomDraws) {
00169
00170   switch (iMethod) {
00171   case 0: {
00172     // Calculate the optimal protections by the Monte Carlo
00173     // Integration approach
00174     rmolService.optimalOptimisationByMCIntegration (iRandomDraws);
00175     break;
00176   }
00177   case 1: {
00178     // Calculate the optimal protections by DP.
00179     rmolService.optimalOptimisationByDP ();
00180     break;
00181   }
00182   case 2: {
00183     // Calculate the Bid-Price Vector by EMSR
00184     rmolService.heuristicOptimisationByEmsr ();
00185     break;
00186   }
00187   case 3: {
00188     // Calculate the protections by EMSR-a
00189     rmolService.heuristicOptimisationByEmsrA ();
00190     break;
00191   }
00192   case 4: {
00193     // Calculate the protections by EMSR-b
00194     rmolService.heuristicOptimisationByEmsrB ();
00195     break;
00196   }
00197   default: {
00198     rmolService.optimalOptimisationByMCIntegration (iRandomDraws);
00199   }
00200   }
00201 }
00202
00203 // ///////// M A I N /////////////
00204 int main (int argc, char* argv[]) {
00205
00206   // Number of random draws to be generated (best if greater than 100)
00207   int lRandomDraws = 0;
00208
00209   // Cabin Capacity (it must be greater then 100 here)
00210   double lCapacity = 0.0;
00211
00212   // Methods of optimisation (0 = Monte-Carlo, 1 = Dynamic Programming,
00213   // 2 = EMSR, 3 = EMSR-a, 4 = EMSR-b)
00214   short lMethod = 0;
00215
00216   // Built-in
00217   bool isBuiltin;
00218
00219   // Input file name
00220   std::string lInputFilename;
00221
```

```
00222   // Output log File
00223   std::string lLogFilename;
00224
00225   // Call the command-line option parser
00226   const int lOptionParserStatus =
00227     readConfiguration (argc, argv, lRandomDraws, lCapacity, lMethod,
00228                        isBuiltin, lInputFilename, lLogFilename);
00229
00230   if (lOptionParserStatus == K_RMOL_EARLY_RETURN_STATUS) {
00231     return 0;
00232   }
00233
00234   // Set the log parameters
00235   std::ofstream logOutputFile;
00236   // Open and clean the log outputfile
00237   logOutputFile.open (lLogFilename.c_str());
00238   logOutputFile.clear();
00239
00240   // Initialise the log stream
00241   const stdair::BasLogParams lLogParams (stdair::LOG::DEBUG, logOutputFile);
00242
00243   // Initialise the RMOL service
00244   RMOL::RMOL_Service rmolService (lLogParams);
00245
00246   if (isBuiltin == true) {
00247     // DEBUG
00248     STDAIR_LOG_DEBUG ("No input file has been given."
00249                       "A sample BOM tree will therefore be built.");
00250
00251     // Build a sample BOM tree
00252     rmolService.buildSampleBom();
00253
00254   } else {
00255     // DEBUG
00256     STDAIR_LOG_DEBUG ("RMOL will parse " << lInputFilename
00257                       << " and build the corresponding BOM tree.");
00258
00259     //
00260     rmolService.parseAndLoad (lCapacity, lInputFilename);
00261   }
00262
00263   // Launch the optimisation
00264   optimise (rmolService, lMethod, lRandomDraws);
00265
00266   //
00267   logOutputFile.close();
00268
00269   return 0;
00270 }
```

43.70 rmol/bom/BucketHolderTypes.hpp File Reference

```
#include <list>
#include <map>
#include <stdair/stdair_basic_types.hpp>
```

Namespaces

- namespace RMOL

Typedefs

- typedef std::list< BucketHolder * > RMOL::BucketHolderList_T

43.71 BucketHolderTypes.hpp

```
00001 #ifndef __RMOL_BUCKETHOLDERTYPES_HPP
00002 #define __RMOL_BUCKETHOLDERTYPES_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <list>
00009 #include <map>
00010 // STDAIR
00011 #include <stdair/stdair_basic_types.hpp>
00012
00013 namespace RMOL {
00014
00016   class BucketHolder;
00017
00019   typedef std::list<BucketHolder*> BucketHolderList_T;
00020
00023   typedef std::map<const stdair::MapKey_T, BucketHolder*>;
00024 }
00025 #endif // __RMOL_BUCKETHOLDERTYPES_HPP
```

43.72 rmol/bom/DistributionParameterList.hpp File Reference

```
#include <list>
#include <rmol/field/FldDistributionParameters.hpp>
```

Namespaces

- namespace RMOL

Typedefs

- typedef std::list< FldDistributionParameters > RMOL::DistributionParameterList_-T

43.73 DistributionParameterList.hpp

```
00001 #ifndef __RMOL_DISTRIBUTIONPARAMETERLIST_HPP
```

```
00002 #define __RMOL_DISTRIBUTIONPARAMETERLIST_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <list>
00009 // RMOL
00010 #include <rmol/field/FldDistributionParameters.hpp>
00011
00012 namespace RMOL {
00013
00016   typedef std::list<FldDistributionParameters> DistributionParameterList_T;
00017
00018 }
00019 #endif // __RMOL_DISTRIBUTIONPARAMETERLIST_HPP
```

43.74 rmol/bom/DPOptimiser.cpp File Reference

```
#include <cassert>
#include <sstream>
#include <vector>
#include <cmath>
#include <boost/math/distributions/normal.hpp>
#include <stdair/bom/LegCabin.hpp>
#include <stdair/bom/VirtualClassStruct.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/basic/BasConst_General.hpp>
#include <rmol/bom/DPOptimiser.hpp>
```

Namespaces

- namespace RMOL

43.75 DPOptimiser.cpp

```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 #include <sstream>
00007 #include <vector>
00008 #include <cmath>
00009 // Boost Math
00010 #include <boost/math/distributions/normal.hpp>
00011 // StdAir
00012 #include <stdair/bom/LegCabin.hpp>
00013 #include <stdair/bom/VirtualClassStruct.hpp>
```

```
00014 #include <stdair/service/Logger.hpp>
00015 // RMOL
00016 #include <rmol/basic/BasConst_General.hpp>
00017 #include <rmol/bom/DPOptimiser.hpp>
00018
00019 namespace RMOL {
00020
00021   // ////////////////////////////////////////////////////////////////////
00022   void DPOptimiser::optimalOptimisationByDP (stdair::LegCabin& ioLegCabin) {
00023     // // Number of classes/buckets: n
00024     // const short nbOfClasses = ioBucketHolder.getSize();
00025
00026     // // Number of values of x to compute for each Vj(x).
00027     // const int maxValue = static_cast<int> (iCabinCapacity * DEFAULT_PRECISION)
      ;
00028
00029     // // Vector of the Expected Maximal Revenue (Vj).
00030     // std::vector< std::vector<double> > MERVectorHolder;
00031
00032     // // Vector of V_0(x).
00033     // std::vector<double> initialMERVector (maxValue+1, 0.0);
00034     // MERVectorHolder.push_back (initialMERVector);
00035
00036     // // Current cumulative protection level (y_j * DEFAULT_PRECISION).
00037     // // Initialise with y_0 = 0.
00038     // int currentProtection = 0;
00039
00040     // int currentBucketIndex = 1;
00041     // ioBucketHolder.begin();
00042
00043     // while (currentProtection < maxValue && currentBucketIndex < nbOfClasses) {

00044     // //while (currentBucketIndex == 1) {
00045     //   bool protectionChanged = false;
00046     //   double nextProtection = 0.0;
00047     //   std::vector<double> currentMERVector;
00048     //   // double testGradient = 10000;
00049
00050     //   Bucket& currentBucket = ioBucketHolder.getCurrentBucket();
00051     //   const double meanDemand = currentBucket.getMean();
00052     //   const double SDDemand = currentBucket.getStandardDeviation();
00053     //   const double currentYield = currentBucket.getAverageYield();
00054     //   const double errorFactor = 1.0;
00055
00056     //   Bucket& nextBucket = ioBucketHolder.getNextBucket();
00057     //   const double nextYield = nextBucket.getAverageYield();
00058
00059     //   // For x <= currentProtection (y_(j-1)), V_j(x) = V_(j-1)(x).
00060     //   for (int x = 0; x <= currentProtection; ++x) {
00061     //     const double MERValue = MERVectorHolder.at(currentBucketIndex-1).at(x)
      ;
00062     //     currentMERVector.push_back (MERValue);
00063     //   }
00064
00065     //   //
00066     //   boost::math::normal lNormalDistribution (meanDemand, SDDemand);
00067
00068     //   // Vector of gaussian pdf values.
00069     //   std::vector<double> pdfVector;
00070     //   for (int s = 0; s <= maxValue - currentProtection; ++s) {
00071     //     const double pdfValue =
00072     //       boost::math::pdf (lNormalDistribution, s/DEFAULT_PRECISION);
```

```
00073     //     pdfVector.push_back (pdfValue);
00074     //   }
00075     //
00076     //   // Vector of gaussian cdf values.
00077     //   std::vector<double> cdfVector;
00078     //   for (int s = 0; s <= maxValue - currentProtection; ++s) {
00079     //     const double cdfValue =
00080     //       boost::math::cdf (boost::math::complement (lNormalDistribution,
00081     //                                                  s/DEFAULT_PRECISION));
00082     //     cdfVector.push_back (cdfValue);
00083     //   }
00084     //
00085     //   // Compute V_j(x) for x > currentProtection (y_(j-1)).
00086     //   for (int x = currentProtection + 1; x <= maxValue; ++x) {
00087     //     const double lowerBound = static_cast<double> (x - currentProtection);
00088     //
00089     //     // Compute the first integral in the V_j(x) formulation (see
00090     //     // the memo of Jerome Contant).
00091     //     const double power1 =
00092     //       - 0.5 * meanDemand * meanDemand / (SDDemand * SDDemand);
00093     //     const double e1 = std::exp (power1);
00094     //     const double power2 =
00095     //       - 0.5 * (lowerBound / DEFAULT_PRECISION - meanDemand)
00096     //       * (lowerBound / DEFAULT_PRECISION - meanDemand)
00097     //       / (SDDemand * SDDemand);
00098     //     const double e2 = std::exp (power2);
00099     //
00100     //     const double cdfValue0 =
00101     //       boost::math::cdf (boost::math::complement (lNormalDistribution,
00102     //                                                  0.0));
00103     //     const double cdfValue1 =
00104     //       boost::math::cdf(boost::math::complement(lNormalDistribution,
00105     //                                                lowerBound/DEFAULT_PRECISIO
      N));
00106     //     const double integralResult1 = currentYield
00107     //       * ((e1 - e2) * SDDemand / sqrt (2 * 3.14159265)
00108     //          + meanDemand * (cdfValue0 - cdfValue1));
00109     //
00110     //     double integralResult2 = 0.0;
00111     //
00112     //     for (int s = 0; s < lowerBound; ++s) {
00113     //       const double partialResult =
00114     //         2 * MERVectorHolder.at(currentBucketIndex-1).at(x-s)
00115     //         * pdfVector.at(s);
00116     //
00117     //       integralResult2 += partialResult;
00118     //     }
00119     //     integralResult2 -= MERVectorHolder.at(currentBucketIndex-1).at(x) *
00120     //       pdfVector.at(0);
00121     //
00122     //     const int intLowerBound = static_cast<int>(lowerBound);
00123     //     integralResult2 +=
00124     //       MERVectorHolder.at(currentBucketIndex-1).at(x - intLowerBound) *
00125     //       pdfVector.at(intLowerBound);
00126     //
00127     //     integralResult2 /= 2 * DEFAULT_PRECISION;
00128     //     /*
00129     //     for (int s = 0; s < lowerBound; ++s) {
00130     //       const double partialResult =
00131     //         (MERVectorHolder.at(currentBucketIndex-1).at(x-s) +
00132     //          MERVectorHolder.at(currentBucketIndex-1).at(x-s-1)) *
```

```
00133     //         (cdfVector.at(s+1) - cdfVector.at(s)) / 2;
00134     //       integralResult2 += partialResult;
00135     //     }
00136     //     */
00137     //     const double firstElement = integralResult1 + integralResult2;
00138 
00139     //     // Compute the second integral in the V_j(x) formulation (see
00140     //     // the memo of Jerome Contant).
00141     //     const double constCoefOfSecondElement =
00142     //       currentYield * lowerBound / DEFAULT_PRECISION
00143     //       + MERVectorHolder.at(currentBucketIndex-1).at(currentProtection);
00144 
00145     //     const double secondElement = constCoefOfSecondElement
00146     //       * boost::math::cdf(boost::math::complement(lNormalDistribution,
00147     //                                                  lowerBound/DEFAULT_PRECIS
      ION));
00148 
00149     //     const double MERValue = (firstElement + secondElement) / errorFactor;
00150 
00151 
00152     //     assert (currentMERVector.size() > 0);
00153     //     const double lastMERValue = currentMERVector.back();
00154 
00155     //     const double currentGradient =
00156     //       (MERValue - lastMERValue) * DEFAULT_PRECISION;
00157 
00158     //     //assert (currentGradient >= 0);
00159     //     if (currentGradient < -0) {
00160     //       std::ostringstream ostr;
00161     //       ostr << currentGradient  << std::endl
00162     //            << "x = " << x << std::endl
00163     //            << "class: " << currentBucketIndex << std::endl;
00164     //       STDAIR_LOG_DEBUG (ostr.str());
00165     //     }
00166 
00167     //     /*
00168     //     assert (currentGradient <= testGradient);
00169     //     testGradient = currentGradient;
00170     //     */
00171     //     if (protectionChanged == false && currentGradient <= nextYield) {
00172     //       nextProtection = x - 1;
00173     //       protectionChanged = true;
00174     //     }
00175 
00176     //      if (protectionChanged == true && currentGradient > nextYield) {
00177     //       protectionChanged = false;
00178     //     }
00179 
00180     //     if (protectionChanged == false && x == maxValue) {
00181     //       nextProtection = maxValue;
00182     //     }
00183 
00184     //     currentMERVector.push_back (MERValue);
00185     //   }
00186 
00187     //   // DEBUG
00188     //   STDAIR_LOG_DEBUG ("Vmaxindex = " << currentMERVector.back());
00189 
00190     //   MERVectorHolder.push_back (currentMERVector);
00191 
00192     //   const double realProtection = nextProtection / DEFAULT_PRECISION;
00193     //   const double bookingLimit = iCabinCapacity - realProtection;
```

```
00194
00195     //   currentBucket.setCumulatedProtection (realProtection);
00196     //   nextBucket.setCumulatedBookingLimit (bookingLimit);
00197
00198     //   currentProtection = static_cast<int> (std::floor (nextProtection));
00199
00200     //   ioBucketHolder.iterate();
00201     //   ++currentBucketIndex;
00202     // }
00203   }
00204
00205 }
```

43.76 rmol/bom/DPOptimiser.hpp File Reference

```
#include <rmol/RMOL_Types.hpp>
```

Classes

- class RMOL::DPOptimiser

Namespaces

- namespace stdair
- namespace RMOL

43.77 DPOptimiser.hpp

```
00001 #ifndef __RMOL_BOM_DPOPTIMISER_HPP
00002 #define __RMOL_BOM_DPOPTIMISER_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // RMOL
00008 #include <rmol/RMOL_Types.hpp>
00009
00011 namespace stdair {
00012   class LegCabin;
00013 }
00014
00015 namespace RMOL {
00017   class DPOptimiser {
00018   public:
00019
00025     static void optimalOptimisationByDP (stdair::LegCabin&);
00026
00030     static double cdfGaussianQ (const double, const double);
00031   };
00032 }
00033 #endif // __RMOL_BOM_DPOPTIMISER_HPP
```

43.78 rmol/bom/EMDetruncator.cpp File Reference

```
#include <iostream>
#include <cmath>
#include <vector>
#include <cassert>
#include <stdair/stdair_basic_types.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/bom/HistoricalBookingHolder.hpp>
#include <rmol/bom/EMDetruncator.hpp>
```

Namespaces

- namespace RMOL

43.79 EMDetruncator.cpp

```
00001 // ////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // ////////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <iostream>
00006 #include <cmath>
00007 #include <vector>
00008 #include <cassert>
00009 // StdAir
00010 #include <stdair/stdair_basic_types.hpp>
00011 #include <stdair/service/Logger.hpp>
00012 // RMOL
00013 #include <rmol/bom/HistoricalBookingHolder.hpp>
00014 #include <rmol/bom/EMDetruncator.hpp>
00015
00016 namespace RMOL {
00017
00018   // ////////////////////////////////////////////////////////////////////
00019   void EMDetruncator::unconstrainUsingEMMethod
00020   (HistoricalBookingHolder& ioHistoricalBookingHolder) {
00021
00022     // Number of flights.
00023     const short lNbOfFlights =
00024       ioHistoricalBookingHolder.getNbOfFlights();
00025
00026     // Number of uncensored booking data.
00027     const short lNbOfUncensoredData =
00028       ioHistoricalBookingHolder.getNbOfUncensoredData();
00029
00030     if (lNbOfUncensoredData > 1) {
00031       // Number of uncensored bookings.
00032       const stdair::NbOfBookings_T lNbOfUncensoredBookings =
00033         ioHistoricalBookingHolder.getNbOfUncensoredBookings();
00034
00035       const double lMeanOfUncensoredBookings =
```

```
00036         static_cast<double>(lNbOfUncensoredBookings/lNbOfUncensoredData);
00037
00038       const double lStdDevOfUncensoredBookings =
00039         ioHistoricalBookingHolder.getUncensoredStandardDeviation
00040         (lMeanOfUncensoredBookings, lNbOfUncensoredData);
00041
00042       std::vector<bool> toBeUnconstrained =
00043         ioHistoricalBookingHolder.getListOfToBeUnconstrainedFlags();
00044
00045       double lDemandMean = lMeanOfUncensoredBookings;
00046       double lStdDev = lStdDevOfUncensoredBookings;
00047
00048       // DEBUG
00049       STDAIR_LOG_DEBUG ("mean: " << lDemandMean << ", std: " << lStdDev);
00050
00051       if (lStdDev != 0) {
00052         bool stopUnconstraining = false;
00053         while (stopUnconstraining == false) {
00054           stopUnconstraining = true;
00055
00056           for (short i = 0; i < lNbOfFlights; ++i) {
00057             if (toBeUnconstrained.at(i) == true) {
00058               // Get the unconstrained demand of the (i+1)-th flight.
00059               const stdair::NbOfBookings_T demand =
00060                 ioHistoricalBookingHolder.getUnconstrainedDemand (i);
00061               //STDAIR_LOG_DEBUG ("demand: " << demand);
00062
00063               // Execute the Expectation step.
00064               const stdair::NbOfBookings_T expectedDemand =
00065                 ioHistoricalBookingHolder.
00066                 calculateExpectedDemand (lDemandMean, lStdDev, i, demand);
00067               //STDAIR_LOG_DEBUG ("expected: " << expectedDemand);
00068               assert (expectedDemand >= 0 || expectedDemand < 0);
00069
00070               double absDiff =
00071                 static_cast<double>(expectedDemand - demand);
00072
00073               if (absDiff < 0) {
00074                 absDiff = - absDiff;
00075               }
00076               if (absDiff < 0.001) {
00077                 toBeUnconstrained.at (i) = false;
00078               }
00079               else {
00080                 stopUnconstraining = false;
00081               }
00082
00083               ioHistoricalBookingHolder.setUnconstrainedDemand (expectedDemand,
00084                                                                 i);
00085             }
00086           }
00087
00088           if (stopUnconstraining == false) {
00089             lDemandMean = ioHistoricalBookingHolder.getDemandMean();
00090             lStdDev =
00091               ioHistoricalBookingHolder.getStandardDeviation (lDemandMean);
00092           }
00093         }
00094       }
00095     }
00096
00097   }
```

```
00098 }
```

43.80 rmol/bom/EMDetruncator.hpp File Reference

Classes

- class RMOL::EMDetruncator

Namespaces

- namespace RMOL

43.81 EMDetruncator.hpp

```
00001 #ifndef __RMOL_BOM_EMDETRUNCATOR_HPP
00002 #define __RMOL_BOM_EMDETRUNCATOR_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 namespace RMOL {
00008   // Forward declarations.
00009   struct HistoricalBookingHolder;
00010
00012   class EMDetruncator {
00013   public:
00016     static void unconstrainUsingEMMethod (HistoricalBookingHolder&);
00017   };
00018 }
00019 #endif // __RMOL_BOM_EMDETRUNCATOR_HPP
```

43.82 rmol/bom/Emsr.cpp File Reference

```
#include <assert.h>
#include <iostream>
#include <cmath>
#include <list>
#include <algorithm>
#include <stdair/stdair_rm_types.hpp>
#include <stdair/bom/LegCabin.hpp>
#include <stdair/bom/VirtualClassStruct.hpp>
#include <rmol/bom/Emsr.hpp>
#include <rmol/bom/EmsrUtils.hpp>
```

Namespaces

- namespace RMOL

43.83 Emsr.cpp

```
00001 // ////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // ////////////////////////////////////////////////////////////////////
00004 // C
00005 #include <assert.h>
00006 // STL
00007 #include <iostream>
00008 #include <cmath>
00009 #include <list>
00010 #include <algorithm>
00011 // StdAir
00012 #include <stdair/stdair_rm_types.hpp>
00013 #include <stdair/bom/LegCabin.hpp>
00014 #include <stdair/bom/VirtualClassStruct.hpp>
00015 // RMOL
00016 #include <rmol/bom/Emsr.hpp>
00017 #include <rmol/bom/EmsrUtils.hpp>
00018
00019 namespace RMOL {
00020   // ////////////////////////////////////////////////////////////////////
00021   void Emsr::heuristicOptimisationByEmsrA (stdair::LegCabin& ioLegCabin) {
00022     stdair::VirtualClassList_T& lVirtualClassList =
00023       ioLegCabin.getVirtualClassList ();
00024     const stdair::CabinCapacity_T& lCabinCapacity =
00025       ioLegCabin.getOfferedCapacity();
00026
00032     stdair::VirtualClassList_T::iterator itVC =lVirtualClassList.begin();
00033     assert (itVC != lVirtualClassList.end());
00034
00035     stdair::VirtualClassStruct& lFirstVC = *itVC;
00036     lFirstVC.setCumulatedBookingLimit (lCabinCapacity);
00037     ++itVC;
00038     for (; itVC != lVirtualClassList.end(); ++itVC) {
00039       stdair::VirtualClassStruct& lNextVC = *itVC;
00040
00041       // Initialise the protection for class/bucket j.
00042       stdair::ProtectionLevel_T lProtectionLevel = 0.0;
00043
00044       for(stdair::VirtualClassList_T::iterator itHigherVC =
00045             lVirtualClassList.begin(); itHigherVC != itVC; ++itHigherVC) {
00046         stdair::VirtualClassStruct& lHigherVC = *itHigherVC;
00047         const double lPartialProtectionLevel =
00048           EmsrUtils::computeProtectionLevel (lHigherVC, lNextVC);
00049         lProtectionLevel += lPartialProtectionLevel;
00050       }
00051       stdair::VirtualClassList_T::iterator itCurrentVC = itVC; --itCurrentVC;
00052       stdair::VirtualClassStruct& lCurrentVC = *itCurrentVC;
00053       lCurrentVC.setCumulatedProtection (lProtectionLevel);
00054
00055       // Compute the booking limit for the class/bucket j+1 (can be negative).
00056       const double lBookingLimit = lCabinCapacity - lProtectionLevel;
00057
00058       // Set the booking limit for class/bucket j+1.
00059       lNextVC.setCumulatedBookingLimit (lBookingLimit);
```

```
00060     }
00061   }
00062
00063   // ////////////////////////////////////////////////////////////////////
00064   void Emsr::heuristicOptimisationByEmsrB (stdair::LegCabin& ioLegCabin) {
00065     stdair::VirtualClassList_T& lVirtualClassList =
00066       ioLegCabin.getVirtualClassList ();
00067     const stdair::CabinCapacity_T& lCabinCapacity =
00068       ioLegCabin.getOfferedCapacity();
00069
00075     stdair::VirtualClassList_T::iterator itVC =lVirtualClassList.begin();
00076     assert (itVC != lVirtualClassList.end());
00077
00078     stdair::VirtualClassStruct& lFirstVC = *itVC;
00079     lFirstVC.setCumulatedBookingLimit (lCabinCapacity);
00080     ++itVC;
00081     stdair::VirtualClassStruct lAggregatedVC = lFirstVC;
00082     for (; itVC != lVirtualClassList.end(); ++itVC) {
00083       stdair::VirtualClassStruct& lNextVC = *itVC;
00084
00085       // Compute the protection level for the aggregated class/bucket
00086       // using the Little-Wood formular.
00087       const stdair::ProtectionLevel_T lProtectionLevel =
00088         EmsrUtils::computeProtectionLevel (lAggregatedVC, lNextVC);
00089
00090       // Set the protection level for class/bucket j.
00091       stdair::VirtualClassList_T::iterator itCurrentVC = itVC; --itCurrentVC;
00092       stdair::VirtualClassStruct& lCurrentVC = *itCurrentVC;
00093       lCurrentVC.setCumulatedProtection (lProtectionLevel);
00094
00095       // Compute the booking limit for class/bucket j+1 (can be negative).
00096       const double lBookingLimit = lCabinCapacity - lProtectionLevel;
00097
00098       // Set the booking limit for class/bucket j+1.
00099       lNextVC.setCumulatedBookingLimit (lBookingLimit);
00100
00101       // Compute the aggregated class/bucket of classes/buckets 1,..,j.
00102       EmsrUtils::computeAggregatedVirtualClass (lAggregatedVC, lNextVC);
00103
00104     }
00105   }
00106
00107   // ////////////////////////////////////////////////////////////////////
00108   void Emsr::heuristicOptimisationByEmsr (stdair::LegCabin& ioLegCabin) {
00109     stdair::VirtualClassList_T& lVirtualClassList =
00110       ioLegCabin.getVirtualClassList ();
00111     const stdair::CabinCapacity_T& lCapacity = ioLegCabin.getOfferedCapacity();
00112     ioLegCabin.emptyBidPriceVector();
00113     stdair::BidPriceVector_T& lBidPriceVector =
00114       ioLegCabin.getBidPriceVector();
00115
00116     // Cabin capacity in integer.
00117     const int lCabinCapacity = static_cast<const int> (lCapacity);
00118
00119     // List of all EMSR values.
00120     stdair::EmsrValueList_T lEmsrValueList;
00121
00127     for (stdair::VirtualClassList_T::iterator itVC = lVirtualClassList.begin();
00128          itVC != lVirtualClassList.end(); ++itVC) {
00129       stdair::VirtualClassStruct& lCurrentVC = *itVC;
00130       for (int k = 1; k <= lCabinCapacity; ++k) {
00131         const double emsrValue = EmsrUtils::computeEmsrValue (k, lCurrentVC);
```

```
00132         lEmsrValueList.push_back(emsrValue);
00133       }
00134     }
00135
00136     // Sort the EMSR values from high to low.
00137     std::sort(lEmsrValueList.rbegin(), lEmsrValueList.rend());
00138
00139     // Sanity check
00140     const int lEmsrValueListSize = lEmsrValueList.size();
00141     assert (lEmsrValueListSize >= lCabinCapacity);
00142
00143     // Copy the EMSR sorted values to the BPV.
00144     stdair::EmsrValueList_T::const_iterator itCurrentValue =
00145       lEmsrValueList.begin();
00146     for (int j = 0; j < lCabinCapacity; ++j, ++itCurrentValue) {
00147       const double lBidPrice = *itCurrentValue;
00148       lBidPriceVector.push_back (lBidPrice);
00149     }
00150     lEmsrValueList.clear();
00151
00152     // Build the protection levels and booking limits.
00153     if (lVirtualClassList.size() > 1) {
00154       int lCapacityIndex = 0;
00155       for (stdair::VirtualClassList_T::iterator itVC =lVirtualClassList.begin();
00156            itVC != lVirtualClassList.end();;) {
00157         stdair::VirtualClassStruct& lCurrentVC = *itVC;
00158         if (itVC != lVirtualClassList.end()) {
00159           ++itVC;
00160         }
00161         stdair::VirtualClassStruct& lNextVC = *itVC;
00162         const stdair::Yield_T lNextYield = lNextVC.getYield();
00163         while ((lCapacityIndex < lCabinCapacity)
00164                && (lBidPriceVector.at(lCapacityIndex) > lNextYield)) {
00165           ++lCapacityIndex;
00166         }
00167         lCurrentVC.setCumulatedProtection (lCapacityIndex);
00168         lNextVC.setCumulatedBookingLimit (lCapacity - lCapacityIndex);
00169       }
00170     }
00171   }
00172
00173 }
```

43.84 rmol/bom/Emsr.hpp File Reference

`#include <rmol/RMOL_Types.hpp>`

Classes

- class RMOL::Emsr

Namespaces

- namespace stdair
- namespace RMOL

43.85 Emsr.hpp

```
00001 #ifndef __RMOL_EMSR_HPP
00002 #define __RMOL_EMSR_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // RMOL
00008 #include <rmol/RMOL_Types.hpp>
00009
00011 namespace stdair {
00012   class LegCabin;
00013 }
00014
00015 namespace RMOL {
00016
00018   class Emsr {
00019   public:
00031     static void heuristicOptimisationByEmsr (stdair::LegCabin&);
00032
00037     static void heuristicOptimisationByEmsrA (stdair::LegCabin&);
00038
00043     static void heuristicOptimisationByEmsrB (stdair::LegCabin&);
00044
00045   };
00046 }
00047 #endif // __RMOL_EMSR_HPP
```

43.86 rmol/bom/EmsrUtils.cpp File Reference

```
#include <cassert>
#include <cmath>
#include <boost/math/distributions/normal.hpp>
#include <stdair/stdair_maths_types.hpp>
#include <stdair/bom/VirtualClassStruct.hpp>
#include <rmol/bom/EmsrUtils.hpp>
#include <rmol/basic/BasConst_General.hpp>
```

Namespaces

- namespace RMOL

43.87 EmsrUtils.cpp

```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 #include <cmath>
```

```
00007 // Boost Math
00008 #include <boost/math/distributions/normal.hpp>
00009 // StdAir
00010 #include <stdair/stdair_maths_types.hpp>
00011 #include <stdair/bom/VirtualClassStruct.hpp>
00012 // RMOL
00013 #include <rmol/bom/EmsrUtils.hpp>
00014 #include <rmol/basic/BasConst_General.hpp>
00015
00016 namespace RMOL {
00017   // ////////////////////////////////////////////////////////////////////
00018   void EmsrUtils::computeAggregatedVirtualClass
00019   (stdair::VirtualClassStruct& ioAggregatedVirtualClass,
00020    stdair::VirtualClassStruct& ioCurrentVirtualClass) {
00021     // Retrieve the demand mean, demand standard deviation and average
00022     // yield of the classes/buckets.
00023     const stdair::MeanValue_T lAggregatedMean =
00024       ioAggregatedVirtualClass.getMean();
00025     const stdair::MeanValue_T lCurrentMean = ioCurrentVirtualClass.getMean();
00026     const stdair::StdDevValue_T lAggregatedSD =
00027       ioAggregatedVirtualClass.getStdDev();
00028     const stdair::StdDevValue_T lCurrentSD = ioCurrentVirtualClass.getStdDev();
00029     const stdair::Yield_T lAggregatedYield =
00030       ioAggregatedVirtualClass.getYield();
00031     const stdair::Yield_T lCurrentYield = ioCurrentVirtualClass.getYield();
00032
00033     // Compute the new demand mean, new demand standard deviation and
00034     // new average yield for the new aggregated class/bucket.
00035     const stdair::MeanValue_T lNewMean = lAggregatedMean + lCurrentMean;
00036     const stdair::StdDevValue_T lNewSD =
00037       sqrt (lAggregatedSD*lAggregatedSD + lCurrentSD*lCurrentSD);
00038     stdair::Yield_T lNewYield = lCurrentYield;
00039     if (lNewMean > 0) {
00040       lNewYield = (lAggregatedYield*lAggregatedMean +
00041                    lCurrentYield*lCurrentMean) / lNewMean;
00042     }
00043     // Set the new yield range for the new aggregated class/bucket.
00044     ioAggregatedVirtualClass.setYield(lNewYield);
00045
00046     // Set the new demand for the new aggregated class/bucket.
00047     ioAggregatedVirtualClass.setMean (lNewMean);
00048     ioAggregatedVirtualClass.setStdDev (lNewSD);
00049   }
00050
00051   // ////////////////////////////////////////////////////////////////////
00052   const stdair::ProtectionLevel_T EmsrUtils::
00053   computeProtectionLevel (stdair::VirtualClassStruct& ioAggregatedVirtualClass,
00054                           stdair::VirtualClassStruct& ioNextVirtualClass) {
00055     // Retrive the mean & standard deviation of the aggregated
00056     // class/bucket and the average yield of all the two
00057     // classes/buckets.
00058     const stdair::MeanValue_T lMean = ioAggregatedVirtualClass.getMean();
00059     const stdair::StdDevValue_T lSD = ioAggregatedVirtualClass.getStdDev();
00060     const stdair::Yield_T lAggreatedYield = ioAggregatedVirtualClass.getYield();
00061     const stdair::Yield_T lNextYield = ioNextVirtualClass.getYield();
00062     assert (lAggreatedYield != 0);
00063
00064     // Compute the yield ratio between the higher bucket and the current one
00065     const double lYieldRatio = lNextYield / lAggreatedYield;
00066
00070     boost::math::normal lNormalDistribution (lMean, lSD);
00071     const stdair::ProtectionLevel_T lProtection =
```

```
00072       boost::math::quantile (boost::math::complement (lNormalDistribution,
00073                                                       lYieldRatio));
00074
00075     return lProtection;
00076   }
00077
00078   // ////////////////////////////////////////////////////////////////////
00079   const double EmsrUtils::
00080   computeEmsrValue (double iCapacity,
00081                     stdair::VirtualClassStruct& ioVirtualClass){
00082     // Retrieve the average yield, mean and standard deviation of the
00083     // demand of the class/bucket.
00084     const stdair::MeanValue_T lMean = ioVirtualClass.getMean();
00085     const stdair::StdDevValue_T lSD = ioVirtualClass.getStdDev();
00086     const stdair::Yield_T lYield = ioVirtualClass.getYield();
00087
00088     // Compute the EMSR value = lYield * Pr (demand >= iCapacity).
00089     boost::math::normal lNormalDistribution (lMean, lSD);
00090     const double emsrValue =
00091       lYield * boost::math::cdf (boost::math::complement (lNormalDistribution,
00092                                                           iCapacity));
00093
00094     return emsrValue;
00095   }
00096 }
```

43.88 rmol/bom/EmsrUtils.hpp File Reference

```
#include <stdair/stdair_inventory_types.hpp>
```

Classes

- class RMOL::EmsrUtils

Namespaces

- namespace stdair
- namespace RMOL

43.89 EmsrUtils.hpp

```
00001 #ifndef __RMOL_EMSRUTILS_HPP
00002 #define __RMOL_EMSRUTILS_HPP
00003
00004 // ////////////////////////////////////////////////////////////////////
00005 // Import section
00006 // ////////////////////////////////////////////////////////////////////
00007 // StdAir
00008 #include <stdair/stdair_inventory_types.hpp>
00009
00010 // Forward declarations.
00011 namespace stdair {
00012   struct VirtualClassStruct;
00013 }
```

```
00014
00015 namespace RMOL {
00016
00019   class EmsrUtils {
00020   public:
00023     static void computeAggregatedVirtualClass (stdair::VirtualClassStruct&,
00024                                                stdair::VirtualClassStruct&);
00025
00027     static const stdair::ProtectionLevel_T computeProtectionLevel (stdair::Virtua
      lClassStruct&, stdair::VirtualClassStruct&);
00028
00030     static const double computeEmsrValue (double, stdair::VirtualClassStruct&);
00031   };
00032 }
00033 #endif // __RMOL_EMSRUTILS_HPP
```

43.90 rmol/bom/GuillotineBlockHelper.cpp File Reference

```
#include <cassert>
#include <stdair/basic/BasConst_Inventory.hpp>
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/SegmentDate.hpp>
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/bom/BookingClass.hpp>
#include <stdair/bom/GuillotineBlock.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/bom/GuillotineBlockHelper.hpp>
```

Namespaces

- namespace RMOL

43.91 GuillotineBlockHelper.cpp

```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 // StdAir
00007 #include <stdair/basic/BasConst_Inventory.hpp>
00008 #include <stdair/bom/BomManager.hpp>
00009 #include <stdair/bom/SegmentDate.hpp>
00010 #include <stdair/bom/SegmentCabin.hpp>
00011 #include <stdair/bom/BookingClass.hpp>
00012 #include <stdair/bom/GuillotineBlock.hpp>
00013 #include <stdair/service/Logger.hpp>
00014 // RMOL
00015 #include <rmol/bom/GuillotineBlockHelper.hpp>
```

```
00016
00017 namespace RMOL {
00018   // ////////////////////////////////////////////////////////////////////
00019   stdair::NbOfSegments_T GuillotineBlockHelper::
00020   getNbOfSegmentAlreadyPassedThisDTD (const stdair::GuillotineBlock& iGB,
00021                                       const stdair::DTD_T& iDTD,
00022                                       const stdair::Date_T& iCurrentDate) {
00023     stdair::NbOfSegments_T oNbOfSegments = 0;
00024
00025     // Browse the list of segments and check if it has passed the given DTD.
00026     const stdair::SegmentCabinIndexMap_T& lSCMap=iGB.getSegmentCabinIndexMap();
00027     for (stdair::SegmentCabinIndexMap_T::const_iterator itSC = lSCMap.begin();
00028          itSC != lSCMap.end(); ++itSC) {
00029       const stdair::SegmentCabin* lSC_ptr = itSC->first;
00030       assert (lSC_ptr != NULL);
00031
00032       if (hasPassedThisDTD (*lSC_ptr, iDTD, iCurrentDate) == true) {
00033         ++oNbOfSegments;
00034       }
00035     }
00036
00037     return oNbOfSegments;
00038   }
00039
00040   // ////////////////////////////////////////////////////////////////////
00041   bool GuillotineBlockHelper::
00042   hasPassedThisDTD (const stdair::SegmentCabin& iSegmentCabin,
00043                     const stdair::DTD_T& iDTD,
00044                     const stdair::Date_T& iCurrentDate) {
00045     // Retrieve the boarding date.
00046     const stdair::SegmentDate& lSegmentDate =
00047       stdair::BomManager::getParent<stdair::SegmentDate> (iSegmentCabin);
00048     const stdair::Date_T& lBoardingDate = lSegmentDate.getBoardingDate();
00049
00050     // Compare the date offset between the boarding date and the current date
00051     // to the DTD.
00052     stdair::DateOffset_T lDateOffset = lBoardingDate - iCurrentDate;
00053     stdair::DTD_T lDateOffsetInDays = lDateOffset.days();
00054     if (iDTD < lDateOffsetInDays) {
00055       return false;
00056     } else {
00057       return true;
00058     }
00059   }
00060 }
```

43.92 rmol/bom/GuillotineBlockHelper.hpp File Reference

```
#include <string>
#include <stdair/stdair_inventory_types.hpp>
#include <stdair/stdair_date_time_types.hpp>
```

Classes

- class RMOL::GuillotineBlockHelper

Namespaces

- namespace stdair
- namespace RMOL

43.93 GuillotineBlockHelper.hpp

```
00001 #ifndef __RMOL_BOM_GUILLOTINEBLOCKHELPER_HPP
00002 #define __RMOL_BOM_GUILLOTINEBLOCKHELPER_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <string>
00009 // StdAir
00010 #include <stdair/stdair_inventory_types.hpp>
00011 #include <stdair/stdair_date_time_types.hpp>
00012
00013 // Forward declarations
00014 namespace stdair {
00015   class GuillotineBlock;
00016   class SegmentCabin;
00017 }
00018
00019 namespace RMOL {
00020
00023   class GuillotineBlockHelper {
00024   public:
00025     // ********** Business Methods *********
00030     static stdair::NbOfSegments_T getNbOfSegmentAlreadyPassedThisDTD (const stdai
      r::GuillotineBlock&, const stdair::DTD_T&, const stdair::Date_T&);
00031
00035     static bool hasPassedThisDTD (const stdair::SegmentCabin&,
00036                                   const stdair::DTD_T&, const stdair::Date_T&);
00037   };
00038
00039 }
00040 #endif // __RMOL_BOM_GUILLOTINEBLOCKHELPER_HPP
```

43.94 rmol/bom/HistoricalBooking.cpp File Reference

```
#include <sstream>
#include <cassert>
#include <iomanip>
#include <iostream>
#include <rmol/bom/HistoricalBooking.hpp>
```

Namespaces

- namespace RMOL

43.95 HistoricalBooking.cpp

```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <sstream>
00006 #include <cassert>
00007 #include <iomanip>
00008 #include <iostream>
00009 // RMOL
00010 #include <rmol/bom/HistoricalBooking.hpp>
00011
00012 namespace RMOL {
00013
00014   // //////////////////////////////////////////////////////////////////
00015   HistoricalBooking::HistoricalBooking () :
00016     _numberOfBookings (0.0),_unconstrainedDemand (0.0), _flag (false) {
00017   }
00018
00019   // //////////////////////////////////////////////////////////////////
00020   HistoricalBooking::
00021   HistoricalBooking (const stdair::NbOfBookings_T iNbOfBookings,
00022                      const stdair::Flag_T iFlag)
00023     : _numberOfBookings (iNbOfBookings),
00024       _unconstrainedDemand (iNbOfBookings), _flag (iFlag) {
00025   }
00026
00027   // //////////////////////////////////////////////////////////////////
00028   HistoricalBooking::HistoricalBooking
00029   (const HistoricalBooking& iHistoricalBooking) :
00030     _numberOfBookings (iHistoricalBooking.getNbOfBookings()),
00031     _unconstrainedDemand (iHistoricalBooking.getUnconstrainedDemand()),
00032     _flag (iHistoricalBooking.getFlag()) {
00033   }
00034
00035   // //////////////////////////////////////////////////////////////////
00036   HistoricalBooking::~HistoricalBooking() {
00037   }
00038
00039   // //////////////////////////////////////////////////////////////////
00040   void HistoricalBooking::setParameters
00041   (const stdair::NbOfBookings_T iNbOfBookings, const stdair::Flag_T iFlag) {
00042     _numberOfBookings = iNbOfBookings;
00043     _unconstrainedDemand = iNbOfBookings;
00044     _flag = iFlag;
00045   }
00046
00047   // //////////////////////////////////////////////////////////////////
00048   const std::string HistoricalBooking::describe() const {
00049     std::ostringstream ostr;
00050     ostr << "Struct of hitorical booking, unconstrained demand and flag of "
00051          << "censorship for a FlightDate/Class.";
00052
00053     return ostr.str();
00054   }
00055
00056   // //////////////////////////////////////////////////////////////////
00057   void HistoricalBooking::toStream (std::ostream& ioOut) const {
00058     const stdair::NbOfBookings_T bj = getNbOfBookings();
00059     const stdair::NbOfBookings_T uj = getUnconstrainedDemand();
00060     const stdair::Flag_T fj = getFlag();
```

```
00061     ioOut << std::fixed << std::setprecision (2)
00062           << bj << "; " << uj << "; " << fj << std::endl;
00063   }
00064
00065   // ////////////////////////////////////////////////////////////////////
00066   void HistoricalBooking::display () const {
00067     toStream (std::cout);
00068   }
00069 }
```

43.96 rmol/bom/HistoricalBooking.hpp File Reference

```
#include <stdair/stdair_basic_types.hpp>
#include <stdair/basic/StructAbstract.hpp>
```

Classes

- struct RMOL::HistoricalBooking

  Structure keeping track, for a given class, of the number of historical bookings and of the censorship flag.

Namespaces

- namespace RMOL

43.97 HistoricalBooking.hpp

```
00001 #ifndef __RMOL_BOM_HISTORICALBOOKING_HPP
00002 #define __RMOL_BOM_HISTORICALBOOKING_HPP
00003
00004 // ////////////////////////////////////////////////////////////////////
00005 // Import section
00006 // ////////////////////////////////////////////////////////////////////
00007 // StdAir
00008 #include <stdair/stdair_basic_types.hpp>
00009 #include <stdair/basic/StructAbstract.hpp>
00010
00011 namespace RMOL {
00012
00017   struct HistoricalBooking : public stdair::StructAbstract {
00018
00019   public:
00020     // ////////////////// Getters ////////////////////////
00022     const stdair::NbOfBookings_T& getNbOfBookings() const {
00023       return _numberOfBookings;
00024     }
00026     const stdair::NbOfBookings_T& getUnconstrainedDemand() const {
00027       return _unconstrainedDemand;
00028     }
00031     const stdair::Flag_T& getFlag() const {
00032       return _flag;
00033     }
00034
```

```
00035   public:
00036     // ////////////////////// Setters //////////////////////
00038     void setUnconstrainedDemand (const stdair::NbOfBookings_T& iDemand) {
00039       _unconstrainedDemand = iDemand;
00040     }
00041
00043     void setParameters (const stdair::NbOfBookings_T, const stdair::Flag_T);
00044
00045   public:
00046     // ///////// Display Methods //////////
00052     void toStream (std::ostream& ioOut) const;
00053
00057     const std::string describe() const;
00058
00062     void display () const;
00063
00064   public:
00065     // ////////////// Constructors and destructor. /////////////
00069     HistoricalBooking (const stdair::NbOfBookings_T, const stdair::Flag_T);
00073     HistoricalBooking();
00077     HistoricalBooking (const HistoricalBooking&);
00078
00082     virtual ~HistoricalBooking();
00083
00084   private:
00085     // ////////////// Attributes /////////////
00089     stdair::NbOfBookings_T _numberOfBookings;
00090
00094     stdair::NbOfBookings_T _unconstrainedDemand;
00095
00099     stdair::Flag_T _flag;
00100   };
00101 }
00102 #endif // __RMOL_BOM_HISTORICALBOOKING_HPP
```

43.98 rmol/bom/HistoricalBookingHolder.cpp File Reference

```
#include <sstream>
#include <iostream>
#include <iomanip>
#include <cmath>
#include <cassert>
#include <stdair/service/Logger.hpp>
#include <rmol/bom/HistoricalBooking.hpp>
#include <rmol/bom/HistoricalBookingHolder.hpp>
```

Namespaces

- namespace RMOL

43.99 HistoricalBookingHolder.cpp

```
00001 // //////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <sstream>
00006 #include <iostream>
00007 #include <iomanip>
00008 #include <cmath>
00009 #include <cassert>
00010 // StdAir
00011 #include <stdair/service/Logger.hpp>
00012 // RMOL
00013 #include <rmol/bom/HistoricalBooking.hpp>
00014 #include <rmol/bom/HistoricalBookingHolder.hpp>
00015
00016 namespace RMOL {
00017
00018   // //////////////////////////////////////////////////////////////////////
00019   HistoricalBookingHolder::HistoricalBookingHolder () {
00020   }
00021
00022   // //////////////////////////////////////////////////////////////////////
00023   HistoricalBookingHolder::~HistoricalBookingHolder () {
00024     _historicalBookingVector.clear();
00025   }
00026
00027   // //////////////////////////////////////////////////////////////////////
00028   const short HistoricalBookingHolder::getNbOfFlights () const {
00029     return _historicalBookingVector.size();
00030   }
00031
00032   // //////////////////////////////////////////////////////////////////////
00033   const short HistoricalBookingHolder::getNbOfUncensoredData () const {
00034     short lResult = 0;
00035     const short lSize = _historicalBookingVector.size();
00036
00037     for (short ite = 0; ite < lSize; ++ite) {
00038       const stdair::Flag_T lFlag = _historicalBookingVector.at(ite).getFlag ();
00039       if (lFlag == false) {
00040         ++ lResult;
00041       }
00042     }
00043
00044     return lResult;
00045   }
00046
00047   // //////////////////////////////////////////////////////////////////////
00048   const stdair::NbOfBookings_T HistoricalBookingHolder::
00049   getNbOfUncensoredBookings () const {
00050     stdair::NbOfBookings_T lResult = 0;
00051     const short lSize = _historicalBookingVector.size();
00052
00053     for (short ite = 0; ite < lSize; ++ite) {
00054       const HistoricalBooking& lHistorialBooking =
00055         _historicalBookingVector.at (ite);
00056       const stdair::Flag_T lFlag = lHistorialBooking.getFlag ();
00057       if (lFlag == false) {
00058         const stdair::NbOfBookings_T& lBooking =
00059           lHistorialBooking.getNbOfBookings ();
00060         lResult += lBooking;
```

```
00061       }
00062     }
00063
00064     return lResult;
00065   }
00066
00067   // ////////////////////////////////////////////////////////////////////
00068   const double HistoricalBookingHolder::
00069   getUncensoredStandardDeviation (const double& iMeanOfUncensoredBookings,
00070                                   const short iNbOfUncensoredData) const {
00071
00072     double lResult = 0;
00073     const short lSize = _historicalBookingVector.size();
00074
00075     for (short ite = 0; ite < lSize; ++ite) {
00076       const stdair::Flag_T lFlag = _historicalBookingVector.at(ite).getFlag ();
00077       if (lFlag == false) {
00078         const HistoricalBooking& lHistorialBooking =
00079           _historicalBookingVector.at (ite);
00080
00081         const stdair::NbOfBookings_T& lBooking =
00082           lHistorialBooking.getNbOfBookings ();
00083
00084         lResult += (lBooking - iMeanOfUncensoredBookings)
00085           * (lBooking - iMeanOfUncensoredBookings);
00086       }
00087     }
00088     lResult /= (iNbOfUncensoredData - 1);
00089     lResult = sqrt (lResult);
00090
00091     return lResult;
00092   }
00093
00094   // ////////////////////////////////////////////////////////////////////
00095   const double HistoricalBookingHolder::getDemandMean () const {
00096     double lResult = 0;
00097     const short lSize = _historicalBookingVector.size();
00098
00099     for (short ite = 0; ite < lSize; ++ite) {
00100       const HistoricalBooking& lHistorialBooking =
00101         _historicalBookingVector.at(ite);
00102
00103       const stdair::NbOfBookings_T& lDemand =
00104         lHistorialBooking.getUnconstrainedDemand ();
00105
00106       lResult += static_cast<double>(lDemand);
00107     }
00108
00109     lResult /= lSize;
00110
00111     return lResult;
00112   }
00113
00114   // ////////////////////////////////////////////////////////////////////
00115   const double HistoricalBookingHolder::getStandardDeviation
00116   (const double iDemandMean) const {
00117     double lResult = 0;
00118     const short lSize = _historicalBookingVector.size();
00119
00120     for (short ite = 0; ite < lSize; ++ite) {
00121       const HistoricalBooking& lHistorialBooking =
00122         _historicalBookingVector.at(ite);
```

```
00123
00124       const stdair::NbOfBookings_T& lDemand =
00125         lHistorialBooking.getUnconstrainedDemand ();
00126
00127       const double lDoubleDemand = static_cast<double> (lDemand);
00128       lResult += (lDoubleDemand - iDemandMean) * (lDoubleDemand - iDemandMean);
00129     }
00130
00131     lResult /= (lSize - 1);
00132
00133     lResult = sqrt (lResult);
00134
00135     return lResult;
00136   }
00137
00138   // ////////////////////////////////////////////////////////////////////
00139   const std::vector<bool> HistoricalBookingHolder::
00140   getListOfToBeUnconstrainedFlags () const {
00141     std::vector<bool> lResult;
00142     const short lSize = _historicalBookingVector.size();
00143
00144     for (short ite = 0; ite < lSize; ++ite) {
00145       const HistoricalBooking& lHistorialBooking =
00146         _historicalBookingVector.at(ite);
00147       const stdair::Flag_T lFlag = lHistorialBooking.getFlag ();
00148       if (lFlag == true) {
00149         lResult.push_back(true);
00150       }
00151       else {
00152         lResult.push_back(false);
00153       }
00154     }
00155
00156     return lResult;
00157   }
00158
00159   // ////////////////////////////////////////////////////////////////////
00160   const stdair::NbOfBookings_T& HistoricalBookingHolder::
00161   getHistoricalBooking (const short i) const {
00162     const HistoricalBooking& lHistorialBooking =
00163       _historicalBookingVector.at(i);
00164     return lHistorialBooking.getNbOfBookings();
00165   }
00166
00167   // ////////////////////////////////////////////////////////////////////
00168   const stdair::NbOfBookings_T& HistoricalBookingHolder::
00169   getUnconstrainedDemand (const short i) const {
00170     const HistoricalBooking& lHistorialBooking =
00171       _historicalBookingVector.at(i);
00172     return lHistorialBooking.getUnconstrainedDemand();
00173   }
00174
00175   // ////////////////////////////////////////////////////////////////////
00176   const stdair::Flag_T& HistoricalBookingHolder::
00177   getCensorshipFlag (const short i) const {
00178     const HistoricalBooking& lHistorialBooking =
00179       _historicalBookingVector.at(i);
00180     return lHistorialBooking.getFlag();
00181   }
00182
00183   // ////////////////////////////////////////////////////////////////////
00184   void HistoricalBookingHolder::setUnconstrainedDemand
```

```
00185   (const stdair::NbOfBookings_T& iExpectedDemand, const short i) {
00186     _historicalBookingVector.at(i).setUnconstrainedDemand(iExpectedDemand);
00187   }
00188
00189   // ////////////////////////////////////////////////////////////////////
00190   const stdair::NbOfBookings_T HistoricalBookingHolder::calculateExpectedDemand
00191   (const double iMean, const double iSD,
00192    const short i, const stdair::NbOfBookings_T iDemand) const {
00193
00194     const HistoricalBooking lHistorialBooking =
00195       _historicalBookingVector.at(i);
00196     const double lBooking =
00197       static_cast <double> (lHistorialBooking.getNbOfBookings());
00198     double e, d1, d2;
00199
00200     e = - (lBooking - iMean) * (lBooking - iMean) * 0.625 / (iSD * iSD);
00201     //STDAIR_LOG_DEBUG ("e: " << e);
00202     e = exp (e);
00203     //STDAIR_LOG_DEBUG ("e: " << e);
00204
00205     double s = sqrt (1 - e);
00206     //STDAIR_LOG_DEBUG ("s: " << s);
00207
00208     if (lBooking >= iMean) {
00209       if (e < 0.01) {
00210         return iDemand;
00211       }
00212       d1 = 0.5 * (1 - s);
00213     }
00214     else {
00215       d1 = 0.5 * (1 + s);
00216     }
00217     //STDAIR_LOG_DEBUG ("d1: " << d1);
00218
00219     e = - (lBooking - iMean) * (lBooking - iMean) * 0.5 / (iSD * iSD);
00220     e = exp (e);
00221     d2 = e * iSD / sqrt(2 * 3.14159265);
00222     //STDAIR_LOG_DEBUG ("d2: " << d2);
00223
00224     if (d1 == 0) {
00225       return iDemand;
00226     }
00227
00228     const stdair::NbOfBookings_T lDemand =
00229       static_cast<stdair::NbOfBookings_T> (iMean + d2/d1);
00230
00231     return lDemand;
00232   }
00233
00234   // ////////////////////////////////////////////////////////////////////
00235   void HistoricalBookingHolder::addHistoricalBooking
00236   (const HistoricalBooking& iHistoricalBooking) {
00237     _historicalBookingVector.push_back(iHistoricalBooking);
00238   }
00239
00240   // ////////////////////////////////////////////////////////////////////
00241   void HistoricalBookingHolder::toStream (std::ostream& ioOut) const {
00242     const short lSize = _historicalBookingVector.size();
00243
00244     ioOut << "Historical Booking; Unconstrained Demand; Flag" << std::endl;
00245
00246     for (short ite = 0; ite < lSize; ++ite) {
```

```
00247       const HistoricalBooking& lHistorialBooking =
00248         _historicalBookingVector.at(ite);
00249
00250       const stdair::NbOfBookings_T& lBooking =
00251         lHistorialBooking.getNbOfBookings();
00252
00253       const stdair::NbOfBookings_T& lDemand =
00254         lHistorialBooking.getUnconstrainedDemand();
00255
00256       const stdair::Flag_T lFlag = lHistorialBooking.getFlag();
00257
00258       ioOut << lBooking << "    "
00259             << lDemand << "    "
00260             << lFlag << std::endl;
00261     }
00262   }
00263
00264   // ////////////////////////////////////////////////////////////////////
00265   const std::string HistoricalBookingHolder::describe() const {
00266     std::ostringstream ostr;
00267     ostr << "Holder of HistoricalBooking structs.";
00268
00269     return ostr.str();
00270   }
00271
00272   // ////////////////////////////////////////////////////////////////////
00273   void HistoricalBookingHolder::display() const {
00274     toStream (std::cout);
00275   }
00276 }
```

43.100 rmol/bom/HistoricalBookingHolder.hpp File Reference

```
#include <iostream>
#include <vector>
#include <stdair/stdair_basic_types.hpp>
#include <stdair/basic/StructAbstract.hpp>
```

Classes

- struct RMOL::HistoricalBookingHolder

Namespaces

- namespace RMOL

Typedefs

- typedef std::vector< HistoricalBooking > RMOL::HistoricalBookingVector_T

43.101 HistoricalBookingHolder.hpp

```
00001 #ifndef __RMOL_BOM_HISTORICALBOOKINGHOLDER_HPP
00002 #define __RMOL_BOM_HISTORICALBOOKINGHOLDER_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <iostream>
00009 #include <vector>
00010 // StdAir
00011 #include <stdair/stdair_basic_types.hpp>
00012 #include <stdair/basic/StructAbstract.hpp>
00013
00014 namespace RMOL {
00016   struct HistoricalBooking;
00017
00019   typedef std::vector<HistoricalBooking> HistoricalBookingVector_T;
00020
00023   struct HistoricalBookingHolder : public stdair::StructAbstract {
00024
00025   public:
00026     // ////// Getters //////
00028     const short getNbOfFlights () const;
00029
00031     const short getNbOfUncensoredData () const;
00032
00034     const stdair::NbOfBookings_T getNbOfUncensoredBookings () const;
00035
00037     const double getUncensoredStandardDeviation
00038     (const double& iMeanOfUncensoredBookings,
00039      const short iNbOfUncensoredData) const;
00040
00042     const double getDemandMean () const;
00043
00045     const double getStandardDeviation (const double) const;
00046
00048     const std::vector<bool> getListOfToBeUnconstrainedFlags() const;
00049
00051     const stdair::NbOfBookings_T& getHistoricalBooking (const short i) const;
00052
00054     const stdair::NbOfBookings_T& getUnconstrainedDemand (const short i) const;
00055
00057     const stdair::Flag_T& getCensorshipFlag (const short i) const;
00058
00060     const stdair::NbOfBookings_T& getUnconstrainedDemandOnFirstElement() const {
00061       return getUnconstrainedDemand (0);
00062     }
00063
00065     const stdair::NbOfBookings_T calculateExpectedDemand (const double,
00066                                                           const double,
00067                                                           const short,
00068                                                 const stdair::NbOfBookings_T) const;
00069
00071     void setUnconstrainedDemand (const stdair::NbOfBookings_T& iExpectedDemand,
00072                                  const short i);
00073
00075     void addHistoricalBooking (const HistoricalBooking& iHistoricalBooking);
00076
00080     void toStream (std::ostream& ioOut) const;
00081
```

```
00082     // ********* Display Methods **********
00084     const std::string describe() const;
00085
00087     void display () const;
00088
00090     virtual ~HistoricalBookingHolder();
00091
00092   public:
00095     HistoricalBookingHolder ();
00096
00097   private:
00099     HistoricalBookingVector_T _historicalBookingVector;
00100
00101   protected:
00102   };
00103 }
00104 #endif // __RMOL_BOM_HISTORICALBOOKINGHOLDER_HPP
00105
```

43.102 rmol/bom/MCOptimiser.cpp File Reference

```
#include <cassert>
#include <string>
#include <sstream>
#include <algorithm>
#include <cmath>
#include <stdair/stdair_basic_types.hpp>
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/LegCabin.hpp>
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/bom/BookingClass.hpp>
#include <stdair/bom/VirtualClassStruct.hpp>
#include <stdair/service/Logger.hpp>
#include <stdair/basic/RandomGeneration.hpp>
#include <stdair/basic/BasConst_General.hpp>
#include <rmol/bom/MCOptimiser.hpp>
```

Namespaces

- namespace RMOL

43.103 MCOptimiser.cpp

```
00001 // ////////////////////////////////////////////////////////////////////
```

```
00002 // Import section
00003 // ////////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 #include <string>
00007 #include <sstream>
00008 #include <algorithm>
00009 #include <cmath>
00010 // StdAir
00011 #include <stdair/stdair_basic_types.hpp>
00012 #include <stdair/bom/BomManager.hpp>
00013 #include <stdair/bom/LegCabin.hpp>
00014 #include <stdair/bom/SegmentCabin.hpp>
00015 #include <stdair/bom/BookingClass.hpp>
00016 #include <stdair/bom/VirtualClassStruct.hpp>
00017 #include <stdair/service/Logger.hpp>
00018
00019 #include <stdair/basic/RandomGeneration.hpp>
00020 #include <stdair/basic/BasConst_General.hpp>
00021 // RMOL
00022 #include <rmol/bom/MCOptimiser.hpp>
00023
00024 namespace RMOL {
00025
00026   // // ////////////////////////////////////////////////////////////////////
00027   void MCOptimiser::
00028   optimalOptimisationByMCIntegration (stdair::LegCabin& ioLegCabin) {
00029     // Retrieve the segment-cabin
00030     const stdair::SegmentCabinList_T lSegmentCabinList =
00031       stdair::BomManager::getList<stdair::SegmentCabin> (ioLegCabin);
00032     stdair::SegmentCabinList_T::const_iterator itSC = lSegmentCabinList.begin();
00033     assert (itSC != lSegmentCabinList.end());
00034     const stdair::SegmentCabin* lSegmentCabin_ptr = *itSC;
00035     assert (lSegmentCabin_ptr != NULL);
00036
00037     // Retrieve the class list.
00038     const stdair::BookingClassList_T lBookingClassList =
00039       stdair::BomManager::getList<stdair::BookingClass> (*lSegmentCabin_ptr);
00040
00041     // Retrieve the remaining cabin capacity.
00042     const stdair::Availability_T& lCap = ioLegCabin.getAvailabilityPool();
00043     const int lCapacity = static_cast<const int> (lCap);
00044     const stdair::UnsignedIndex_T lCapacityIndex =
00045       static_cast<const stdair::UnsignedIndex_T> ((lCapacity+abs(lCapacity))/2);
00046
00047     // Retrieve the virtual class list.
00048     stdair::VirtualClassList_T& lVCList = ioLegCabin.getVirtualClassList();
00049
00050     // Parse the virtual class list and compute the protection levels.
00051     stdair::VirtualClassList_T::iterator itCurrentVC = lVCList.begin();
00052     assert (itCurrentVC != lVCList.end());
00053     stdair::VirtualClassList_T::iterator itNextVC = itCurrentVC; ++itNextVC;
00054
00055     // Initialise  the partial sum holder with the demand sample of the first
00056     // virtual class.
00057     stdair::VirtualClassStruct& lFirstVC = *itCurrentVC;
00058     stdair::GeneratedDemandVector_T lPartialSumHolder =
00059       lFirstVC.getGeneratedDemandVector();
00060
00061     // Initialise the booking limit for the first class, which is equal to
00062     // the remaining capacity.
00063     lFirstVC.setCumulatedBookingLimit (lCap);
```

```
00064
00065     // Initialise bid price vector with the first element (index 0) equal to
00066     // the highest yield.
00067     ioLegCabin.emptyBidPriceVector();
00068     stdair::BidPriceVector_T& lBPV = ioLegCabin.getBidPriceVector();
00069     //const stdair::Yield_T& y1 = lFirstVC.getYield ();
00070     //lBPV.push_back (y1);
00071     stdair::UnsignedIndex_T idx = 1;
00072
00073     for (; itNextVC != lVCList.end(); ++itCurrentVC, ++itNextVC) {
00074       // Get the yields of the two classes.
00075       stdair::VirtualClassStruct& lCurrentVC = *itCurrentVC;
00076       stdair::VirtualClassStruct& lNextVC = *itNextVC;
00077       const stdair::Yield_T& yj = lCurrentVC.getYield ();
00078       const stdair::Yield_T& yj1 = lNextVC.getYield ();
00079
00080       // Consistency check: the yield/price of a higher class/bucket
00081       // (with the j index lower) must be higher.
00082       assert (yj > yj1);
00083
00084       // Sort the partial sum holder.
00085       std::sort (lPartialSumHolder.begin(), lPartialSumHolder.end());
00086       const stdair::UnsignedIndex_T K = lPartialSumHolder.size ();
00087
00088       // Compute the optimal index lj = floor {[y(j)-y(j+1)]/y(j) . K}
00089       const double ljdouble = std::floor (K * (yj - yj1) / yj);
00090       stdair::UnsignedIndex_T lj =
00091         static_cast<stdair::UnsignedIndex_T> (ljdouble);
00092
00093       // Consistency check.
00094       assert (lj >= 1 && lj < K);
00095
00096       //  The optimal protection: p(j) = 1/2 [S(j,lj) + S(j, lj+1)]
00097       const double sjl = lPartialSumHolder.at (lj - 1);
00098       const double sjlp1 = lPartialSumHolder.at (lj + 1 - 1);
00099       const double pj = (sjl + sjlp1) / 2;
00100
00101       // Set the cumulated protection level for the current class.
00102       lCurrentVC.setCumulatedProtection (pj);
00103       // Set the cumulated booking limit for the next class.
00104       lNextVC.setCumulatedBookingLimit (lCap - pj);
00105
00110       const stdair::UnsignedIndex_T pjint = static_cast<const int> (pj);
00111       stdair::GeneratedDemandVector_T::iterator itLowerBound =
00112         lPartialSumHolder.begin();
00113       for (; idx <= pjint && idx <= lCapacityIndex; ++idx) {
00114         itLowerBound =
00115           std::lower_bound (itLowerBound, lPartialSumHolder.end(), idx);
00116         const stdair::UnsignedIndex_T pos =
00117           itLowerBound - lPartialSumHolder.begin();
00118
00119         const stdair::BidPrice_T lBP = yj * (K - pos) / K;
00120         lBPV.push_back (lBP);
00121       }
00122
00123       // Update the partial sum holder.
00124       const stdair::GeneratedDemandVector_T& lNextPSH =
00125         lNextVC.getGeneratedDemandVector();
00126       assert (K <= lNextPSH.size());
00127       for (stdair::UnsignedIndex_T i = 0; i < K - lj; ++i) {
00128         lPartialSumHolder.at(i) = lPartialSumHolder.at(i + lj) + lNextPSH.at(i);
00129       }
```

```
00130       lPartialSumHolder.resize (K - lj);
00131     }
00132
00137     stdair::VirtualClassStruct& lLastVC = *itCurrentVC;
00138     const stdair::Yield_T& yn = lLastVC.getYield();
00139     stdair::GeneratedDemandVector_T::iterator itLowerBound =
00140       lPartialSumHolder.begin();
00141     for (; idx <= lCapacityIndex; ++idx) {
00142       itLowerBound =
00143         std::lower_bound (itLowerBound, lPartialSumHolder.end(), idx);
00144       const stdair::UnsignedIndex_T pos =
00145         itLowerBound - lPartialSumHolder.begin();
00146       const stdair::UnsignedIndex_T K = lPartialSumHolder.size();
00147       const stdair::BidPrice_T lBP = yn * (K - pos) / K;
00148       lBPV.push_back (lBP);
00149     }
00150   }
00151
00152   // ////////////////////////////////////////////////////////////////////
00153   stdair::GeneratedDemandVector_T MCOptimiser::
00154   generateDemandVector (const stdair::MeanValue_T& iMean,
00155                         const stdair::StdDevValue_T& iStdDev,
00156                         const unsigned int& K) {
00157     stdair::GeneratedDemandVector_T oDemandVector;
00158     if (iStdDev > 0) {
00159       stdair::RandomGeneration lGenerator (stdair::DEFAULT_RANDOM_SEED);
00160       for (unsigned int i = 0; i < K; ++i) {
00161         stdair::RealNumber_T lDemandSample =
00162           lGenerator.generateNormal (iMean, iStdDev);
00163         oDemandVector.push_back (lDemandSample);
00164       }
00165     } else {
00166       for (unsigned int i = 0; i < K; ++i) {
00167         oDemandVector.push_back (iMean);
00168       }
00169     }
00170     return oDemandVector;
00171   }
00172
00173   // ////////////////////////////////////////////////////////////////////
00174   void MCOptimiser::
00175   optimisationByMCIntegration (stdair::LegCabin& ioLegCabin) {
00176     // Number of MC samples
00177     unsigned int K = 100000;
00178
00179     const stdair::YieldLevelDemandMap_T& lYieldDemandMap =
00180       ioLegCabin.getYieldLevelDemandMap();
00181     assert (!lYieldDemandMap.empty());
00182
00183     std::ostringstream oStr;
00184     oStr << "Yield list ";
00185     for (stdair::YieldLevelDemandMap_T::const_iterator itYD =
00186            lYieldDemandMap.begin();
00187          itYD != lYieldDemandMap.end(); ++itYD) {
00188       const stdair::Yield_T& y = itYD->first;
00189       oStr << y << " ";
00190     }
00191
00192     STDAIR_LOG_DEBUG (oStr.str());
00193     ioLegCabin.emptyBidPriceVector();
00194     stdair::BidPriceVector_T& lBidPriceVector =
00195       ioLegCabin.getBidPriceVector();
```

```
00196     const stdair::Availability_T& lAvailabilityPool =
00197       ioLegCabin.getAvailabilityPool();
00198     // Initialise the minimal bid price to 1.0 (just to avoid problems
00199     // of division by zero).
00200     const stdair::BidPrice_T& lMinBP = 1.0;
00201
00202     stdair::YieldLevelDemandMap_T::const_reverse_iterator itCurrentYD =
00203       lYieldDemandMap.rbegin();
00204     stdair::YieldLevelDemandMap_T::const_reverse_iterator itNextYD = itCurrentYD;

00205     ++itNextYD;
00206
00207     // Initialise the partial sum holder
00208     stdair::MeanStdDevPair_T lMeanStdDevPair = itCurrentYD->second;
00209     stdair::GeneratedDemandVector_T lPartialSumHolder =
00210       generateDemandVector(lMeanStdDevPair.first, lMeanStdDevPair.second, K);
00211
00212     stdair::UnsignedIndex_T idx = 1;
00213     for (; itNextYD!=lYieldDemandMap.rend(); ++itCurrentYD, ++itNextYD) {
00214       const stdair::Yield_T& yj = itCurrentYD->first;
00215       const stdair::Yield_T& yj1 = itNextYD->first;
00216       // Consistency check: the yield/price of a higher class/bucket
00217       // (with the j index lower) must be higher.
00218       assert (yj > yj1);
00219       // Sort the partial sum holder.
00220       std::sort (lPartialSumHolder.begin(), lPartialSumHolder.end());
00221       // STDAIR_LOG_DEBUG ("Partial sums : max = " << lPartialSumHolder.back()
00222       //                   << " min = " << lPartialSumHolder.front());
00223       K = lPartialSumHolder.size ();
00224       // Compute the optimal index lj = floor {[y(j)-y(j+1)]/y(j) . K}
00225       const double ljdouble = std::floor (K * (yj - yj1) / yj);
00226       stdair::UnsignedIndex_T lj =
00227         static_cast<stdair::UnsignedIndex_T> (ljdouble);
00228       // Consistency check.
00229       assert (lj >= 1 && lj < K);
00230       //  The optimal protection: p(j) = 1/2 [S(j,lj) + S(j, lj+1)]
00231       const double sjl = lPartialSumHolder.at (lj - 1);
00232       const double sjlp1 = lPartialSumHolder.at (lj + 1 - 1);
00233       const double pj = (sjl + sjlp1) / 2;
00238       const stdair::UnsignedIndex_T pjint = static_cast<const int> (pj);
00239       stdair::GeneratedDemandVector_T::iterator itLowerBound =
00240         lPartialSumHolder.begin();
00241       for (; idx <= pjint && idx <= lAvailabilityPool; ++idx) {
00242         itLowerBound =
00243           std::lower_bound (itLowerBound, lPartialSumHolder.end(), idx);
00244         const stdair::UnsignedIndex_T pos =
00245           itLowerBound - lPartialSumHolder.begin();
00246
00247         const stdair::BidPrice_T lBP = yj * (K - pos) / K;
00248         lBidPriceVector.push_back (lBP);
00249       }
00250       // Update the partial sum holder.
00251       lMeanStdDevPair = itNextYD->second;
00252       const stdair::GeneratedDemandVector_T& lNextDV =
00253         generateDemandVector (lMeanStdDevPair.first,
00254                               lMeanStdDevPair.second, K - lj);
00255       for (stdair::UnsignedIndex_T i = 0; i < K - lj; ++i) {
00256         lPartialSumHolder.at(i) = lPartialSumHolder.at(i + lj) + lNextDV.at(i);
00257       }
00258       lPartialSumHolder.resize (K - lj);
00259     }
00268     // STDAIR_LOG_DEBUG ("Partial sums : max = " << lPartialSumHolder.back()
```

```
00269     //                   << " min = " << lPartialSumHolder.front());
00270
00271     std::sort (lPartialSumHolder.begin(), lPartialSumHolder.end());
00272     const stdair::Yield_T& yn = itCurrentYD->first;
00273     stdair::GeneratedDemandVector_T::iterator itLowerBound =
00274       lPartialSumHolder.begin();
00275     K = lPartialSumHolder.size();
00276
00277     bool lMinBPReached = false;
00278     for (; idx <= lAvailabilityPool; ++idx) {
00279       itLowerBound =
00280         std::lower_bound (itLowerBound, lPartialSumHolder.end(), idx);
00281
00282       if (!lMinBPReached) {
00283         const stdair::UnsignedIndex_T pos =
00284           itLowerBound - lPartialSumHolder.begin();
00285         stdair::BidPrice_T lBP = yn * (K - pos) / K;
00286
00287         if (lBP < lMinBP) {
00288           lBP = lMinBP; lMinBPReached = true;
00289         }
00290
00291         lBidPriceVector.push_back (lBP);
00292
00293       } else {
00294         lBidPriceVector.push_back (lMinBP);
00295       }
00296
00297     }
00298
00299     // Updating the bid price values
00300     ioLegCabin.updatePreviousBidPrice();
00301     ioLegCabin.setCurrentBidPrice (lBidPriceVector.back());
00302
00303     // Compute and display the bid price variation after optimisation
00304     const stdair::BidPrice_T lPreviousBP = ioLegCabin.getPreviousBidPrice();
00305     stdair::BidPrice_T lNewBP = ioLegCabin.getCurrentBidPrice();
00306     // Check
00307     assert (lPreviousBP != 0);
00308     stdair::BidPrice_T lBidPriceDelta = lNewBP - lPreviousBP;
00309
00310     double lBidPriceVariation = 100*lBidPriceDelta/lPreviousBP;
00311
00312     STDAIR_LOG_DEBUG ("Bid price: previous value " << lPreviousBP
00313                       << ", new value " << lNewBP
00314                       << ", variation " << lBidPriceVariation << " %"
00315                       <<", BPV size " << lBidPriceVector.size());
00316   }
00317
00318 }
```

43.104 rmol/bom/MCOptimiser.hpp File Reference

```
#include <rmol/RMOL_Types.hpp>
#include <stdair/stdair_maths_types.hpp>
#include <stdair/stdair_rm_types.hpp>
```

Classes

- class RMOL::MCOptimiser

Namespaces

- namespace stdair
- namespace RMOL

43.105 MCOptimiser.hpp

```
00001 #ifndef __RMOL_BOM_MCUTILS_HPP
00002 #define __RMOL_BOM_MCUTILS_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // RMOL
00008 #include <rmol/RMOL_Types.hpp>
00009 #include <stdair/stdair_maths_types.hpp>
00010 #include <stdair/stdair_rm_types.hpp>
00011
00012 // Forward declarations.
00013 namespace stdair {
00014   class LegCabin;
00015 }
00016
00017 namespace RMOL {
00019   class MCOptimiser {
00020   public:
00021
00030     static void optimalOptimisationByMCIntegration (stdair::LegCabin&);
00031
00035     static stdair::GeneratedDemandVector_T
00036     generateDemandVector (const stdair::MeanValue_T&,
00037                           const stdair::StdDevValue_T&, const unsigned int&);
00038
00039     static void optimisationByMCIntegration (stdair::LegCabin&);
00040
00041   };
00042 }
00043 #endif // __RMOL_BOM_MCUTILS_HPP
```

43.106 rmol/bom/old/DemandGeneratorList.cpp File Reference

```
#include <rmol/bom/DemandGeneratorList.hpp>
```

Namespaces

- namespace RMOL

43.107 DemandGeneratorList.cpp

```
00001 // ////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // ////////////////////////////////////////////////////////////////////
00004 // RMOL
00005 #include <rmol/bom/DemandGeneratorList.hpp>
00006
00007 namespace RMOL {
00008
00009   // ////////////////////////////////////////////////////////////////////
00010   DemandGeneratorList::DemandGeneratorList () {
00011     const DistributionParameterList_T aDistributionParameterList;
00012     init (aDistributionParameterList);
00013   }
00014
00015   // ////////////////////////////////////////////////////////////////////
00016   DemandGeneratorList::
00017   DemandGeneratorList (const DemandGeneratorList& iDemandGeneratorList) {
00018     // TODO: copy the distribution parameters of the input generator list
00019     const DistributionParameterList_T aDistributionParameterList;
00020     init (aDistributionParameterList);
00021   }
00022
00023   // ////////////////////////////////////////////////////////////////////
00024   DemandGeneratorList::
00025   DemandGeneratorList (const DistributionParameterList_T& iDistributionParameterL
      ist) {
00026     init (iDistributionParameterList);
00027   }
00028
00029   // ////////////////////////////////////////////////////////////////////
00030   DemandGeneratorList::~DemandGeneratorList () {
00031   }
00032
00033   // ////////////////////////////////////////////////////////////////////
00034   void DemandGeneratorList::
00035   init (const DistributionParameterList_T& iDistributionParameterList) {
00036
00037     DistributionParameterList_T::const_iterator itParams =
00038       iDistributionParameterList.begin();
00039     for ( ; itParams != iDistributionParameterList.end(); itParams++) {
00040       const FldDistributionParameters& aParams = *itParams;
00041
00042       const Gaussian gaussianGenerator (aParams);
00043
00044       _demandGeneratorList.push_back (gaussianGenerator);
00045     }
00046   }
00047
00048   // ////////////////////////////////////////////////////////////////////
00049   void DemandGeneratorList::
00050   generateVariateList (VariateList_T& ioVariateList) const {
00051
00052     // Iterate on the (number of) classes/buckets, n
00053     DemandGeneratorList_T::const_iterator itGenerator =
00054       _demandGeneratorList.begin();
00055     for ( ; itGenerator != _demandGeneratorList.end(); itGenerator++) {
00056       const Gaussian& gaussianGenerator = *itGenerator;
00057
00058       // Generate a random variate following the Gaussian distribution
00059       const double generatedVariate = gaussianGenerator.generateVariate ();
```

```
00060       ioVariateList.push_back (generatedVariate);
00061     }
00062   }
00063
00064 }
```

43.108 rmol/bom/old/DemandGeneratorList.hpp File Reference

```
#include <list>
#include <rmol/bom/VariateList.hpp>
#include <rmol/bom/DistributionParameterList.hpp>
#include <rmol/bom/Gaussian.hpp>
```

Classes

- class RMOL::DemandGeneratorList

Namespaces

- namespace RMOL

43.109 DemandGeneratorList.hpp

```
00001 #ifndef __RMOL_DEMANDGENERATORLIST_HPP
00002 #define __RMOL_DEMANDGENERATORLIST_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <list>
00009 // RMOL
00010 #include <rmol/bom/VariateList.hpp>
00011 #include <rmol/bom/DistributionParameterList.hpp>
00012 #include <rmol/bom/Gaussian.hpp>
00013
00014 namespace RMOL {
00015
00017   class DemandGeneratorList {
00018   protected:
00020     typedef std::list<Gaussian> DemandGeneratorList_T;
00021
00022   public:
00024     DemandGeneratorList ();
00025     DemandGeneratorList (const DemandGeneratorList&);
00027     DemandGeneratorList (const DistributionParameterList_T&);
00028
00030     virtual ~DemandGeneratorList();
00031
00033     void generateVariateList (VariateList_T&) const;
00034
00035   private:
```

```
00036     DemandGeneratorList_T _demandGeneratorList;
00037
00039     void init (const DistributionParameterList_T&);
00040
00041   };
00042 }
00043 #endif // __RMOL_DEMANDGENERATORLIST_HPP
```

43.110 rmol/bom/Utilities.cpp File Reference

```
#include <cassert>
#include <string>
#include <numeric>
#include <algorithm>
#include <cmath>
#include <stdair/basic/BasConst_Inventory.hpp>
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/basic/BasConst_General.hpp>
#include <rmol/bom/Utilities.hpp>
#include <rmol/bom/GuillotineBlockHelper.hpp>
```

Namespaces

- namespace RMOL

43.111 Utilities.cpp

```
00001
00002 // //////////////////////////////////////////////////////////////////
00003 // Import section
00004 // //////////////////////////////////////////////////////////////////
00005 // STL
00006 #include <cassert>
00007 #include <string>
00008 #include <numeric>
00009 #include <algorithm>
00010 #include <cmath>
00011 // StdAir
00012 #include <stdair/basic/BasConst_Inventory.hpp>
00013 #include <stdair/bom/BomManager.hpp>
00014 #include <stdair/bom/SegmentCabin.hpp>
00015 #include <stdair/service/Logger.hpp>
00016 // RMOL
00017 #include <rmol/basic/BasConst_General.hpp>
00018 #include <rmol/bom/Utilities.hpp>
```

```
00019 #include <rmol/bom/GuillotineBlockHelper.hpp>
00020
00021 namespace RMOL {
00022   // ////////////////////////////////////////////////////////////////////
00023   void Utilities::
00024   computeDistributionParameters (const UnconstrainedDemandVector_T& iVector,
00025                                  double& ioMean, double& ioStdDev) {
00026     ioMean = 0.0; ioStdDev = 0.0;
00027     unsigned int lNbOfSamples = iVector.size();
00028     assert (lNbOfSamples > 1);
00029
00030     // Compute the mean
00031     for (UnconstrainedDemandVector_T::const_iterator itSample = iVector.begin();
00032          itSample != iVector.end(); ++itSample) {
00033       //STDAIR_LOG_NOTIFICATION (*itSample);
00034       ioMean += *itSample;
00035     }
00036     ioMean /= lNbOfSamples;
00037
00038     // Compute the standard deviation
00039     for (UnconstrainedDemandVector_T::const_iterator itSample = iVector.begin();
00040          itSample != iVector.end(); ++itSample) {
00041       const double& lSample = *itSample;
00042       ioStdDev += ((lSample - ioMean) * (lSample - ioMean));
00043     }
00044     ioStdDev /= (lNbOfSamples - 1);
00045     ioStdDev = sqrt (ioStdDev);
00046
00047     // Sanity check
00048     if (ioStdDev == 0) {
00049       ioStdDev = 0.1;
00050     }
00051   }
00052
00053   // ////////////////////////////////////////////////////////////////////
00054   stdair::DCPList_T Utilities::
00055   buildRemainingDCPList (const stdair::DTD_T& iDTD) {
00056     stdair::DCPList_T oDCPList;
00057
00058     const stdair::DCPList_T lWholeDCPList = stdair::DEFAULT_DCP_LIST;
00059     stdair::DCPList_T::const_iterator itDCP = lWholeDCPList.begin();
00060     while (itDCP != lWholeDCPList.end()) {
00061       const stdair::DCP_T& lDCP = *itDCP;
00062       if (iDTD >= lDCP) {
00063         break;
00064       }
00065       ++itDCP;
00066     }
00067     assert (itDCP != lWholeDCPList.end());
00068
00069     oDCPList.push_back (iDTD);
00070     ++itDCP;
00071     for (; itDCP != lWholeDCPList.end(); ++itDCP) {
00072       oDCPList.push_back (*itDCP);
00073     }
00074
00075     return oDCPList;
00076   }
00077
00078   // ////////////////////////////////////////////////////////////////////
00079   stdair::DCPList_T Utilities::
00080   buildRemainingDCPList2 (const stdair::DTD_T& iDTD) {
```

```
00081     stdair::DCPList_T oDCPList;
00082
00083     const stdair::DCPList_T lWholeDCPList = RMOL::DEFAULT_DCP_LIST;
00084     stdair::DCPList_T::const_iterator itDCP = lWholeDCPList.begin();
00085     while (itDCP != lWholeDCPList.end()) {
00086       const stdair::DCP_T& lDCP = *itDCP;
00087       if (iDTD >= lDCP) {
00088         break;
00089       }
00090       ++itDCP;
00091     }
00092     assert (itDCP != lWholeDCPList.end());
00093
00094     oDCPList.push_back (iDTD);
00095     ++itDCP;
00096     for (; itDCP != lWholeDCPList.end(); ++itDCP) {
00097       oDCPList.push_back (*itDCP);
00098     }
00099
00100     return oDCPList;
00101   }
00102
00103   // ////////////////////////////////////////////////////////////////////
00104   stdair::NbOfSegments_T Utilities::
00105   getNbOfDepartedSimilarSegments (const stdair::SegmentCabin& iSegmentCabin,
00106                                   const stdair::Date_T& iEventDate) {
00107     stdair::DTD_T lDTD = 0;
00108     // Retrieve the guillotine block.
00109     const stdair::GuillotineBlock& lGuillotineBlock =
00110       iSegmentCabin.getGuillotineBlock();
00111     return GuillotineBlockHelper::
00112       getNbOfSegmentAlreadyPassedThisDTD (lGuillotineBlock, lDTD, iEventDate);
00113   }
00114
00115 }
```

43.112 rmol/bom/Utilities.hpp File Reference

```
#include <stdair/stdair_inventory_types.hpp>
#include <rmol/RMOL_Types.hpp>
```

Classes

- class RMOL::Utilities

Namespaces

- namespace stdair
- namespace RMOL

43.113 Utilities.hpp

```
00001 #ifndef __RMOL_BOM_UTILITIES_HPP
```

```
00002 #define __RMOL_BOM_UTILITIES_HPP
00003 // //////////////////////////////////////////////////////////////////
00004 // Import section
00005 // //////////////////////////////////////////////////////////////////
00006 // StdAir
00007 #include <stdair/stdair_inventory_types.hpp>
00008 // RMOL
00009 #include <rmol/RMOL_Types.hpp>
00010
00011 // Forward declarations
00012 namespace stdair {
00013   class SegmentCabin;
00014 }
00015
00016 namespace RMOL {
00017
00019   class Utilities {
00020   public:
00022     static void computeDistributionParameters (const UnconstrainedDemandVector_T&
      , double&, double&);
00023
00027     static stdair::DCPList_T buildRemainingDCPList (const stdair::DTD_T&);
00028     static stdair::DCPList_T buildRemainingDCPList2 (const stdair::DTD_T&);
00029
00033     static stdair::NbOfSegments_T getNbOfDepartedSimilarSegments (const stdair::S
      egmentCabin&, const stdair::Date_T&);
00034
00035   };
00036
00037 }
00038
00039 #endif // __RMOL_BOM_UTILITIES_HPP
```

43.114 rmol/command/Detruncator.cpp File Reference

```
#include <cassert>
#include <stdair/basic/BasConst_Inventory.hpp>
#include <stdair/bom/GuillotineBlock.hpp>
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/FlightDate.hpp>
#include <stdair/bom/SegmentDate.hpp>
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/bom/BookingClass.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/bom/GuillotineBlockHelper.hpp>
#include <rmol/bom/HistoricalBookingHolder.hpp>
#include <rmol/bom/HistoricalBooking.hpp>
#include <rmol/bom/EMDetruncator.hpp>
#include <rmol/command/Detruncator.hpp>
```

Namespaces

- namespace RMOL

43.115 Detruncator.cpp

```
00001 // //////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 // StdAir
00007 #include <stdair/basic/BasConst_Inventory.hpp>
00008 #include <stdair/bom/GuillotineBlock.hpp>
00009 #include <stdair/bom/BomManager.hpp>
00010 #include <stdair/bom/FlightDate.hpp>
00011 #include <stdair/bom/SegmentDate.hpp>
00012 #include <stdair/bom/SegmentCabin.hpp>
00013 #include <stdair/bom/BookingClass.hpp>
00014 #include <stdair/service/Logger.hpp>
00015 // RMOL
00016 #include <rmol/bom/GuillotineBlockHelper.hpp>
00017 #include <rmol/bom/HistoricalBookingHolder.hpp>
00018 #include <rmol/bom/HistoricalBooking.hpp>
00019 #include <rmol/bom/EMDetruncator.hpp>
00020 #include <rmol/command/Detruncator.hpp>
00021
00022 namespace RMOL {
00023   // //////////////////////////////////////////////////////////////////////
00024   void Detruncator::
00025   unconstrainUsingAdditivePickUp (const stdair::SegmentCabin& iSegmentCabin,
00026                BookingClassUnconstrainedDemandVectorMap_T& ioBkgClassUncDemMap,
00027                UnconstrainedDemandVector_T& ioQEquivalentDemandVector,
00028                const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00029                const stdair::Date_T& iCurrentDate) {
00030
00031     // Retrieve the guillotine block.
00032     const stdair::GuillotineBlock& lGuillotineBlock =
00033       iSegmentCabin.getGuillotineBlock();
00034
00035     // Build the historical booking holders for the product-oriented bookings
00036     // of the casses and the Q-equivalent (price-oriented) bookings of the cabin
00037     const stdair::NbOfSegments_T lNbOfUsableSegments = GuillotineBlockHelper::
00038       getNbOfSegmentAlreadyPassedThisDTD (lGuillotineBlock, iDCPEnd,
00039                                           iCurrentDate);
00040
00041     // Parse the booking class list and unconstrain historical bookings.
00042     for (BookingClassUnconstrainedDemandVectorMap_T::iterator itBCUDV =
00043            ioBkgClassUncDemMap.begin(); itBCUDV != ioBkgClassUncDemMap.end();
00044          ++itBCUDV) {
00045       stdair::BookingClass* lBC_ptr = itBCUDV->first;
00046       assert (lBC_ptr != NULL);
00047       const stdair::MapKey_T& lBCKey = lBC_ptr->describeKey();
00048       const stdair::BlockIndex_T& lBlockIdx =
00049         lGuillotineBlock.getBlockIndex (lBCKey);
00050       UnconstrainedDemandVector_T& lUncDemVector = itBCUDV->second;
00051
00052       STDAIR_LOG_DEBUG ("Unconstrain product-oriented bookings for " << lBCKey);
00053       // STDAIR_LOG_NOTIFICATION (lBCKey << ";" << iDCPBegin
00054       //                          << ";" << iDCPEnd);
```

```
00055       unconstrainUsingAdditivePickUp (lGuillotineBlock, lUncDemVector,
00056                                       iDCPBegin, iDCPEnd,
00057                                       lNbOfUsableSegments, lBlockIdx);
00058     }
00059
00060     // Unconstrain the Q-equivalent bookings.
00061     // Retrieve the block index of the segment-cabin.
00062     std::ostringstream lSCMapKey;
00063     lSCMapKey << stdair::DEFAULT_SEGMENT_CABIN_VALUE_TYPE
00064               << iSegmentCabin.describeKey();
00065     const stdair::BlockIndex_T& lCabinIdx =
00066       lGuillotineBlock.getBlockIndex (lSCMapKey.str());
00067
00068     STDAIR_LOG_DEBUG ("Unconstrain price-oriented bookings");
00069     //STDAIR_LOG_NOTIFICATION (iDCPBegin << ";" << iDCPEnd);
00070     unconstrainUsingAdditivePickUp (lGuillotineBlock, ioQEquivalentDemandVector,
00071                                     iDCPBegin, iDCPEnd, lNbOfUsableSegments,
00072                                     lCabinIdx, iSegmentCabin, iCurrentDate);
00073   }
00074
00075   // ////////////////////////////////////////////////////////////////////
00076   void Detruncator::unconstrainUsingAdditivePickUp
00077   (const stdair::GuillotineBlock& iGuillotineBlock,
00078    UnconstrainedDemandVector_T& ioUncDemVector,
00079    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00080    const stdair::NbOfSegments_T& iNbOfUsableSegments,
00081    const stdair::BlockIndex_T& iBlockIdx) {
00082     // TODO:
00083     stdair::NbOfSegments_T lSegBegin = 0;
00084     if (iNbOfUsableSegments > 52) lSegBegin = iNbOfUsableSegments - 52;
00085     // Retrieve the gross daily booking and availability snapshots.
00086     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lBookingView =
00087       iGuillotineBlock.getConstSegmentCabinDTDRangeProductAndPriceOrientedBooking
      SnapshotView (lSegBegin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00088     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lAvlView =
00089       iGuillotineBlock.getConstSegmentCabinDTDRangeAvailabilitySnapshotView (lSeg
      Begin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00090
00091     // Browse the list of segments and build the historical booking holder.
00092     const stdair::ValueTypeIndexMap_T& lVTIdxMap =
00093       iGuillotineBlock.getValueTypeIndexMap();
00094     const unsigned int lNbOfValueTypes = lVTIdxMap.size();
00095     HistoricalBookingHolder lHBHolder;
00096     for (short i = 0; i < iNbOfUsableSegments-lSegBegin; ++i) {
00097       stdair::Flag_T lCensorshipFlag = false;
00098       stdair::NbOfBookings_T lNbOfHistoricalBkgs = 0.0;
00099       const short lNbOfDTDs = iDCPBegin - iDCPEnd + 1;
00100
00101       // Parse the DTDs during the period
00102       for (short j = 0; j < lNbOfDTDs; ++j) {
00103         // Check if the data has been censored during this day.
00104         // STDAIR_LOG_DEBUG ("i: " << i << ", NbOfValues: " << lNbOfValueTypes
00105         //                   << ", BlockIdx: " << iBlockIdx << ", j: " << j);
00106         if (lCensorshipFlag == false) {
00107           if (lAvlView[i*lNbOfValueTypes + iBlockIdx][j] < 1.0) {
00108             lCensorshipFlag = true;
00109           }
00110         }
00111
00112         // Get the bookings of the day.
00113         //STDAIR_LOG_DEBUG ("Bookings of the day: " << lBookingView[i*lNbOfValueT
      ypes + iBlockIdx][j]);
```

```
00114         lNbOfHistoricalBkgs += lBookingView[i*lNbOfValueTypes + iBlockIdx][j];
00115       }
00116
00117       HistoricalBooking lHistoricalBkg (lNbOfHistoricalBkgs, lCensorshipFlag);
00118       lHBHolder.addHistoricalBooking (lHistoricalBkg);
00119
00120       // DEBUG
00121       STDAIR_LOG_DEBUG ("Historical bkgs: " << lNbOfHistoricalBkgs
00122                         << ", censored: " << lCensorshipFlag);
00123       // STDAIR_LOG_NOTIFICATION (lNbOfHistoricalBkgs
00124       //                          << ";" << lCensorshipFlag);
00125     }
00126
00127     // DEBUG
00128     STDAIR_LOG_DEBUG ("Unconstrain by EM");
00129
00130     // Unconstrain the booking figures
00131     EMDetruncator::unconstrainUsingEMMethod (lHBHolder);
00132
00133     // Add the unconstrained demand of the period to the unconstrained demand
00134     // vector.
00135     short idx = 0;
00136     for (UnconstrainedDemandVector_T::iterator itUD = ioUncDemVector.begin();
00137          itUD != ioUncDemVector.end(); ++itUD, ++idx) {
00138       *itUD += lHBHolder.getUnconstrainedDemand (idx);
00139       //STDAIR_LOG_NOTIFICATION (lHBHolder.getUnconstrainedDemand (idx));
00140     }
00141   }
00142
00143   // ////////////////////////////////////////////////////////////////////
00144   void Detruncator::unconstrainUsingAdditivePickUp
00145   (const stdair::GuillotineBlock& iGuillotineBlock,
00146    UnconstrainedDemandVector_T& ioUncDemVector,
00147    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00148    const stdair::NbOfSegments_T& iNbOfUsableSegments,
00149    const stdair::BlockIndex_T& iBlockIdx,
00150    const stdair::SegmentCabin& iSegmentCabin,
00151    const stdair::Date_T& iCurrentDate) {
00152     // TODO
00153     stdair::NbOfSegments_T lSegBegin = 0;
00154     if (iNbOfUsableSegments > 52) lSegBegin = iNbOfUsableSegments - 52;
00155     // Retrieve the gross daily booking and availability snapshots.
00156     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lBookingView =
00157       iGuillotineBlock.getConstSegmentCabinDTDRangeProductAndPriceOrientedBooking
      SnapshotView (lSegBegin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00158     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lAvlView =
00159       iGuillotineBlock.getConstSegmentCabinDTDRangeAvailabilitySnapshotView (lSeg
      Begin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00160
00161     // Browse the list of segments and build the historical booking holder.
00162     const stdair::ValueTypeIndexMap_T& lVTIdxMap =
00163       iGuillotineBlock.getValueTypeIndexMap();
00164     const unsigned int lNbOfValueTypes = lVTIdxMap.size();
00165     HistoricalBookingHolder lHBHolder;
00166     for (short i = 0; i < iNbOfUsableSegments-lSegBegin; ++i) {
00167       stdair::Flag_T lCensorshipFlag = false;
00168       stdair::NbOfBookings_T lNbOfHistoricalBkgs = 0.0;
00169       const short lNbOfDTDs = iDCPBegin - iDCPEnd + 1;
00170
00171       // Parse the DTDs during the period
00172       for (short j = 0; j < lNbOfDTDs; ++j) {
00173         // Check if the data has been censored during this day.
```

```
00174         // STDAIR_LOG_DEBUG ("i: " << i << ", NbOfValues: " << lNbOfValueTypes
00175         //                   << ", BlockIdx: " << iBlockIdx << ", j: " << j);
00176         if (lCensorshipFlag == false) {
00177           if (lAvlView[i*lNbOfValueTypes + iBlockIdx][j] < 1.0) {
00178             lCensorshipFlag = true;
00179           }
00180         }
00181
00182         // Get the bookings of the day.
00183         //STDAIR_LOG_DEBUG ("Bookings of the day: " << lBookingView[i*lNbOfValueT
      ypes + iBlockIdx][j]);
00184         lNbOfHistoricalBkgs += lBookingView[i*lNbOfValueTypes + iBlockIdx][j];
00185       }
00186
00187       HistoricalBooking lHistoricalBkg (lNbOfHistoricalBkgs, lCensorshipFlag);
00188       lHBHolder.addHistoricalBooking (lHistoricalBkg);
00189
00190       // DEBUG
00191       STDAIR_LOG_DEBUG ("Historical bkgs: " << lNbOfHistoricalBkgs
00192                         << ", censored: " << lCensorshipFlag);
00193       // STDAIR_LOG_NOTIFICATION (lNbOfHistoricalBkgs
00194       //                          << ";" << lCensorshipFlag);
00195     }
00196
00197     // DEBUG
00198     STDAIR_LOG_DEBUG ("Unconstrain by EM");
00199
00200     // Unconstrain the booking figures
00201     EMDetruncator::unconstrainUsingEMMethod (lHBHolder);
00202
00203     // Add the unconstrained demand of the period to the unconstrained demand
00204     // vector.
00205     // LOG
00206     const stdair::SegmentDate& lSegmentDate = stdair::BomManager::
00207       getParent<stdair::SegmentDate, stdair::SegmentCabin> (iSegmentCabin);
00208     const stdair::FlightDate& lFlightDate = stdair::BomManager::
00209       getParent<stdair::FlightDate, stdair::SegmentDate> (lSegmentDate);
00210     const stdair::Date_T& lDepDate = lFlightDate.getDepartureDate();
00211     const boost::gregorian::date_duration lDD = lDepDate - iCurrentDate;
00212     const long lDTD = lDD.days();
00213     stdair::Date_T lRefDate (2012, boost::gregorian::Jan, 01);
00214
00215     short idx = 0;
00216     for (UnconstrainedDemandVector_T::iterator itUD = ioUncDemVector.begin();
00217          itUD != ioUncDemVector.end(); ++itUD, ++idx) {
00218       *itUD += lHBHolder.getUnconstrainedDemand (idx);
00219       if (lDepDate > lRefDate) {
00220         const stdair::DateOffset_T lDateOffset (7 *(52 - idx) + 420);
00221         const stdair::Date_T lHDate = lDepDate - lDateOffset;
00222         STDAIR_LOG_NOTIFICATION (boost::gregorian::to_iso_string(lDepDate)
00223                                  << ";" << lDTD << ";" << iDCPBegin << ";"
00224                                  << iDCPEnd << ";"
00225                                  << boost::gregorian::to_iso_string (lHDate)
00226                                  <<";"<<lHBHolder.getUnconstrainedDemand (idx));
00227
00228         STDAIR_LOG_NOTIFICATION (boost::gregorian::to_iso_string(lDepDate)
00229                                  << ";" << lDTD << ";" << iDCPBegin << ";"
00230                                  << iDCPEnd << ";"
00231                                  << boost::gregorian::to_iso_string (lHDate)
00232                                  <<";"<<lHBHolder.getHistoricalBooking (idx));
00233       }
00234     }
```

```
00235   }
00236
00237   // ////////////////////////////////////////////////////////////////////
00238   void Detruncator::retrieveUnconstrainedDemandForFirstDCP
00239   (const stdair::SegmentCabin& iSegmentCabin,
00240    BookingClassUnconstrainedDemandVectorMap_T& ioBkgClassUncDemVectorMap,
00241    UnconstrainedDemandVector_T& ioQEquivalentDemandVector,
00242    const stdair::DCP_T& iFirstDCP, const stdair::NbOfSegments_T& iNbOfSegments,
00243    const stdair::NbOfSegments_T& iNbOfUsedSegments){
00244
00245     // Retrieve the guillotine block.
00246     const stdair::GuillotineBlock& lGuillotineBlock =
00247       iSegmentCabin.getGuillotineBlock();
00248
00249     // Parse the booking class list and unconstrain historical bookings.
00250     for (BookingClassUnconstrainedDemandVectorMap_T::iterator itBCUDV =
00251            ioBkgClassUncDemVectorMap.begin();
00252          itBCUDV != ioBkgClassUncDemVectorMap.end(); ++itBCUDV) {
00253       stdair::BookingClass* lBC_ptr = itBCUDV->first;
00254       assert (lBC_ptr != NULL);
00255       const stdair::MapKey_T& lBCKey = lBC_ptr->describeKey();
00256       const stdair::BlockIndex_T& lBlockIdx =
00257         lGuillotineBlock.getBlockIndex (lBCKey);
00258       UnconstrainedDemandVector_T& lUncDemVector = itBCUDV->second;
00259
00260       STDAIR_LOG_DEBUG("Retrieve the unconstrained product-oriented demand for "
00261                        << lBCKey);
00262       retrieveUnconstrainedDemandForFirstDCP (lGuillotineBlock, lUncDemVector,
00263                                               iFirstDCP, lBlockIdx,
00264                                               iNbOfSegments, iNbOfUsedSegments);
00265     }
00266
00267     // Unconstrain the Q-equivalent bookings.
00268     // Retrieve the block index of the segment-cabin.
00269     std::ostringstream lSCMapKey;
00270     lSCMapKey << stdair::DEFAULT_SEGMENT_CABIN_VALUE_TYPE
00271               << iSegmentCabin.describeKey();
00272     const stdair::BlockIndex_T& lCabinValueIdx =
00273       lGuillotineBlock.getBlockIndex (lSCMapKey.str());
00274
00275     STDAIR_LOG_DEBUG ("Retrieve the unconstrained price-oriented demand");
00276     retrieveUnconstrainedDemandForFirstDCP (lGuillotineBlock,
00277                                             ioQEquivalentDemandVector,iFirstDCP,
00278                                             lCabinValueIdx, iNbOfSegments,
00279                                             iNbOfUsedSegments);
00280   }
00281
00282   // ////////////////////////////////////////////////////////////////////
00283   void Detruncator::retrieveUnconstrainedDemandForFirstDCP
00284   (const stdair::GuillotineBlock& iGuillotineBlock,
00285    UnconstrainedDemandVector_T& ioUnconstrainedDemandVector,
00286    const stdair::DCP_T& iFirstDCP, const stdair::BlockIndex_T& iValueIdx,
00287    const stdair::NbOfSegments_T& iNbOfSegments,
00288    const stdair::NbOfSegments_T& iNbOfUsedSegments) {
00289
00290     //TODO
00291     stdair::NbOfSegments_T lSegBegin = iNbOfSegments - iNbOfUsedSegments;
00292
00293     // Retrieve the snapshots of the corresponding booking value from the
00294     // first DTD (usually 365) till the given iFirstDCP.
00295     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lRangeBookingView =
00296       iGuillotineBlock.getConstSegmentCabinDTDRangeProductAndPriceOrientedBooking
```

```
      SnapshotView (lSegBegin, iNbOfSegments -1, iFirstDCP, stdair::DEFAULT_MAX_DTD);
00297
00298     // Sum the bookings from the first day till the given iFirstDCP in order to
00299     // get the supposing unconstrained demand for this period.
00300     const stdair::ValueTypeIndexMap_T& lVTIdxMap =
00301       iGuillotineBlock.getValueTypeIndexMap();
00302     const unsigned int lNbOfValueTypes = lVTIdxMap.size();
00303     for (int itSegment = 0; itSegment < iNbOfSegments-lSegBegin; ++itSegment) {
00304       for (int i = iFirstDCP; i <= stdair::DEFAULT_MAX_DTD; ++i) {
00305         stdair::NbOfRequests_T& lUncDemand =
00306           ioUnconstrainedDemandVector.at(itSegment);
00307         lUncDemand +=
00308           lRangeBookingView[iValueIdx + itSegment*lNbOfValueTypes][i-iFirstDCP];
00309       }
00310       // STDAIR_LOG_NOTIFICATION (ioUnconstrainedDemandVector.at(itSegment)
00311       //                          << ";" << itSegment);
00312     }
00313   }
00314
00315   // ////////////////////////////////////////////////////////////////////
00316   void Detruncator::unconstrainUsingMultiplicativePickUp
00317   (const stdair::SegmentCabin& iSegmentCabin,
00318    BookingClassUnconstrainedDemandVectorMap_T& ioBkgClassUncDemMap,
00319    UnconstrainedDemandVector_T& ioQEquivalentDemandVector,
00320    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00321    const stdair::Date_T& iCurrentDate,
00322    const stdair::NbOfSegments_T& iNbOfDepartedSegments) {
00323
00324     // Retrieve the guillotine block.
00325     const stdair::GuillotineBlock& lGuillotineBlock =
00326       iSegmentCabin.getGuillotineBlock();
00327
00328     // Build the historical booking holders for the product-oriented bookings
00329     // of the casses and the Q-equivalent (price-oriented) bookings of the cabin
00330     const stdair::NbOfSegments_T lNbOfUsableSegments = GuillotineBlockHelper::
00331       getNbOfSegmentAlreadyPassedThisDTD (lGuillotineBlock, iDCPEnd,
00332                                           iCurrentDate);
00333
00334     // Parse the booking class list and unconstrain historical bookings.
00335     for (BookingClassUnconstrainedDemandVectorMap_T::iterator itBCUDV =
00336            ioBkgClassUncDemMap.begin(); itBCUDV != ioBkgClassUncDemMap.end();
00337          ++itBCUDV) {
00338       stdair::BookingClass* lBC_ptr = itBCUDV->first;
00339       assert (lBC_ptr != NULL);
00340       const stdair::MapKey_T& lBCKey = lBC_ptr->describeKey();
00341       const stdair::BlockIndex_T& lBlockIdx =
00342         lGuillotineBlock.getBlockIndex (lBCKey);
00343       UnconstrainedDemandVector_T& lUncDemVector = itBCUDV->second;
00344
00345       STDAIR_LOG_DEBUG ("Unconstrain product-oriented bookings for " << lBCKey);
00346       unconstrainUsingMultiplicativePickUp (lGuillotineBlock, lUncDemVector,
00347                                             iDCPBegin, iDCPEnd,
00348                                             lNbOfUsableSegments, lBlockIdx,
00349                                             iNbOfDepartedSegments);
00350     }
00351
00352     // Unconstrain the Q-equivalent bookings.
00353     // Retrieve the block index of the segment-cabin.
00354     std::ostringstream lSCMapKey;
00355     lSCMapKey << stdair::DEFAULT_SEGMENT_CABIN_VALUE_TYPE
00356               << iSegmentCabin.describeKey();
00357     const stdair::BlockIndex_T& lCabinIdx =
```

```
00358       lGuillotineBlock.getBlockIndex (lSCMapKey.str());
00359
00360     STDAIR_LOG_DEBUG ("Unconstrain price-oriented bookings");
00361     unconstrainUsingMultiplicativePickUp (lGuillotineBlock,
00362                                           ioQEquivalentDemandVector,
00363                                           iDCPBegin, iDCPEnd,
00364                                           lNbOfUsableSegments, lCabinIdx,
00365                                           iNbOfDepartedSegments,
00366                                           iSegmentCabin, iCurrentDate);
00367   }
00368
00369   // ////////////////////////////////////////////////////////////////////
00370   void Detruncator::unconstrainUsingMultiplicativePickUp
00371   (const stdair::GuillotineBlock& iGuillotineBlock,
00372    UnconstrainedDemandVector_T& ioUncDemVector,
00373    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00374    const stdair::NbOfSegments_T& iNbOfUsableSegments,
00375    const stdair::BlockIndex_T& iBlockIdx,
00376    const stdair::NbOfSegments_T& iNbOfDepartedSegments) {
00377     // TODO:
00378     stdair::NbOfSegments_T lSegBegin = 0;
00379     if (iNbOfDepartedSegments > 52) {
00380       lSegBegin = iNbOfDepartedSegments - 52;
00381     }
00382
00383     // Retrieve the gross daily booking and availability snapshots.
00384     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lBookingView =
00385       iGuillotineBlock.getConstSegmentCabinDTDRangeProductAndPriceOrientedBooking
      SnapshotView (lSegBegin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00386     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lAvlView =
00387       iGuillotineBlock.getConstSegmentCabinDTDRangeAvailabilitySnapshotView (lSeg
      Begin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00388
00389     // Browse the list of segments and build the historical booking holder.
00390     const stdair::ValueTypeIndexMap_T& lVTIdxMap =
00391       iGuillotineBlock.getValueTypeIndexMap();
00392     const unsigned int lNbOfValueTypes = lVTIdxMap.size();
00393     HistoricalBookingHolder lHBHolder;
00394     std::vector<short> lDataIndexList;
00395     for (short i = 0; i < iNbOfUsableSegments-lSegBegin; ++i) {
00396       stdair::Flag_T lCensorshipFlag = false;
00397       stdair::NbOfBookings_T lNbOfHistoricalBkgs = 0.0;
00398       const short lNbOfDTDs = iDCPBegin - iDCPEnd + 1;
00399
00400       // Parse the DTDs during the period
00401       for (short j = 0; j < lNbOfDTDs; ++j) {
00402         // Check if the data has been censored during this day.
00403         // STDAIR_LOG_DEBUG ("i: " << i << ", NbOfValues: " << lNbOfValueTypes
00404         //                   << ", BlockIdx: " << iBlockIdx << ", j: " << j);
00405         if (lCensorshipFlag == false) {
00406           if (lAvlView[i*lNbOfValueTypes + iBlockIdx][j] < 1.0) {
00407             lCensorshipFlag = true;
00408           }
00409         }
00410
00411         // Get the bookings of the day.
00412         //STDAIR_LOG_DEBUG ("Bookings of the day: " << lBookingView[i*lNbOfValueT
      ypes + iBlockIdx][j]);
00413         lNbOfHistoricalBkgs += lBookingView[i*lNbOfValueTypes + iBlockIdx][j];
00414       }
00415
00416       // If there is no booking till now for this class and for this segment,
```

```
00417       // there will be no unconstraining process.
00418       stdair::NbOfRequests_T& lUncDemand = ioUncDemVector.at (i);
00419       if (lUncDemand < 1.0) {
00420         lUncDemand += lNbOfHistoricalBkgs;
00421       } else {
00422         double lBkgDemandFactor = lNbOfHistoricalBkgs / lUncDemand;
00423         HistoricalBooking lHistoricalBkg (lBkgDemandFactor, lCensorshipFlag);
00424         lHBHolder.addHistoricalBooking (lHistoricalBkg);
00425         lDataIndexList.push_back (i);
00426       }
00427
00428       // DEBUG
00429       STDAIR_LOG_DEBUG ("Historical bkgs: " << lNbOfHistoricalBkgs
00430                         << ", censored: " << lCensorshipFlag);
00431     }
00432
00433     // DEBUG
00434     STDAIR_LOG_DEBUG ("Unconstrain by multiplicative pick-up using EM");
00435
00436     // Unconstrain the booking figures
00437     unconstrainUsingMultiplicativePickUp (lHBHolder);
00438
00439     // Update the unconstrained demand vector.
00440     short i = 0;
00441     for (std::vector<short>::iterator itIdx = lDataIndexList.begin();
00442          itIdx != lDataIndexList.end(); ++itIdx, ++i) {
00443       short lIdx = *itIdx;
00444       stdair::NbOfRequests_T& lPastDemand = ioUncDemVector.at (lIdx);
00445       const stdair::NbOfRequests_T& lUncDemandFactorOfThisPeriod =
00446         lHBHolder.getUnconstrainedDemand (i);
00447       lPastDemand *= (1+lUncDemandFactorOfThisPeriod);
00448     }
00449   }
00450
00451   // ////////////////////////////////////////////////////////////////////
00452   void Detruncator::unconstrainUsingMultiplicativePickUp
00453   (const stdair::GuillotineBlock& iGuillotineBlock,
00454    UnconstrainedDemandVector_T& ioUncDemVector,
00455    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00456    const stdair::NbOfSegments_T& iNbOfUsableSegments,
00457    const stdair::BlockIndex_T& iBlockIdx,
00458    const stdair::NbOfSegments_T& iNbOfDepartedSegments,
00459    const stdair::SegmentCabin& iSegmentCabin,
00460    const stdair::Date_T& iCurrentDate) {
00461     // TODO:
00462     stdair::NbOfSegments_T lSegBegin = 0;
00463     if (iNbOfDepartedSegments > 52) {
00464       lSegBegin = iNbOfDepartedSegments - 52;
00465     }
00466
00467     // Retrieve the gross daily booking and availability snapshots.
00468     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lBookingView =
00469       iGuillotineBlock.getConstSegmentCabinDTDRangeProductAndPriceOrientedBooking
      SnapshotView (lSegBegin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00470     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lAvlView =
00471       iGuillotineBlock.getConstSegmentCabinDTDRangeAvailabilitySnapshotView (lSeg
      Begin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00472
00473     // Browse the list of segments and build the historical booking holder.
00474     const stdair::ValueTypeIndexMap_T& lVTIdxMap =
00475       iGuillotineBlock.getValueTypeIndexMap();
00476     const unsigned int lNbOfValueTypes = lVTIdxMap.size();
```

```
00477     HistoricalBookingHolder lHBHolder;
00478     std::vector<short> lDataIndexList;
00479     for (short i = 0; i < iNbOfUsableSegments-lSegBegin; ++i) {
00480       stdair::Flag_T lCensorshipFlag = false;
00481       stdair::NbOfBookings_T lNbOfHistoricalBkgs = 0.0;
00482       const short lNbOfDTDs = iDCPBegin - iDCPEnd + 1;
00483 
00484       // Parse the DTDs during the period
00485       for (short j = 0; j < lNbOfDTDs; ++j) {
00486         // Check if the data has been censored during this day.
00487         // STDAIR_LOG_DEBUG ("i: " << i << ", NbOfValues: " << lNbOfValueTypes
00488         //                   << ", BlockIdx: " << iBlockIdx << ", j: " << j);
00489         if (lCensorshipFlag == false) {
00490           if (lAvlView[i*lNbOfValueTypes + iBlockIdx][j] < 1.0) {
00491             lCensorshipFlag = true;
00492           }
00493         }
00494 
00495         // Get the bookings of the day.
00496         //STDAIR_LOG_DEBUG ("Bookings of the day: " << lBookingView[i*lNbOfValueT
      ypes + iBlockIdx][j]);
00497         lNbOfHistoricalBkgs += lBookingView[i*lNbOfValueTypes + iBlockIdx][j];
00498       }
00499 
00500       // If there is no booking till now for this class and for this segment,
00501       // there will be no unconstraining process.
00502       stdair::NbOfRequests_T& lUncDemand = ioUncDemVector.at (i);
00503       if (lUncDemand < 1.0) {
00504         lUncDemand += lNbOfHistoricalBkgs;
00505       } else {
00506         double lBkgDemandFactor = lNbOfHistoricalBkgs / lUncDemand;
00507         HistoricalBooking lHistoricalBkg (lBkgDemandFactor, lCensorshipFlag);
00508         lHBHolder.addHistoricalBooking (lHistoricalBkg);
00509         lDataIndexList.push_back (i);
00510       }
00511 
00512       // DEBUG
00513       STDAIR_LOG_DEBUG ("Historical bkgs: " << lNbOfHistoricalBkgs
00514                         << ", censored: " << lCensorshipFlag);
00515     }
00516 
00517     // DEBUG
00518     STDAIR_LOG_DEBUG ("Unconstrain by multiplicative pick-up");
00519 
00520     // Unconstrain the booking figures
00521     unconstrainUsingMultiplicativePickUp (lHBHolder);
00522 
00523     // Update the unconstrained demand vector.
00524     // LOG
00525     const stdair::SegmentDate& lSegmentDate = stdair::BomManager::
00526       getParent<stdair::SegmentDate, stdair::SegmentCabin> (iSegmentCabin);
00527     const stdair::FlightDate& lFlightDate = stdair::BomManager::
00528       getParent<stdair::FlightDate, stdair::SegmentDate> (lSegmentDate);
00529     const stdair::Date_T& lDepDate = lFlightDate.getDepartureDate();
00530     const boost::gregorian::date_duration lDD = lDepDate - iCurrentDate;
00531     const long lDTD = lDD.days();
00532     stdair::Date_T lRefDate (2012, boost::gregorian::Jan, 01);
00533 
00534     short i = 0;
00535     for (std::vector<short>::iterator itIdx = lDataIndexList.begin();
00536          itIdx != lDataIndexList.end(); ++itIdx, ++i) {
00537       short lIdx = *itIdx;
```

```
00538       stdair::NbOfRequests_T& lPastDemand = ioUncDemVector.at (lIdx);
00539       const stdair::NbOfRequests_T& lUncDemandFactorOfThisPeriod =
00540         lHBHolder.getUnconstrainedDemand (i);
00541       const double lUncDemThisPeriod =
00542         lPastDemand * lUncDemandFactorOfThisPeriod;
00543       lPastDemand *= (1+lUncDemandFactorOfThisPeriod);
00544       if (lDepDate > lRefDate) {
00545         const stdair::DateOffset_T lDateOffset (7 *(53 - lIdx) + 420);
00546         const stdair::Date_T lHDate = lDepDate - lDateOffset;
00547         STDAIR_LOG_NOTIFICATION (boost::gregorian::to_iso_string(lDepDate)
00548                                  << ";" << lDTD << ";" << iDCPBegin << ";"
00549                                  << iDCPEnd << ";"
00550                                  << boost::gregorian::to_iso_string (lHDate)
00551                                  << ";" << lUncDemThisPeriod);
00552       }
00553     }
00554   }
00555
00556   // ////////////////////////////////////////////////////////////////////
00557   void Detruncator::
00558   unconstrainUsingMultiplicativePickUp (HistoricalBookingHolder& ioHBHolder) {
00559     // We use two loops in this algorithm. The first one is for calculating the
00560     // average of unconstrained data. The second one is fore calculating the
00561     // average of unconstrained data and the constrained data which are higher
00562     // than the first average.
00563     short lNbOfUsedData = ioHBHolder.getNbOfUncensoredData();
00564     if (lNbOfUsedData > 0) {
00565       double lSumOfValues = 0.0;
00566       const short lNbOfData = ioHBHolder.getNbOfFlights();
00567
00568       // First loop
00569       for (short i = 0; i < lNbOfData; ++i) {
00570         if (ioHBHolder.getCensorshipFlag (i) == false) {
00571           lSumOfValues += ioHBHolder.getHistoricalBooking (i);
00572         }
00573       }
00574       double lFirstAverage = lSumOfValues / lNbOfUsedData;
00575
00576       // Second loop
00577       for (short i = 0; i < lNbOfData; ++i) {
00578         if (ioHBHolder.getCensorshipFlag (i) == true) {
00579           const stdair::NbOfBookings_T& lBkgs =
00580             ioHBHolder.getHistoricalBooking (i);
00581           if (lBkgs >= lFirstAverage) {
00582             lSumOfValues += lBkgs;
00583             ++lNbOfUsedData;
00584           }
00585         }
00586       }
00587       double lSecondAverage = lSumOfValues / lNbOfUsedData;
00588
00589       // Last loop for updating the demand.
00590       for (short i = 0; i < lNbOfData; ++i) {
00591         if (ioHBHolder.getCensorshipFlag (i) == true) {
00592           const stdair::NbOfBookings_T& lBkgs =
00593             ioHBHolder.getHistoricalBooking (i);
00594           if (lBkgs < lSecondAverage) {
00595             ioHBHolder.setUnconstrainedDemand (lSecondAverage, i);
00596           }
00597         }
00598       }
00599     }
```

```
00600   }
00601 }
00602
```

43.116 rmol/command/Detruncator.hpp File Reference

```
#include <stdair/stdair_inventory_types.hpp>
#include <rmol/RMOL_Types.hpp>
```

Classes

- class RMOL::Detruncator

Namespaces

- namespace stdair
- namespace RMOL

43.117 Detruncator.hpp

```
00001 #ifndef __RMOL_COMMAND_DETRUNCATOR_HPP
00002 #define __RMOL_COMMAND_DETRUNCATOR_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // StdAir
00008 #include <stdair/stdair_inventory_types.hpp>
00009 // RMOL
00010 #include <rmol/RMOL_Types.hpp>
00011
00012 // Forward declarations.
00013 namespace stdair {
00014   class GuillotineBlock;
00015   class SegmentCabin;
00016 }
00017
00018 namespace RMOL {
00019   // Forward declarations.
00020   struct HistoricalBookingHolder;
00021
00024   class Detruncator {
00025   public:
00029     static void unconstrainUsingAdditivePickUp (const stdair::SegmentCabin&,
00030                                BookingClassUnconstrainedDemandVectorMap_T&,
00031                                UnconstrainedDemandVector_T&,
00032                                const stdair::DCP_T&, const stdair::DCP_T&,
00033                                const stdair::Date_T&);
00034
00038     static void unconstrainUsingMultiplicativePickUp
00039     (const stdair::SegmentCabin&, BookingClassUnconstrainedDemandVectorMap_T&,
00040      UnconstrainedDemandVector_T&, const stdair::DCP_T&, const stdair::DCP_T&,
00041      const stdair::Date_T&, const stdair::NbOfSegments_T&);
```

```
00042
00046     static void retrieveUnconstrainedDemandForFirstDCP
00047     (const stdair::SegmentCabin&,
00048      BookingClassUnconstrainedDemandVectorMap_T&,
00049      UnconstrainedDemandVector_T&, const stdair::DCP_T&,
00050      const stdair::NbOfSegments_T&, const stdair::NbOfSegments_T&);
00051
00055     static void unconstrainUsingMultiplicativePickUp (HistoricalBookingHolder&);
00056
00057   private:
00061     static void unconstrainUsingAdditivePickUp (const stdair::GuillotineBlock&,
00062                                                 UnconstrainedDemandVector_T&,
00063                                                 const stdair::DCP_T&,
00064                                                 const stdair::DCP_T&,
00065                                                 const stdair::NbOfSegments_T&,
00066                                                 const stdair::BlockIndex_T&);
00070     static void unconstrainUsingAdditivePickUp (const stdair::GuillotineBlock&,
00071                                                 UnconstrainedDemandVector_T&,
00072                                                 const stdair::DCP_T&,
00073                                                 const stdair::DCP_T&,
00074                                                 const stdair::NbOfSegments_T&,
00075                                                 const stdair::BlockIndex_T&,
00076                                                 const stdair::SegmentCabin&,
00077                                                 const stdair::Date_T&);
00078
00082     static void unconstrainUsingMultiplicativePickUp
00083     (const stdair::GuillotineBlock&, UnconstrainedDemandVector_T&,
00084      const stdair::DCP_T&, const stdair::DCP_T&,
00085      const stdair::NbOfSegments_T&, const stdair::BlockIndex_T&,
00086      const stdair::NbOfSegments_T&);
00087
00091     static void unconstrainUsingMultiplicativePickUp
00092     (const stdair::GuillotineBlock&, UnconstrainedDemandVector_T&,
00093      const stdair::DCP_T&, const stdair::DCP_T&,
00094      const stdair::NbOfSegments_T&, const stdair::BlockIndex_T&,
00095      const stdair::NbOfSegments_T&,
00096      const stdair::SegmentCabin&, const stdair::Date_T&);
00097
00101     static void retrieveUnconstrainedDemandForFirstDCP
00102     (const stdair::GuillotineBlock&, UnconstrainedDemandVector_T&,
00103      const stdair::DCP_T&, const stdair::BlockIndex_T&,
00104      const stdair::NbOfSegments_T&, const stdair::NbOfSegments_T&);
00105   };
00106 }
00107 #endif // __RMOL_COMMAND_DETRUNCATOR_HPP
00108
00109
```

43.118 rmol/command/Forecaster.cpp File Reference

```
#include <cassert>
#include <sstream>
#include <cmath>
#include <stdair/basic/BasConst_General.hpp>
#include <stdair/basic/BasConst_Inventory.hpp>
#include <stdair/basic/RandomGeneration.hpp>
```

```
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/FlightDate.hpp>
#include <stdair/bom/LegDate.hpp>
#include <stdair/bom/SegmentDate.hpp>
#include <stdair/bom/LegCabin.hpp>
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/bom/GuillotineBlock.hpp>
#include <stdair/bom/BookingClass.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/basic/BasConst_Curves.hpp>
#include <rmol/bom/Utilities.hpp>
#include <rmol/bom/GuillotineBlockHelper.hpp>
#include <rmol/bom/HistoricalBookingHolder.hpp>
#include <rmol/bom/HistoricalBooking.hpp>
#include <rmol/bom/EMDetruncator.hpp>
#include <rmol/command/Forecaster.hpp>
#include <rmol/command/Detruncator.hpp>
```

Namespaces

- namespace RMOL

43.119 Forecaster.cpp

```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 #include <sstream>
00007 #include <cmath>
00008 // StdAir
00009 #include <stdair/basic/BasConst_General.hpp>
00010 #include <stdair/basic/BasConst_Inventory.hpp>
00011 #include <stdair/basic/RandomGeneration.hpp>
00012 #include <stdair/bom/BomManager.hpp>
00013 #include <stdair/bom/FlightDate.hpp>
00014 #include <stdair/bom/LegDate.hpp>
00015 #include <stdair/bom/SegmentDate.hpp>
00016 #include <stdair/bom/LegCabin.hpp>
00017 #include <stdair/bom/SegmentCabin.hpp>
00018 #include <stdair/bom/GuillotineBlock.hpp>
00019 #include <stdair/bom/BookingClass.hpp>
00020 #include <stdair/service/Logger.hpp>
00021 // RMOL
```

```
00022 #include <rmol/basic/BasConst_Curves.hpp>
00023 #include <rmol/bom/Utilities.hpp>
00024 #include <rmol/bom/GuillotineBlockHelper.hpp>
00025 #include <rmol/bom/HistoricalBookingHolder.hpp>
00026 #include <rmol/bom/HistoricalBooking.hpp>
00027 #include <rmol/bom/EMDetruncator.hpp>
00028 #include <rmol/command/Forecaster.hpp>
00029 #include <rmol/command/Detruncator.hpp>
00030
00031 namespace RMOL {
00032
00033   // ////////////////////////////////////////////////////////////////////
00034   bool Forecaster::
00035   forecastUsingAdditivePickUp (stdair::FlightDate& ioFlightDate,
00036                                const stdair::DateTime_T& iEventTime) {
00037     // Build the offset dates.
00038     const stdair::Date_T& lEventDate = iEventTime.date();
00039     stdair::Date_T lRefDate (2012, boost::gregorian::Jan, 01);
00040
00041     //
00042     bool isSucceeded = true;
00043     const stdair::SegmentDateList_T& lSDList =
00044       stdair::BomManager::getList<stdair::SegmentDate> (ioFlightDate);
00045     for (stdair::SegmentDateList_T::const_iterator itSD = lSDList.begin();
00046          itSD != lSDList.end(); ++itSD) {
00047       stdair::SegmentDate* lSD_ptr = *itSD;
00048       assert (lSD_ptr != NULL);
00049
00050       const stdair::Date_T& lBoardingDate = lSD_ptr->getBoardingDate();
00051       const stdair::DateOffset_T lSegmentDateOffset =
00052         lBoardingDate - lEventDate;
00053       const stdair::DTD_T lSegmentDTD = lSegmentDateOffset.days();
00054
00055       // Build remaining DCP's for the segment-date.
00056       // TODO: treat the case where the segment departure is not the
00057       // same as the flight-date departure.
00058       stdair::DCPList_T lDCPList;
00059
00060       if (lEventDate < lRefDate) {
00061         lDCPList = Utilities::buildRemainingDCPList (lSegmentDTD);
00062       } else {
00063         lDCPList = Utilities::buildRemainingDCPList2 (lSegmentDTD);
00064       }
00065
00066       //
00067       const stdair::SegmentCabinList_T& lSCList =
00068         stdair::BomManager::getList<stdair::SegmentCabin> (*lSD_ptr);
00069       for (stdair::SegmentCabinList_T::const_iterator itSC = lSCList.begin();
00070            itSC != lSCList.end(); ++itSC) {
00071         stdair::SegmentCabin* lSC_ptr = *itSC;
00072         assert (lSC_ptr != NULL);
00073
00074         //
00075         // STDAIR_LOG_NOTIFICATION (ioFlightDate.getDepartureDate()
00076         //                          << ";" << lSegmentDTD);
00077         bool isForecasted = forecastUsingAdditivePickUp (*lSC_ptr, lDCPList,
00078                                                          lEventDate);
00079         if (isForecasted == false) {
00080           isSucceeded = false;
00081         }
00082       }
00083     }
```

```
00084
00085     return isSucceeded;
00086   }
00087
00088   // ////////////////////////////////////////////////////////////////////
00089   bool Forecaster::
00090   forecastUsingAdditivePickUp (stdair::SegmentCabin& ioSegmentCabin,
00091                                const stdair::DCPList_T& iDCPList,
00092                                const stdair::Date_T& iEventDate) {
00093     // Retrieve the number of departed similar segments.
00094     stdair::NbOfSegments_T lNbOfDepartedSegments =
00095       Utilities::getNbOfDepartedSimilarSegments (ioSegmentCabin, iEventDate);
00096     // TODO
00097     if (lNbOfDepartedSegments > 52) lNbOfDepartedSegments = 52;
00098
00099     // DEBUG
00100     STDAIR_LOG_DEBUG ("Nb of similar departed segments: "
00101                       << lNbOfDepartedSegments);
00102
00103     // If the DCP list includes only DTD0 or the number of departed
00104     // segments are less than two, remaining demand for all classes
00105     // will be set to zero.
00106     stdair::DCPList_T::const_iterator itDCP = iDCPList.begin();
00107     assert (itDCP != iDCPList.end());
00108     const stdair::DCP_T& lCurrentDTD = *itDCP;
00109     if (iDCPList.size() == 1 || lNbOfDepartedSegments < 2) {
00110       setRemainingDemandForecastToZero (ioSegmentCabin);
00111       return false;
00112     } else {
00113       // Initialise a holder for the unconstrained demand.
00114       UnconstrainedDemandVector_T lQEquivalentDemandVector (lNbOfDepartedSegments
     , 0.0);
00115       BookingClassUnconstrainedDemandVectorMap_T lBkgClassUncDemMap;
00116       const stdair::BookingClassList_T& lBCList =
00117         stdair::BomManager::getList<stdair::BookingClass> (ioSegmentCabin);
00118       for (stdair::BookingClassList_T::const_iterator itBC = lBCList.begin();
00119            itBC != lBCList.end(); ++itBC) {
00120         stdair::BookingClass* lBC_ptr = *itBC;
00121         assert (lBC_ptr != NULL);
00122         std::vector<stdair::NbOfRequests_T> lUncDemandVector (lNbOfDepartedSegmen
     ts, 0.0);
00123         bool insertionSucceeded = lBkgClassUncDemMap.insert
00124           (BookingClassUnconstrainedDemandVectorMap_T::
00125            value_type (lBC_ptr, lUncDemandVector)).second;
00126         assert (insertionSucceeded == true);
00127       }
00128
00129       // Build the DCP intervals and unconstrain censored booking figures for
00130       // each interval.
00131       stdair::DCPList_T::const_iterator itNextDCP = itDCP; ++itNextDCP;
00132       for (; itNextDCP != iDCPList.end(); ++itDCP, ++itNextDCP) {
00133         const stdair::DCP_T& lCurrentDCP = *itDCP;
00134         const stdair::DCP_T& lNextDCP = *itNextDCP;
00135
00136         // DEBUG
00137         STDAIR_LOG_DEBUG ("Unconstrain demand for "
00138                           << ioSegmentCabin.describeKey()
00139                           << " and the DCP's " << lCurrentDCP << ", "
00140                           << lNextDCP);
00141         Detruncator::unconstrainUsingAdditivePickUp (ioSegmentCabin,
00142                                                      lBkgClassUncDemMap,
00143                                                      lQEquivalentDemandVector,
```

```
00144                                                   lCurrentDCP-1, lNextDCP,
00145                                                   iEventDate);
00146         STDAIR_LOG_DEBUG ("Detrucation successful");
00147       }
00148
00149       // Retrieve the FRAT5 coefficient and compute the sell-up coef.
00150       FRAT5Curve_T::const_iterator itFRAT5 =
00151         DEFAULT_CUMULATIVE_FRAT5_CURVE.lower_bound (lCurrentDTD);
00152       assert (itFRAT5 != DEFAULT_CUMULATIVE_FRAT5_CURVE.end());
00153       const double lFRAT5Coef = itFRAT5->second;
00154       const double lSellUpCoef = -log(0.5) / (lFRAT5Coef - 1);
00155
00156       forecastUsingAdditivePickUp (ioSegmentCabin, lBkgClassUncDemMap,
00157                                    lQEquivalentDemandVector, lSellUpCoef);
00158       return true;
00159     }
00160   }
00161
00162   // ////////////////////////////////////////////////////////////////////
00163   void Forecaster::
00164   forecastUsingAdditivePickUp (stdair::SegmentCabin& ioSegmentCabin,
00165                                const BookingClassUnconstrainedDemandVectorMap_T&
      iClassUncDemMap,
00166                                const UnconstrainedDemandVector_T& iUncDemVector,
00167                                const double& iSellUpFactor) {
00168     double lPriceOriMean; double lPriceOriStdDev;
00169     Utilities::computeDistributionParameters (iUncDemVector, lPriceOriMean,
00170                                               lPriceOriStdDev);
00171
00172     // DEBUG
00173     //STDAIR_LOG_NOTIFICATION (lPriceOriMean << ";" << lPriceOriStdDev);
00174
00175     // Retrieve the classes from low to high and compute the distributions of
00176     // product-oriented and price-oriented demand.
00177     // Retrieve the lowest class.
00178     const stdair::BookingClassList_T& lBCList =
00179       stdair::BomManager::getList<stdair::BookingClass> (ioSegmentCabin);
00180     stdair::BookingClassList_T::const_reverse_iterator itCurrentClass =
00181       lBCList.rbegin();
00182     assert (itCurrentClass != lBCList.rend());
00183     stdair::BookingClassList_T::const_reverse_iterator itNextClass =
00184       itCurrentClass;
00185     ++itNextClass;
00186     // If there is only one class in the cabin, the demand distribution of this
00187     // class is equal to the price-oriented demand distribution of the cabin.
00188     if (itNextClass == lBCList.rend()) {
00189       stdair::BookingClass* lLowestBC_ptr = *itCurrentClass;
00190       lLowestBC_ptr->setMean (lPriceOriMean);
00191       lLowestBC_ptr->setStdDev (lPriceOriStdDev);
00192     } else {
00193       // Compute the demand for higher class using the formula
00194       // Pro_sell_up_from_Q_to_F = e ^ ((y_F/y_Q - 1) * ln (0.5) / (FRAT5 - 1))
00195       for (; itNextClass != lBCList.rend(); ++itCurrentClass, ++itNextClass) {
00196         stdair::BookingClass* lCurrentBC_ptr = *itCurrentClass;
00197         assert (lCurrentBC_ptr != NULL);
00198         const stdair::Yield_T& lCurrentYield = lCurrentBC_ptr->getYield();
00199         stdair::BookingClass* lNextBC_ptr = *itNextClass;
00200         assert (lNextBC_ptr != NULL);
00201         const stdair::Yield_T& lNextYield = lNextBC_ptr->getYield();
00202
00203         // Compute the part of price-oriented demand distributed to the
00204         // current class.
```

```
00205         const double lSellUp =
00206           exp ((1.0 - lNextYield/lCurrentYield) * iSellUpFactor);
00207         const double lPriceOriDemMeanFrac = lPriceOriMean * (1.0 - lSellUp);
00208         const double lPriceOriDemStdDevFrac = lPriceOriStdDev * (1.0 - lSellUp);
00209
00210         // Compute the product-oriented demand distribution for the
00211         // current class.
00212         BookingClassUnconstrainedDemandVectorMap_T::const_iterator itBCUD =
00213           iClassUncDemMap.find (lCurrentBC_ptr);
00214         assert (itBCUD != iClassUncDemMap.end());
00215         const UnconstrainedDemandVector_T& lDemandVector = itBCUD->second;
00216         double lMean; double lStdDev;
00217         Utilities::computeDistributionParameters(lDemandVector, lMean, lStdDev);
00218
00219         // Compute the demand distribution for the current class;
00220         lMean += lPriceOriDemMeanFrac;
00221         lStdDev = sqrt (lStdDev * lStdDev +
00222                         lPriceOriDemStdDevFrac * lPriceOriDemStdDevFrac);
00223         lCurrentBC_ptr->setMean (lMean);
00224         lCurrentBC_ptr->setStdDev (lStdDev);
00225
00226         // DEBUG
00227         // STDAIR_LOG_NOTIFICATION ("Class " << lCurrentBC_ptr->describeKey()
00228         //                          << ", mean = " << lMean
00229         //                          << ", stddev = " << lStdDev);
00230
00231         // Update the price-oriented demand
00232         lPriceOriMean *= lSellUp;
00233         lPriceOriStdDev *= lSellUp;
00234       }
00235
00236       // Compute the demand distribution for the highest class (which is the
00237       // "current class")
00238       stdair::BookingClass* lCurrentBC_ptr = *itCurrentClass;
00239       assert (lCurrentBC_ptr != NULL);
00240       BookingClassUnconstrainedDemandVectorMap_T::const_iterator itBCUD =
00241         iClassUncDemMap.find (lCurrentBC_ptr);
00242       assert (itBCUD != iClassUncDemMap.end());
00243       const UnconstrainedDemandVector_T& lDemandVector = itBCUD->second;
00244       double lMean; double lStdDev;
00245       Utilities::computeDistributionParameters(lDemandVector, lMean, lStdDev);
00246
00247       // Compute the demand distribution for the current class;
00248       lMean += lPriceOriMean;
00249       lStdDev = sqrt (lStdDev * lStdDev + lPriceOriStdDev * lPriceOriStdDev);
00250       lCurrentBC_ptr->setMean (lMean);
00251       lCurrentBC_ptr->setStdDev (lStdDev);
00252
00253       // DEBUG
00254       // STDAIR_LOG_NOTIFICATION ("Class " << lCurrentBC_ptr->describeKey()
00255       //                          << ", mean = " << lMean
00256       //                          << ", stddev = " << lStdDev);
00257     }
00258   }
00259
00260   // ////////////////////////////////////////////////////////////////////
00261   void Forecaster::
00262   setRemainingDemandForecastToZero (const stdair::SegmentCabin& iSegmentCabin) {
00263     // Set the demand forecast for all classes to zero.
00264     const stdair::BookingClassList_T& lBCList =
00265       stdair::BomManager::getList<stdair::BookingClass> (iSegmentCabin);
00266     for (stdair::BookingClassList_T::const_iterator itBC = lBCList.begin();
```

```
00267         itBC != lBCList.end(); ++itBC) {
00268       stdair::BookingClass* lBC_ptr = *itBC;
00269       assert (lBC_ptr != NULL);
00270       lBC_ptr->setMean (0.0);
00271     }
00272   }
00273
00274   // ////////////////////////////////////////////////////////////////////
00275   bool Forecaster::
00276   forecastUsingMultiplicativePickUp (stdair::FlightDate& ioFlightDate,
00277                                      const stdair::DateTime_T& iEventTime) {
00278     // Build the offset dates.
00279     const stdair::Date_T& lEventDate = iEventTime.date();
00280
00281     //
00282     bool isSucceeded = true;
00283     const stdair::SegmentDateList_T& lSDList =
00284       stdair::BomManager::getList<stdair::SegmentDate> (ioFlightDate);
00285     for (stdair::SegmentDateList_T::const_iterator itSD = lSDList.begin();
00286          itSD != lSDList.end(); ++itSD) {
00287       stdair::SegmentDate* lSD_ptr = *itSD;
00288       assert (lSD_ptr != NULL);
00289
00290       const stdair::Date_T& lBoardingDate = lSD_ptr->getBoardingDate();
00291       const stdair::DateOffset_T lSegmentDateOffset =
00292         lBoardingDate - lEventDate;
00293       const stdair::DTD_T lSegmentDTD = lSegmentDateOffset.days();
00294
00295       //
00296       const stdair::SegmentCabinList_T& lSCList =
00297         stdair::BomManager::getList<stdair::SegmentCabin> (*lSD_ptr);
00298       for (stdair::SegmentCabinList_T::const_iterator itSC = lSCList.begin();
00299            itSC != lSCList.end(); ++itSC) {
00300         stdair::SegmentCabin* lSC_ptr = *itSC;
00301         assert (lSC_ptr != NULL);
00302
00303         bool isForecasted = forecastUsingMultiplicativePickUp (*lSC_ptr,
00304                                                                lEventDate,
00305                                                                lSegmentDTD);
00306         if (isForecasted == false) {
00307           isSucceeded = false;
00308         }
00309       }
00310     }
00311     return isSucceeded;
00312   }
00313
00314   // ////////////////////////////////////////////////////////////////////
00315   bool Forecaster::
00316   forecastUsingMultiplicativePickUp (stdair::SegmentCabin& ioSegmentCabin,
00317                                      const stdair::Date_T& iEventDate,
00318                                      const stdair::DTD_T& iSegmentDTD) {
00319     // Retrieving the number of anterior similar segments.
00320     const stdair::GuillotineBlock& lGuillotineBlock =
00321       ioSegmentCabin.getGuillotineBlock();
00322     stdair::NbOfSegments_T lNbOfAnteriorSimilarSegments =
00323       GuillotineBlockHelper::
00324       getNbOfSegmentAlreadyPassedThisDTD (lGuillotineBlock, iSegmentDTD,
00325                                           iEventDate) - 1;
00326     // Retrieve the number of departed similar segments.
00327     stdair::NbOfSegments_T lNbOfDepartedSegments =
00328       Utilities::getNbOfDepartedSimilarSegments (ioSegmentCabin, iEventDate);
```

```
00329     // TODO:
00330     if (lNbOfDepartedSegments > 52) {
00331       lNbOfAnteriorSimilarSegments =
00332         lNbOfAnteriorSimilarSegments  - lNbOfDepartedSegments + 52;
00333     }
00334
00335     // DEBUG
00336     STDAIR_LOG_DEBUG ("Nb of anterior similar segments: "
00337                       << lNbOfAnteriorSimilarSegments);
00338
00339     // If the iSegmentDTD is the last DCP or there is no anterior similar
00340     // segment, remaining demand for all classes will be set to zero
00341     stdair::DCPList_T::const_reverse_iterator itLastDCP =
00342       stdair::DEFAULT_DCP_LIST.rbegin();
00343     assert (itLastDCP != stdair::DEFAULT_DCP_LIST.rend());
00344     const stdair::DCP_T& lLastDCP = *itLastDCP;
00345     if (lNbOfAnteriorSimilarSegments < 1.0 || iSegmentDTD <= lLastDCP) {
00346       setRemainingDemandForecastToZero (ioSegmentCabin);
00347       return false;
00348     } else {
00349       // Retrieve the booking figures of the first DCP and consider them
00350       // as unconstrained demand figures.
00351       stdair::DCPList_T::const_iterator itDCP =stdair::DEFAULT_DCP_LIST.begin();
00352       assert (itDCP != stdair::DEFAULT_DCP_LIST.end());
00353       const stdair::DCP_T& lFirstDCP = *itDCP;
00354
00355       // Initialise the unconstrained demand for classes.
00356       stdair::NbOfSegments_T lNbOfUsableSegments =
00357         GuillotineBlockHelper::
00358         getNbOfSegmentAlreadyPassedThisDTD (lGuillotineBlock, lFirstDCP,
00359                                             iEventDate);
00360       // TODO
00361       unsigned short lSize = lNbOfUsableSegments;
00362       if (lNbOfDepartedSegments > 52) {
00363         lSize = lNbOfUsableSegments - lNbOfDepartedSegments + 52;
00364       }
00365
00366       STDAIR_LOG_DEBUG ("Nb of usable similar segments: "
00367                         << lNbOfUsableSegments);
00368
00369       UnconstrainedDemandVector_T lQEquivalentDemandVector (lSize, 0.0);
00370       stdair::NbOfBookings_T lCurrentSegmentQEquivalentDemand = 0.0;
00371       BookingClassUnconstrainedDemandVectorMap_T lBkgClassUncDemVectorMap;
00372       BookingClassUnconstrainedDemandMap_T lCurrentSegmentBkgClassDemMap;
00373       const stdair::BookingClassList_T& lBCList =
00374         stdair::BomManager::getList<stdair::BookingClass> (ioSegmentCabin);
00375       for (stdair::BookingClassList_T::const_iterator itBC = lBCList.begin();
00376            itBC != lBCList.end(); ++itBC) {
00377         stdair::BookingClass* lBC_ptr = *itBC;
00378         assert (lBC_ptr != NULL);
00379
00380         UnconstrainedDemandVector_T lUncDemandVector (lSize, 0.0);
00381         bool insertionSucceeded = lBkgClassUncDemVectorMap.
00382           insert (BookingClassUnconstrainedDemandVectorMap_T::
00383                   value_type (lBC_ptr, lUncDemandVector)).second;
00384         assert (insertionSucceeded == true);
00385         insertionSucceeded =
00386           lCurrentSegmentBkgClassDemMap.
00387           insert (BookingClassUnconstrainedDemandMap_T::
00388                   value_type (lBC_ptr, 0.0)).second;
00389         assert (insertionSucceeded == true);
00390       }
```

```
00391       Detruncator::
00392         retrieveUnconstrainedDemandForFirstDCP (ioSegmentCabin,
00393                                                 lBkgClassUncDemVectorMap,
00394                                                 lQEquivalentDemandVector,
00395                                                 lFirstDCP, lNbOfUsableSegments,
00396                                                 lSize);
00397
00398       // Unconstrain the booking figures.
00399       stdair::DCPList_T::const_iterator itNextDCP = itDCP; ++itNextDCP;
00400       while (itNextDCP != stdair::DEFAULT_DCP_LIST.end()) {
00401         const stdair::DCP_T& lCurrentDCP = *itDCP;
00402         const stdair::DCP_T& lNextDCP = *itNextDCP;
00403         if (lCurrentDCP <= iSegmentDTD) {
00404           break;
00405         }
00406         Detruncator::
00407           unconstrainUsingMultiplicativePickUp (ioSegmentCabin,
00408                                                 lBkgClassUncDemVectorMap,
00409                                                 lQEquivalentDemandVector,
00410                                                 lCurrentDCP-1, lNextDCP,
00411                                                 iEventDate,
00412                                                 lNbOfDepartedSegments);
00413         ++itNextDCP; ++itDCP;
00414       }
00415
00416       // Update the unconstrained demand for all the classes of the current
00417       // segment.
00418       lCurrentSegmentQEquivalentDemand =
00419         lQEquivalentDemandVector.at (lNbOfAnteriorSimilarSegments);
00420       BookingClassUnconstrainedDemandMap_T::iterator itBCUD =
00421         lCurrentSegmentBkgClassDemMap.begin();
00422       for (BookingClassUnconstrainedDemandVectorMap_T::iterator itBCUDV =
00423              lBkgClassUncDemVectorMap.begin();
00424            itBCUDV != lBkgClassUncDemVectorMap.end(); ++itBCUDV, ++itBCUD) {
00425         assert (itBCUD != lCurrentSegmentBkgClassDemMap.end());
00426         assert (itBCUD->first == itBCUDV->first);
00427         stdair::NbOfRequests_T& lUncDem = itBCUD->second;
00428         UnconstrainedDemandVector_T& lUncDemVector = itBCUDV->second;
00429         lUncDem = lUncDemVector.at (lNbOfAnteriorSimilarSegments);
00430       }
00431
00432       // Forecast the remaining demand for all classes
00433       const stdair::DCP_T& lCurrentDTD = *itDCP;
00434       for (; itNextDCP != stdair::DEFAULT_DCP_LIST.end(); ++itNextDCP, ++itDCP){
00435         const stdair::DCP_T& lCurrentDCP = *itDCP;
00436         const stdair::DCP_T& lNextDCP = *itNextDCP;
00437         forecastUsingMultiplicativePickUp (ioSegmentCabin,
00438                                            lBkgClassUncDemVectorMap,
00439                                            lQEquivalentDemandVector,
00440                                            lCurrentDCP-1, lNextDCP, iEventDate,
00441                                            lNbOfAnteriorSimilarSegments,
00442                                            lNbOfDepartedSegments);
00443       }
00444
00445       // Update the remaining demand for all classes
00446       lCurrentSegmentQEquivalentDemand =
00447         lQEquivalentDemandVector.at (lNbOfAnteriorSimilarSegments)
00448         - lCurrentSegmentQEquivalentDemand;
00449       itBCUD = lCurrentSegmentBkgClassDemMap.begin();
00450       for (BookingClassUnconstrainedDemandVectorMap_T::iterator itBCUDV =
00451              lBkgClassUncDemVectorMap.begin();
00452            itBCUDV != lBkgClassUncDemVectorMap.end(); ++itBCUDV, ++itBCUD) {
```

```
00453         assert (itBCUD != lCurrentSegmentBkgClassDemMap.end());
00454         assert (itBCUD->first == itBCUDV->first);
00455         stdair::NbOfRequests_T& lUncDem = itBCUD->second;
00456         UnconstrainedDemandVector_T& lUncDemVector = itBCUDV->second;
00457         lUncDem = lUncDemVector.at (lNbOfAnteriorSimilarSegments) - lUncDem;
00458       }
00459
00460       // Retrieve the FRAT5 coefficient and compute the sell-up coef.
00461       FRAT5Curve_T::const_iterator itFRAT5 =
00462         DEFAULT_CUMULATIVE_FRAT5_CURVE.lower_bound (lCurrentDTD);
00463       assert (itFRAT5 != DEFAULT_CUMULATIVE_FRAT5_CURVE.end());
00464       const double lFRAT5Coef = itFRAT5->second;
00465       const double lSellUpCoef = -log(0.5) / (lFRAT5Coef - 1);
00466
00467       return forecastUsingMultiplicativePickUp(ioSegmentCabin,
00468                                                lCurrentSegmentBkgClassDemMap,
00469                                                lCurrentSegmentQEquivalentDemand,
00470                                                lSellUpCoef);
00471
00472     }
00473   }
00474
00475   // ////////////////////////////////////////////////////////////////////
00476   void Forecaster::forecastUsingMultiplicativePickUp
00477   (const stdair::SegmentCabin& iSegmentCabin,
00478    BookingClassUnconstrainedDemandVectorMap_T& ioBkgClassUncDemMap,
00479    UnconstrainedDemandVector_T& ioQEquivalentDemandVector,
00480    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00481    const stdair::Date_T& iCurrentDate,
00482    const stdair::NbOfSegments_T& iNbOfAnteriorSimilarSegments,
00483    const stdair::NbOfSegments_T& iNbOfDepartedSegments) {
00484
00485     // Retrieve the guillotine block.
00486     const stdair::GuillotineBlock& lGuillotineBlock =
00487       iSegmentCabin.getGuillotineBlock();
00488
00489     // Build the historical booking holders for the product-oriented bookings
00490     // of the casses and the Q-equivalent (price-oriented) bookings of the cabin
00491     const stdair::NbOfSegments_T lNbOfUsableSegments = GuillotineBlockHelper::
00492       getNbOfSegmentAlreadyPassedThisDTD (lGuillotineBlock, iDCPEnd,
00493                                           iCurrentDate);
00494
00495     STDAIR_LOG_DEBUG ("Nb of usable similar segments: "
00496                       << lNbOfUsableSegments);
00497
00498     if (lNbOfUsableSegments > 0) {
00499
00500       // Parse the booking class list and unconstrain historical bookings.
00501       for (BookingClassUnconstrainedDemandVectorMap_T::iterator itBCUDV =
00502              ioBkgClassUncDemMap.begin(); itBCUDV != ioBkgClassUncDemMap.end();
00503            ++itBCUDV) {
00504         stdair::BookingClass* lBC_ptr = itBCUDV->first;
00505         assert (lBC_ptr != NULL);
00506         const stdair::MapKey_T& lBCKey = lBC_ptr->describeKey();
00507         const stdair::BlockIndex_T& lBlockIdx =
00508           lGuillotineBlock.getBlockIndex (lBCKey);
00509         UnconstrainedDemandVector_T& lUncDemVector = itBCUDV->second;
00510
00511         STDAIR_LOG_DEBUG ("Unconstrain product-oriented bookings for "<<lBCKey);
00512         forecastUsingMultiplicativePickUp (lGuillotineBlock, lUncDemVector,
00513                                            iDCPBegin, iDCPEnd,
00514                                            lNbOfUsableSegments, lBlockIdx,
```

```
00515                                           iNbOfAnteriorSimilarSegments,
00516                                           iNbOfDepartedSegments);
00517       }
00518
00519       // Unconstrain the Q-equivalent bookings.
00520       // Retrieve the block index of the segment-cabin.
00521       std::ostringstream lSCMapKey;
00522       lSCMapKey << stdair::DEFAULT_SEGMENT_CABIN_VALUE_TYPE
00523                 << iSegmentCabin.describeKey();
00524       const stdair::BlockIndex_T& lCabinIdx =
00525         lGuillotineBlock.getBlockIndex (lSCMapKey.str());
00526
00527       STDAIR_LOG_DEBUG ("Unconstrain price-oriented bookings");
00528       forecastUsingMultiplicativePickUp (lGuillotineBlock,
00529                                          ioQEquivalentDemandVector,
00530                                          iDCPBegin, iDCPEnd,
00531                                          lNbOfUsableSegments, lCabinIdx,
00532                                          iNbOfAnteriorSimilarSegments,
00533                                          iNbOfDepartedSegments,
00534                                          iSegmentCabin, iCurrentDate);
00535     }
00536   }
00537
00538   // ////////////////////////////////////////////////////////////////////
00539   void Forecaster::forecastUsingMultiplicativePickUp
00540   (const stdair::GuillotineBlock& iGuillotineBlock,
00541    UnconstrainedDemandVector_T& ioUncDemVector,
00542    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00543    const stdair::NbOfSegments_T& iNbOfUsableSegments,
00544    const stdair::BlockIndex_T& iBlockIdx,
00545    const stdair::NbOfSegments_T& iNbOfAnteriorSimilarSegments,
00546    const stdair::NbOfSegments_T& iNbOfDepartedSegments) {
00547     // TODO
00548     stdair::NbOfSegments_T lSegBegin = 0;
00549     if (iNbOfDepartedSegments > 52) {
00550       lSegBegin = iNbOfDepartedSegments - 52;
00551     }
00552     // Retrieve the gross daily booking and availability snapshots.
00553     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lBookingView =
00554       iGuillotineBlock.getConstSegmentCabinDTDRangeProductAndPriceOrientedBooking
      SnapshotView (lSegBegin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00555     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lAvlView =
00556       iGuillotineBlock.getConstSegmentCabinDTDRangeAvailabilitySnapshotView (lSeg
      Begin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00557
00558     // Browse the list of segments and build the historical booking holder.
00559     const stdair::ValueTypeIndexMap_T& lVTIdxMap =
00560       iGuillotineBlock.getValueTypeIndexMap();
00561     const unsigned int lNbOfValueTypes = lVTIdxMap.size();
00562     HistoricalBookingHolder lHBHolder;
00563     std::vector<short> lDataIndexList;
00564     for (short i = 0; i < iNbOfUsableSegments-lSegBegin; ++i) {
00565       stdair::Flag_T lCensorshipFlag = false;
00566       stdair::NbOfBookings_T lNbOfHistoricalBkgs = 0.0;
00567       const short lNbOfDTDs = iDCPBegin - iDCPEnd + 1;
00568
00569       // Parse the DTDs during the period
00570       for (short j = 0; j < lNbOfDTDs; ++j) {
00571         // Check if the data has been censored during this day.
00572         // STDAIR_LOG_DEBUG ("i: " << i << ", NbOfValues: " << lNbOfValueTypes
00573         //                   << ", BlockIdx: " << iBlockIdx << ", j: " << j);
00574         if (lCensorshipFlag == false) {
```

```
00575           if (lAvlView[i*lNbOfValueTypes + iBlockIdx][j] < 1.0) {
00576             lCensorshipFlag = true;
00577           }
00578         }
00579
00580         // Get the bookings of the day.
00581         // STDAIR_LOG_DEBUG ("Bookings of the day: " << lBookingView[i*lNbOfValue
      Types + iBlockIdx][j]);
00582         lNbOfHistoricalBkgs += lBookingView[i*lNbOfValueTypes + iBlockIdx][j];
00583       }
00584
00585       // If there is no booking till now for this class and for this segment,
00586       // there will be no unconstraining process.
00587       stdair::NbOfRequests_T& lUncDemand = ioUncDemVector.at (i);
00588       if (lUncDemand < 1.0) {
00589         lUncDemand += lNbOfHistoricalBkgs;
00590       } else {
00591         double lBkgDemandFactor = lNbOfHistoricalBkgs / lUncDemand;
00592         HistoricalBooking lHistoricalBkg (lBkgDemandFactor, lCensorshipFlag);
00593         lHBHolder.addHistoricalBooking (lHistoricalBkg);
00594         lDataIndexList.push_back (i);
00595       }
00596
00597       // DEBUG
00598       STDAIR_LOG_DEBUG ("Historical bkgs: " << lNbOfHistoricalBkgs
00599                         << ", censored: " << lCensorshipFlag);
00600     }
00601
00602     // DEBUG
00603     STDAIR_LOG_DEBUG ("Unconstrain by multiplicative pick-up using EM");
00604
00605     // Unconstrain the booking figures
00606     Detruncator::unconstrainUsingMultiplicativePickUp (lHBHolder);
00607
00608     // Update the unconstrained demand vector.
00609     short i = 0;
00610     for (std::vector<short>::iterator itIdx = lDataIndexList.begin();
00611          itIdx != lDataIndexList.end(); ++itIdx, ++i) {
00612       short lIdx = *itIdx;
00613       stdair::NbOfRequests_T& lPastDemand = ioUncDemVector.at (lIdx);
00614       const stdair::NbOfRequests_T& lUncDemandFactorOfThisPeriod =
00615         lHBHolder.getUnconstrainedDemand (i);
00616       lPastDemand *= (1+lUncDemandFactorOfThisPeriod);
00617     }
00618
00619     // Update the unconstrained demand for the current segment.
00620     if (lHBHolder.getNbOfFlights() > 0) {
00621       const stdair::NbOfRequests_T& lUncDemandFactorMean =
00622         lHBHolder.getDemandMean();
00623       stdair::NbOfRequests_T& lPastDemand =
00624         ioUncDemVector.at (iNbOfAnteriorSimilarSegments);
00625       lPastDemand *= (1+lUncDemandFactorMean);
00626     }
00627   }
00628
00629   // ////////////////////////////////////////////////////////////////////
00630   void Forecaster::forecastUsingMultiplicativePickUp
00631   (const stdair::GuillotineBlock& iGuillotineBlock,
00632    UnconstrainedDemandVector_T& ioUncDemVector,
00633    const stdair::DCP_T& iDCPBegin, const stdair::DCP_T& iDCPEnd,
00634    const stdair::NbOfSegments_T& iNbOfUsableSegments,
00635    const stdair::BlockIndex_T& iBlockIdx,
```

```
00636    const stdair::NbOfSegments_T& iNbOfAnteriorSimilarSegments,
00637    const stdair::NbOfSegments_T& iNbOfDepartedSegments,
00638    const stdair::SegmentCabin& iSegmentCabin,
00639    const stdair::Date_T& iCurrentDate) {
00640     // TODO
00641     stdair::NbOfSegments_T lSegBegin = 0;
00642     if (iNbOfDepartedSegments > 52) {
00643       lSegBegin = iNbOfDepartedSegments - 52;
00644     }
00645     // Retrieve the gross daily booking and availability snapshots.
00646     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lBookingView =
00647       iGuillotineBlock.getConstSegmentCabinDTDRangeProductAndPriceOrientedBooking
      SnapshotView (lSegBegin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00648     stdair::ConstSegmentCabinDTDRangeSnapshotView_T lAvlView =
00649       iGuillotineBlock.getConstSegmentCabinDTDRangeAvailabilitySnapshotView (lSeg
      Begin, iNbOfUsableSegments -1, iDCPEnd, iDCPBegin);
00650
00651     // Browse the list of segments and build the historical booking holder.
00652     const stdair::ValueTypeIndexMap_T& lVTIdxMap =
00653       iGuillotineBlock.getValueTypeIndexMap();
00654     const unsigned int lNbOfValueTypes = lVTIdxMap.size();
00655     HistoricalBookingHolder lHBHolder;
00656     std::vector<short> lDataIndexList;
00657     for (short i = 0; i < iNbOfUsableSegments-lSegBegin; ++i) {
00658       stdair::Flag_T lCensorshipFlag = false;
00659       stdair::NbOfBookings_T lNbOfHistoricalBkgs = 0.0;
00660       const short lNbOfDTDs = iDCPBegin - iDCPEnd + 1;
00661
00662       // Parse the DTDs during the period
00663       for (short j = 0; j < lNbOfDTDs; ++j) {
00664         // Check if the data has been censored during this day.
00665         // STDAIR_LOG_DEBUG ("i: " << i << ", NbOfValues: " << lNbOfValueTypes
00666         //                   << ", BlockIdx: " << iBlockIdx << ", j: " << j);
00667         if (lCensorshipFlag == false) {
00668           if (lAvlView[i*lNbOfValueTypes + iBlockIdx][j] < 1.0) {
00669             lCensorshipFlag = true;
00670           }
00671         }
00672
00673         // Get the bookings of the day.
00674         // STDAIR_LOG_DEBUG ("Bookings of the day: " << lBookingView[i*lNbOfValue
      Types + iBlockIdx][j]);
00675         lNbOfHistoricalBkgs += lBookingView[i*lNbOfValueTypes + iBlockIdx][j];
00676       }
00677
00678       // If there is no booking till now for this class and for this segment,
00679       // there will be no unconstraining process.
00680       stdair::NbOfRequests_T& lUncDemand = ioUncDemVector.at (i);
00681       if (lUncDemand < 1.0) {
00682         lUncDemand += lNbOfHistoricalBkgs;
00683       } else {
00684         double lBkgDemandFactor = lNbOfHistoricalBkgs / lUncDemand;
00685         HistoricalBooking lHistoricalBkg (lBkgDemandFactor, lCensorshipFlag);
00686         lHBHolder.addHistoricalBooking (lHistoricalBkg);
00687         lDataIndexList.push_back (i);
00688       }
00689
00690       // DEBUG
00691       STDAIR_LOG_DEBUG ("Historical bkgs: " << lNbOfHistoricalBkgs
00692                         << ", censored: " << lCensorshipFlag);
00693     }
00694
```

```
00695     // DEBUG
00696     STDAIR_LOG_DEBUG ("Unconstrain by multiplicative pick-up using EM");
00697
00698     // Unconstrain the booking figures
00699     Detruncator::unconstrainUsingMultiplicativePickUp (lHBHolder);
00700
00701     // Update the unconstrained demand vector.
00702     // LOG
00703     const stdair::SegmentDate& lSegmentDate = stdair::BomManager::
00704       getParent<stdair::SegmentDate, stdair::SegmentCabin> (iSegmentCabin);
00705     const stdair::FlightDate& lFlightDate = stdair::BomManager::
00706       getParent<stdair::FlightDate, stdair::SegmentDate> (lSegmentDate);
00707     const stdair::Date_T& lDepDate = lFlightDate.getDepartureDate();
00708     const boost::gregorian::date_duration lDD = lDepDate - iCurrentDate;
00709     const long lDTD = lDD.days();
00710     stdair::Date_T lRefDate (2012, boost::gregorian::Jan, 01);
00711     short i = 0;
00712     for (std::vector<short>::iterator itIdx = lDataIndexList.begin();
00713          itIdx != lDataIndexList.end(); ++itIdx, ++i) {
00714       short lIdx = *itIdx;
00715       stdair::NbOfRequests_T& lPastDemand = ioUncDemVector.at (lIdx);
00716       const stdair::NbOfRequests_T& lUncDemandFactorOfThisPeriod =
00717         lHBHolder.getUnconstrainedDemand (i);
00718       const double lUncDemThisPeriod =
00719         lPastDemand * lUncDemandFactorOfThisPeriod;
00720       const double lQEBkgThisPeriod =
00721         lPastDemand * lHBHolder.getHistoricalBooking (i);
00722       lPastDemand *= (1+lUncDemandFactorOfThisPeriod);
00723       if (lDepDate > lRefDate) {
00724         const stdair::DateOffset_T lDateOffset (7 *(52 - i) + 420);
00725         const stdair::Date_T lHDate = lDepDate - lDateOffset;
00726         STDAIR_LOG_NOTIFICATION (boost::gregorian::to_iso_string(lDepDate)
00727                                  << ";" << lDTD << ";" << iDCPBegin << ";"
00728                                  << iDCPEnd << ";"
00729                                  << boost::gregorian::to_iso_string (lHDate)
00730                                  << ";" << lUncDemThisPeriod);
00731         STDAIR_LOG_NOTIFICATION (boost::gregorian::to_iso_string(lDepDate)
00732                                  << ";" << lDTD << ";" << iDCPBegin << ";"
00733                                  << iDCPEnd << ";"
00734                                  << boost::gregorian::to_iso_string (lHDate)
00735                                  << ";" << lQEBkgThisPeriod);
00736       }
00737     }
00738
00739     // Update the unconstrained demand for the current segment.
00740     if (lHBHolder.getNbOfFlights() > 0) {
00741       const stdair::NbOfRequests_T& lUncDemandFactorMean =
00742         lHBHolder.getDemandMean();
00743       stdair::NbOfRequests_T& lPastDemand =
00744         ioUncDemVector.at (iNbOfAnteriorSimilarSegments);
00745       lPastDemand *= (1+lUncDemandFactorMean);
00746     }
00747   }
00748
00749   // ////////////////////////////////////////////////////////////////////
00750   bool Forecaster::
00751   forecastUsingMultiplicativePickUp (stdair::SegmentCabin& ioSegmentCabin,
00752                                      const BookingClassUnconstrainedDemandMap_T&
      iClassUncDemMap,
00753                                      const stdair::NbOfRequests_T& iUncDem,
00754                                      const double& iSellUpFactor) {
00755     double lPriceOriMean = iUncDem;
```

```
00756     double lPriceOriStdDev = sqrt (iUncDem);
00757
00758     // DEBUG
00759     STDAIR_LOG_DEBUG ("Price-oriented demand: mean = " << lPriceOriMean
00760                       << ", stddev = " << lPriceOriStdDev);
00761
00762     // Retrieve the classes from low to high and compute the distributions of
00763     // product-oriented and price-oriented demand.
00764     // Retrieve the lowest class.
00765     const stdair::BookingClassList_T& lBCList =
00766       stdair::BomManager::getList<stdair::BookingClass> (ioSegmentCabin);
00767     stdair::BookingClassList_T::const_reverse_iterator itCurrentClass =
00768       lBCList.rbegin();
00769     assert (itCurrentClass != lBCList.rend());
00770     stdair::BookingClassList_T::const_reverse_iterator itNextClass =
00771       itCurrentClass;
00772     ++itNextClass;
00773     // If there is only one class in the cabin, the demand distribution of this
00774     // class is equal to the price-oriented demand distribution of the cabin.
00775     if (itNextClass == lBCList.rend()) {
00776       stdair::BookingClass* lLowestBC_ptr = *itCurrentClass;
00777       lLowestBC_ptr->setMean (lPriceOriMean);
00778       lLowestBC_ptr->setStdDev (lPriceOriStdDev);
00779       if (lPriceOriMean > 0) {
00780         return true;
00781       } else {
00782         return false;
00783       }
00784     } else {
00785       bool isSucceeded = false;
00786       // Compute the demand for higher class using the formula
00787       // Pro_sell_up_from_Q_to_F = e ^ ((y_F/y_Q - 1) * ln (0.5) / (FRAT5 - 1))
00788       for (; itNextClass != lBCList.rend(); ++itCurrentClass, ++itNextClass) {
00789         stdair::BookingClass* lCurrentBC_ptr = *itCurrentClass;
00790         assert (lCurrentBC_ptr != NULL);
00791         const stdair::Yield_T& lCurrentYield = lCurrentBC_ptr->getYield();
00792         stdair::BookingClass* lNextBC_ptr = *itNextClass;
00793         assert (lNextBC_ptr != NULL);
00794         const stdair::Yield_T& lNextYield = lNextBC_ptr->getYield();
00795
00796         // Compute the part of price-oriented demand distributed to the
00797         // current class.
00798         const double lSellUp =
00799           exp ((1.0 - lNextYield/lCurrentYield) * iSellUpFactor);
00800         const double lPriceOriDemMeanFrac = lPriceOriMean * (1.0 - lSellUp);
00801         const double lPriceOriDemStdDevFrac = lPriceOriStdDev * (1.0 - lSellUp);
00802
00803         // Compute the product-oriented demand distribution for the
00804         // current class.
00805         BookingClassUnconstrainedDemandMap_T::const_iterator itBCUD =
00806           iClassUncDemMap.find (lCurrentBC_ptr);
00807         assert (itBCUD != iClassUncDemMap.end());
00808         double lMean = itBCUD->second;
00809         double lStdDev = sqrt (lMean);
00810
00811         // Compute the demand distribution for the current class;
00812         lMean += lPriceOriDemMeanFrac;
00813         lStdDev = sqrt (lStdDev * lStdDev +
00814                         lPriceOriDemStdDevFrac * lPriceOriDemStdDevFrac);
00815         lCurrentBC_ptr->setMean (lMean);
00816         lCurrentBC_ptr->setStdDev (lStdDev);
00817
```

```
00818         if (lMean > 0) {
00819           isSucceeded = true;
00820         }
00821
00822         // DEBUG
00823         STDAIR_LOG_DEBUG ("Class " << lCurrentBC_ptr->describeKey()
00824                           << ", mean = " << lMean
00825                           << ", stddev = " << lStdDev);
00826
00827         // Update the price-oriented demand
00828         lPriceOriMean *= lSellUp;
00829         lPriceOriStdDev *= lSellUp;
00830       }
00831
00832       // Compute the demand distribution for the highest class (which is the
00833       // "current class")
00834       stdair::BookingClass* lCurrentBC_ptr = *itCurrentClass;
00835       assert (lCurrentBC_ptr != NULL);
00836       BookingClassUnconstrainedDemandMap_T::const_iterator itBCUD =
00837         iClassUncDemMap.find (lCurrentBC_ptr);
00838       assert (itBCUD != iClassUncDemMap.end());
00839       double lMean = itBCUD->second;
00840       double lStdDev = sqrt (lMean);
00841
00842       // Compute the demand distribution for the current class;
00843       lMean += lPriceOriMean;
00844       lStdDev = sqrt (lStdDev * lStdDev + lPriceOriStdDev * lPriceOriStdDev);
00845       lCurrentBC_ptr->setMean (lMean);
00846       lCurrentBC_ptr->setStdDev (lStdDev);
00847
00848       if (lMean > 0) {
00849         isSucceeded = true;
00850       }
00851
00852       // DEBUG
00853       STDAIR_LOG_DEBUG ("Class " << lCurrentBC_ptr->describeKey()
00854                         << ", mean = " << lMean
00855                         << ", stddev = " << lStdDev);
00856       return isSucceeded;
00857     }
00858   }
00859
00860 }
```

43.120 rmol/command/Forecaster.hpp File Reference

```
#include <map>
#include <stdair/stdair_inventory_types.hpp>
#include <rmol/RMOL_Types.hpp>
```

Classes

- class RMOL::Forecaster

Namespaces

- namespace stdair
- namespace RMOL

43.121 Forecaster.hpp

```
00001 #ifndef __RMOL_COMMAND_FORECASTER_HPP
00002 #define __RMOL_COMMAND_FORECASTER_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <map>
00009 // StdAir
00010 #include <stdair/stdair_inventory_types.hpp>
00011 // RMOL
00012 #include <rmol/RMOL_Types.hpp>
00013
00014 // Forward declarations
00015 namespace stdair {
00016   class FlightDate;
00017   class SegmentCabin;
00018   class GuillotineBlock;
00019 }
00020
00021 namespace RMOL {
00023   class Forecaster {
00024   public:
00028     static bool forecastUsingAdditivePickUp (stdair::FlightDate&,
00029                                              const stdair::DateTime_T&);
00030
00034     static bool forecastUsingMultiplicativePickUp (stdair::FlightDate&,
00035                                                    const stdair::DateTime_T&);
00036
00037
00038   private:
00042     static bool forecastUsingAdditivePickUp (stdair::SegmentCabin&,
00043                                              const stdair::DCPList_T&,
00044                                              const stdair::Date_T&);
00045
00050     static void forecastUsingAdditivePickUp (stdair::SegmentCabin&,
00051                                              const
      BookingClassUnconstrainedDemandVectorMap_T&, const UnconstrainedDemandVector_T&,
      const double&);
00052
00056     static bool forecastUsingMultiplicativePickUp (stdair::SegmentCabin&,
00057                                                    const stdair::Date_T&,
00058                                                    const stdair::DTD_T&);
00062     static void forecastUsingMultiplicativePickUp(const stdair::SegmentCabin&,
00063
      BookingClassUnconstrainedDemandVectorMap_T&,
00064                                                   UnconstrainedDemandVector_T&,
00065                                                   const stdair::DCP_T&,
00066                                                   const stdair::DCP_T&,
00067                                                   const stdair::Date_T&,
00068                                                   const stdair::NbOfSegments_T&,
00069                                                   const stdair::NbOfSegments_T&);
```

```
00070
00074     static void forecastUsingMultiplicativePickUp(const stdair::GuillotineBlock&,

00075                                                    UnconstrainedDemandVector_T&,
00076                                                    const stdair::DCP_T&,
00077                                                    const stdair::DCP_T&,
00078                                                    const stdair::NbOfSegments_T&,
00079                                                    const stdair::BlockIndex_T&,
00080                                                    const stdair::NbOfSegments_T&,
00081                                                    const stdair::NbOfSegments_T&);

00082
00086     static void forecastUsingMultiplicativePickUp(const stdair::GuillotineBlock&,

00087                                                    UnconstrainedDemandVector_T&,
00088                                                    const stdair::DCP_T&,
00089                                                    const stdair::DCP_T&,
00090                                                    const stdair::NbOfSegments_T&,
00091                                                    const stdair::BlockIndex_T&,
00092                                                    const stdair::NbOfSegments_T&,
00093                                                    const stdair::NbOfSegments_T&,
00094                                                    const stdair::SegmentCabin&,
00095                                                    const stdair::Date_T&);
00096
00101     static bool forecastUsingMultiplicativePickUp(stdair::SegmentCabin&,
00102                                                    const
      BookingClassUnconstrainedDemandMap_T&,
00103                                                    const stdair::NbOfRequests_T&,
00104                                                    const double&);
00105
00109     static void setRemainingDemandForecastToZero (const stdair::SegmentCabin&);
00110   };
00111 }
00112 #endif // __RMOL_COMMAND_FORECASTER_HPP
```

43.122 rmol/command/InventoryParser.cpp File Reference

```
#include <sstream>
#include <fstream>
#include <cassert>
#include <stdair/stdair_inventory_types.hpp>
#include <stdair/stdair_maths_types.hpp>
#include <stdair/stdair_exceptions.hpp>
#include <stdair/basic/BasConst_DefaultObject.hpp>
#include <stdair/basic/BasConst_Inventory.hpp>
#include <stdair/basic/BasFileMgr.hpp>
#include <stdair/bom/BomRetriever.hpp>
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/BomRoot.hpp>
#include <stdair/bom/Inventory.hpp>
```

```
#include <stdair/bom/FlightDate.hpp>
#include <stdair/bom/SegmentDate.hpp>
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/bom/LegDate.hpp>
#include <stdair/bom/LegCabin.hpp>
#include <stdair/bom/BookingClass.hpp>
#include <stdair/bom/VirtualClassStruct.hpp>
#include <stdair/factory/FacBom.hpp>
#include <stdair/factory/FacBomManager.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/command/InventoryParser.hpp>
```

Namespaces

- namespace RMOL

43.123 InventoryParser.cpp

```
00001 // ////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // ////////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <sstream>
00006 #include <fstream>
00007 #include <cassert>
00008 // StdAir
00009 #include <stdair/stdair_inventory_types.hpp>
00010 #include <stdair/stdair_maths_types.hpp>
00011 #include <stdair/stdair_exceptions.hpp>
00012 #include <stdair/basic/BasConst_DefaultObject.hpp>
00013 #include <stdair/basic/BasConst_Inventory.hpp>
00014 #include <stdair/basic/BasFileMgr.hpp>
00015 #include <stdair/bom/BomRetriever.hpp>
00016 #include <stdair/bom/BomManager.hpp>
00017 #include <stdair/bom/BomRoot.hpp>
00018 #include <stdair/bom/Inventory.hpp>
00019 #include <stdair/bom/FlightDate.hpp>
00020 #include <stdair/bom/SegmentDate.hpp>
00021 #include <stdair/bom/SegmentCabin.hpp>
00022 #include <stdair/bom/LegDate.hpp>
00023 #include <stdair/bom/LegCabin.hpp>
00024 #include <stdair/bom/BookingClass.hpp>
00025 #include <stdair/bom/VirtualClassStruct.hpp>
00026 #include <stdair/factory/FacBom.hpp>
00027 #include <stdair/factory/FacBomManager.hpp>
00028 #include <stdair/service/Logger.hpp>
00029 // RMOL
00030 #include <rmol/command/InventoryParser.hpp>
00031
00032 namespace RMOL {
```

```
00033
00034   // ////////////////////////////////////////////////////////////////////
00035   stdair::LegCabin& InventoryParser::
00036   getSampleLegCabin (stdair::BomRoot& ioBomRoot) {
00037     stdair::LegCabin* oLegCabin_ptr = NULL;
00038
00039     // Retrieve the Inventory
00040     const stdair::Inventory* lInventory_ptr = stdair::BomRetriever::
00041       retrieveInventoryFromKey (ioBomRoot, stdair::DEFAULT_AIRLINE_CODE);
00042
00043     if (lInventory_ptr == NULL) {
00044       std::ostringstream oStr;
00045       oStr << "The inventory corresponding to the '"
00046            << stdair::DEFAULT_AIRLINE_CODE << "' airline can not be found";
00047       throw stdair::ObjectNotFoundException (oStr.str());
00048     }
00049
00050     // Retrieve the FlightDate
00051     const stdair::FlightDate* lFlightDate_ptr = stdair::BomRetriever::
00052       retrieveFlightDateFromKey (*lInventory_ptr, stdair::DEFAULT_FLIGHT_NUMBER,
00053                                  stdair::DEFAULT_DEPARTURE_DATE);
00054
00055     if (lFlightDate_ptr == NULL) {
00056       std::ostringstream oStr;
00057       oStr << "The flight-date corresponding to ("
00058            << stdair::DEFAULT_FLIGHT_NUMBER << ", "
00059            << stdair::DEFAULT_DEPARTURE_DATE << ") can not be found";
00060       throw stdair::ObjectNotFoundException (oStr.str());
00061     }
00062
00063     // Retrieve the LegDate
00064     const stdair::LegDateKey lLegDateKey (stdair::DEFAULT_ORIGIN);
00065     const stdair::LegDate* lLegDate_ptr =
00066       lFlightDate_ptr->getLegDate (lLegDateKey);
00067
00068     if (lLegDate_ptr == NULL) {
00069       std::ostringstream oStr;
00070       oStr << "The leg-date corresponding to the '"
00071            << stdair::DEFAULT_ORIGIN << "' origin can not be found";
00072       throw stdair::ObjectNotFoundException (oStr.str());
00073     }
00074
00075     // Retrieve the LegCabin
00076     const stdair::LegCabinKey lLegCabinKey (stdair::DEFAULT_CABIN_CODE);
00077     oLegCabin_ptr = lLegDate_ptr->getLegCabin (lLegCabinKey);
00078
00079     if (oLegCabin_ptr == NULL) {
00080       std::ostringstream oStr;
00081       oStr << "The leg-cabin corresponding to the '"
00082            << stdair::DEFAULT_CABIN_CODE << "' cabin code can not be found";
00083       throw stdair::ObjectNotFoundException (oStr.str());
00084     }
00085
00086     assert (oLegCabin_ptr != NULL);
00087     return *oLegCabin_ptr;
00088   }
00089
00090   // ////////////////////////////////////////////////////////////////////
00091   stdair::SegmentCabin& InventoryParser::
00092   getSampleSegmentCabin (stdair::BomRoot& ioBomRoot) {
00093     stdair::SegmentCabin* oSegmentCabin_ptr = NULL;
00094
```

```
00095     // Retrieve the segment-cabin.
00096     const stdair::InventoryList_T& lInventoryList =
00097       stdair::BomManager::getList<stdair::Inventory> (ioBomRoot);
00098     stdair::InventoryList_T::const_iterator itInv = lInventoryList.begin();
00099     assert (itInv != lInventoryList.end());
00100     const stdair::Inventory* lInventory_ptr = *itInv;
00101     assert (lInventory_ptr != NULL);
00102
00103     const stdair::FlightDateList_T& lFlightDateList =
00104       stdair::BomManager::getList<stdair::FlightDate> (*lInventory_ptr);
00105     stdair::FlightDateList_T::const_iterator itFD = lFlightDateList.begin();
00106     assert (itFD != lFlightDateList.end());
00107     const stdair::FlightDate* lFD_ptr = *itFD;
00108     assert (lFD_ptr != NULL);
00109
00110     const stdair::SegmentDateList_T& lSegmentDateList =
00111       stdair::BomManager::getList<stdair::SegmentDate> (*lFD_ptr);
00112     stdair::SegmentDateList_T::const_iterator itSD = lSegmentDateList.begin();
00113     assert (itSD != lSegmentDateList.end());
00114     const stdair::SegmentDate* lSD_ptr = *itSD;
00115     assert (lSD_ptr != NULL);
00116
00117     const stdair::SegmentCabinList_T& lSegmentCabinList =
00118       stdair::BomManager::getList<stdair::SegmentCabin> (*lSD_ptr);
00119     stdair::SegmentCabinList_T::const_iterator itSegmentCabin =
00120       lSegmentCabinList.begin();
00121     assert (itSegmentCabin != lSegmentCabinList.end());
00122     oSegmentCabin_ptr = *itSegmentCabin;
00123
00124     assert (oSegmentCabin_ptr != NULL);
00125
00126     return *oSegmentCabin_ptr;
00127   }
00128
00129   // ////////////////////////////////////////////////////////////////////
00130   bool InventoryParser::
00131   parseInputFileAndBuildBom (const std::string& iInputFileName,
00132                              stdair::BomRoot& ioBomRoot) {
00133     bool hasReadBeenSuccessful = false;
00134
00135     // Check that the file path given as input corresponds to an actual file
00136     const bool doesExistAndIsReadable =
00137       stdair::BasFileMgr::doesExistAndIsReadable (iInputFileName);
00138     if (doesExistAndIsReadable == false) {
00139       std::ostringstream oMessage;
00140       oMessage << "The input file, '" << iInputFileName
00141                << "', can not be retrieved on the file-system";
00142       throw stdair::FileNotFoundException (oMessage.str());
00143     }
00144
00145     // Retrieve the (sample) leg-cabin
00146     stdair::LegCabin& lLegCabin = getSampleLegCabin (ioBomRoot);
00147
00148     // Retrieve the (sample) leg-cabin
00149     stdair::SegmentCabin& lSegmentCabin = getSampleSegmentCabin (ioBomRoot);
00150
00151     // Open the input file
00152     std::ifstream inputFile (iInputFileName.c_str());
00153     if (! inputFile) {
00154       STDAIR_LOG_ERROR ("Can not open input file '" << iInputFileName << "'");
00155       throw new stdair::FileNotFoundException ("Can not open input file '"
00156                                                + iInputFileName + "'");
```

```
00157     }
00158
00159     char buffer[80];
00160     double dval;
00161     short i = 1;
00162     bool hasAllPArams = true;
00163     stdair::Yield_T lYield;
00164     stdair::MeanValue_T lMean;
00165     stdair::StdDevValue_T lStdDev;
00166     stdair::BookingClassKey lBCKey (stdair::DEFAULT_CLASS_CODE);
00167
00168     while (inputFile.getline (buffer, sizeof (buffer), ';')) {
00169       std::istringstream iStringStr (buffer);
00170
00171       if (i == 1) {
00172         hasAllPArams = true;
00173       }
00174
00175       if (iStringStr >> dval) {
00176         if (i == 1) {
00177           lYield = dval;
00178           // std::cout << "Yield[" << i << "] = '" << dval << "'" << std::endl;
00179
00180         } else if (i == 2) {
00181           lMean = dval;
00182           // std::cout << "Mean[" << i << "] = '" << dval << "'" << std::endl;
00183
00184         } else if (i == 3) {
00185           lStdDev = dval;
00186           //std::cout << "stdDev[" << i << "] = '" << dval << "'" << std::endl;
00187           i = 0;
00188         }
00189         i++;
00190
00191       } else {
00192         hasAllPArams = false;
00193       }
00194
00195       if (hasAllPArams && i == 1) {
00196         stdair::BookingClass& lBookingClass =
00197           stdair::FacBom<stdair::BookingClass>::instance().create (lBCKey);
00198         stdair::FacBomManager::addToList (lSegmentCabin, lBookingClass);
00199         lBookingClass.setYield (lYield);
00200         lBookingClass.setMean (lMean);
00201         lBookingClass.setStdDev (lStdDev);
00202
00203         stdair::VirtualClassStruct lVirtualClass (lBookingClass);
00204         lVirtualClass.setYield (lYield);
00205         lVirtualClass.setMean (lMean);
00206         lVirtualClass.setStdDev (lStdDev);
00207         lLegCabin.addVirtualClass (lVirtualClass);
00208       }
00209     }
00210
00211     //
00212     if (!inputFile.eof()) {
00213       STDAIR_LOG_ERROR ("Problem when reading input file '" << iInputFileName
00214                         << "'");
00215       return hasReadBeenSuccessful;
00216     }
00217
00218     //
```

```
00219     hasReadBeenSuccessful = true;
00220     return hasReadBeenSuccessful;
00221   }
00222
00223 }
```

43.124 rmol/command/InventoryParser.hpp File Reference

```
#include <string>
#include <stdair/command/CmdAbstract.hpp>
```

Classes

- class RMOL::InventoryParser

  Class filling the virtual class list (representing a list of classes/buckets) from a given input inventory.

Namespaces

- namespace stdair
- namespace RMOL

43.125 InventoryParser.hpp

```
00001 #ifndef __RMOL_CMD_INVENTORYPARSER_HPP
00002 #define __RMOL_CMD_INVENTORYPARSER_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <string>
00009 // StdAir
00010 #include <stdair/command/CmdAbstract.hpp>
00011
00013 namespace stdair {
00014   class BomRoot;
00015   class LegCabin;
00016   class SegmentCabin;
00017 }
00018
00019 namespace RMOL {
00020
00025   class InventoryParser : public stdair::CmdAbstract {
00026   public:
00032     static stdair::LegCabin& getSampleLegCabin (stdair::BomRoot&);
00033
00039     static stdair::SegmentCabin& getSampleSegmentCabin (stdair::BomRoot&);
00040
00048     static bool parseInputFileAndBuildBom (const std::string& iInputFileName,
00049                                            stdair::BomRoot&);
00050   };
00051 }
```

```
00052 #endif // __RMOL_CMD_INVENTORYPARSER_HPP
```

43.126 rmol/command/Optimiser.cpp File Reference

```
#include <cassert>
#include <sstream>
#include <stdair/basic/BasConst_General.hpp>
#include <stdair/basic/RandomGeneration.hpp>
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/FlightDate.hpp>
#include <stdair/bom/LegDate.hpp>
#include <stdair/bom/SegmentDate.hpp>
#include <stdair/bom/LegCabin.hpp>
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/bom/FareFamily.hpp>
#include <stdair/bom/BookingClass.hpp>
#include <stdair/service/Logger.hpp>
#include <rmol/bom/MCOptimiser.hpp>
#include <rmol/bom/Emsr.hpp>
#include <rmol/bom/DPOptimiser.hpp>
#include <rmol/command/Optimiser.hpp>
```

Namespaces

- namespace RMOL

43.127 Optimiser.cpp

```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 #include <sstream>
00007 // StdAir
00008 #include <stdair/basic/BasConst_General.hpp>
00009 #include <stdair/basic/RandomGeneration.hpp>
00010 #include <stdair/bom/BomManager.hpp>
00011 #include <stdair/bom/FlightDate.hpp>
00012 #include <stdair/bom/LegDate.hpp>
00013 #include <stdair/bom/SegmentDate.hpp>
00014 #include <stdair/bom/LegCabin.hpp>
00015 #include <stdair/bom/SegmentCabin.hpp>
```

```
00016 #include <stdair/bom/FareFamily.hpp>
00017 #include <stdair/bom/BookingClass.hpp>
00018 #include <stdair/service/Logger.hpp>
00019 // RMOL
00020 #include <rmol/bom/MCOptimiser.hpp>
00021 #include <rmol/bom/Emsr.hpp>
00022 #include <rmol/bom/DPOptimiser.hpp>
00023 #include <rmol/command/Optimiser.hpp>
00024
00025 namespace RMOL {
00026
00027   // ////////////////////////////////////////////////////////////////////
00028   void Optimiser::
00029   optimalOptimisationByMCIntegration (const int K,
00030                                       stdair::LegCabin& ioLegCabin) {
00031     // Retrieve the segment-cabin
00032     const stdair::SegmentCabinList_T lSegmentCabinList =
00033       stdair::BomManager::getList<stdair::SegmentCabin> (ioLegCabin);
00034     stdair::SegmentCabinList_T::const_iterator itSC = lSegmentCabinList.begin();
00035     assert (itSC != lSegmentCabinList.end());
00036     const stdair::SegmentCabin* lSegmentCabin_ptr = *itSC;
00037     assert (lSegmentCabin_ptr != NULL);
00038
00039     // Retrieve the class list.
00040     const stdair::BookingClassList_T lBookingClassList =
00041       stdair::BomManager::getList<stdair::BookingClass> (*lSegmentCabin_ptr);
00042     stdair::RandomGeneration lSeedGenerator (stdair::DEFAULT_RANDOM_SEED);
00043
00044     // Generate the demand samples for the booking classes.
00045     for (stdair::BookingClassList_T::const_iterator itBC =
00046            lBookingClassList.begin(); itBC != lBookingClassList.end(); ++itBC) {
00047       stdair::RandomSeed_T lRandomSeed =
00048         lSeedGenerator.generateUniform01 () * 1e9;
00049       stdair::BookingClass* lBookingClass_ptr = *itBC;
00050       assert (lBookingClass_ptr != NULL);
00051       lBookingClass_ptr->generateDemandSamples (K, lRandomSeed);
00052
00053       // DEBUG
00054       //STDAIR_LOG_DEBUG ("Generating " << K << " demand samples for the class "
00055       //                  << lBookingClass_ptr->describeKey());
00056     }
00057
00058     // Call the class performing the actual algorithm
00059     MCOptimiser::optimalOptimisationByMCIntegration (ioLegCabin);
00060   }
00061
00062   // ////////////////////////////////////////////////////////////////////
00063   void Optimiser::optimalOptimisationByDP (stdair::LegCabin& ioLegCabin) {
00064     DPOptimiser::optimalOptimisationByDP (ioLegCabin);
00065   }
00066
00067   // ////////////////////////////////////////////////////////////////////
00068   void Optimiser::heuristicOptimisationByEmsr (stdair::LegCabin& ioLegCabin) {
00069     Emsr::heuristicOptimisationByEmsr (ioLegCabin);
00070   }
00071
00072   // ////////////////////////////////////////////////////////////////////
00073   void Optimiser::heuristicOptimisationByEmsrA (stdair::LegCabin& ioLegCabin) {
00074     Emsr::heuristicOptimisationByEmsrA (ioLegCabin);
00075   }
00076
00077   // ////////////////////////////////////////////////////////////////////
```

```
00078   void Optimiser::heuristicOptimisationByEmsrB (stdair::LegCabin& ioLegCabin) {
00079     Emsr::heuristicOptimisationByEmsrB (ioLegCabin);
00080   }
00081
00082   // ////////////////////////////////////////////////////////////////////
00083   void Optimiser::optimise (stdair::FlightDate& ioFlightDate) {
00084     // Browse the leg-cabin list and build the virtual class list for
00085     // each cabin.
00086     const stdair::LegDateList_T& lLDList =
00087       stdair::BomManager::getList<stdair::LegDate> (ioFlightDate);
00088     for (stdair::LegDateList_T::const_iterator itLD = lLDList.begin();
00089          itLD != lLDList.end(); ++itLD) {
00090       stdair::LegDate* lLD_ptr = *itLD;
00091       assert (lLD_ptr != NULL);
00092
00093       //
00094       const stdair::LegCabinList_T& lLCList =
00095         stdair::BomManager::getList<stdair::LegCabin> (*lLD_ptr);
00096       for (stdair::LegCabinList_T::const_iterator itLC = lLCList.begin();
00097            itLC != lLCList.end(); ++itLC) {
00098         stdair::LegCabin* lLC_ptr = *itLC;
00099         assert (lLC_ptr != NULL);
00100
00101         // Build the virtual class list.
00102         buildVirtualClassListForLegBasedOptimisation (*lLC_ptr);
00103
00104         // Optimise using Monte-Carlo Integration method.
00105         optimalOptimisationByMCIntegration (10000, *lLC_ptr);
00106       }
00107     }
00108   }
00109
00110   // ////////////////////////////////////////////////////////////////////
00111   void Optimiser::
00112   buildVirtualClassListForLegBasedOptimisation (stdair::LegCabin& ioLegCabin) {
00113     // The map holding all virtual classes to be created.
00114     stdair::VirtualClassMap_T lVirtualClassMap;
00115
00116     // Retrieve the segment-cabin
00117     const stdair::SegmentCabinList_T lSegmentCabinList =
00118       stdair::BomManager::getList<stdair::SegmentCabin> (ioLegCabin);
00119     stdair::SegmentCabinList_T::const_iterator itSC = lSegmentCabinList.begin();
00120     assert (itSC != lSegmentCabinList.end());
00121     const stdair::SegmentCabin* lSegmentCabin_ptr = *itSC;
00122     assert (lSegmentCabin_ptr != NULL);
00123
00124     // Retrieve the class list.
00125     const stdair::BookingClassList_T lBookingClassList =
00126       stdair::BomManager::getList<stdair::BookingClass> (*lSegmentCabin_ptr);
00127
00128     // Generate the demand samples for the booking classes.
00129     for (stdair::BookingClassList_T::const_iterator itBC =
00130            lBookingClassList.begin(); itBC != lBookingClassList.end(); ++itBC) {
00131       stdair::BookingClass* lBookingClass_ptr = *itBC;
00132       assert (lBookingClass_ptr != NULL);
00133
00134       const stdair::Yield_T& lYield = lBookingClass_ptr->getYield();
00135       stdair::VirtualClassStruct lVirtualClass (*lBookingClass_ptr);
00136       lVirtualClass.setYield (lYield);
00137       lVirtualClass.setMean (lBookingClass_ptr->getMean());
00138       lVirtualClass.setStdDev (lBookingClass_ptr->getStdDev());
00139
```

```
00140       lVirtualClassMap.insert (stdair::VirtualClassMap_T::
00141                                value_type (lYield, lVirtualClass));
00142     }
00143
00144     // Browse the virtual class map from high to low yield.
00145     ioLegCabin.emptyVirtualClassList();
00146     for (stdair::VirtualClassMap_T::reverse_iterator itVC =
00147            lVirtualClassMap.rbegin(); itVC != lVirtualClassMap.rend(); ++itVC) {
00148       stdair::VirtualClassStruct& lVC = itVC->second;
00149
00150       ioLegCabin.addVirtualClass (lVC);
00151     }
00152   }
00153
00154   // ////////////////////////////////////////////////////////////////////
00155   double Optimiser::
00156   optimiseUsingOnDForecast (stdair::FlightDate& ioFlightDate,
00157                             const bool& iReduceFluctuations) {
00158     double lMaxBPVariation = 0.0;
00159     // Check if the flight date holds a list of leg dates.
00160     // If so, retieve it and optimise the cabins.
00161     if (stdair::BomManager::hasList<stdair::LegDate> (ioFlightDate)) {
00162       STDAIR_LOG_DEBUG ("Optimisation for the flight date: "
00163                         << ioFlightDate.toString());
00164       const stdair::LegDateList_T& lLDList =
00165         stdair::BomManager::getList<stdair::LegDate> (ioFlightDate);
00166       for (stdair::LegDateList_T::const_iterator itLD = lLDList.begin();
00167            itLD != lLDList.end(); ++itLD) {
00168         stdair::LegDate* lLD_ptr = *itLD;
00169         assert (lLD_ptr != NULL);
00170
00171         //
00172         const stdair::LegCabinList_T& lLCList =
00173           stdair::BomManager::getList<stdair::LegCabin> (*lLD_ptr);
00174         for (stdair::LegCabinList_T::const_iterator itLC = lLCList.begin();
00175              itLC != lLCList.end(); ++itLC) {
00176           stdair::LegCabin* lLC_ptr = *itLC;
00177           assert (lLC_ptr != NULL);
00178           MCOptimiser::optimisationByMCIntegration (*lLC_ptr);
00179           const stdair::BidPrice_T& lCurrentBidPrice =
00180             lLC_ptr->getCurrentBidPrice();
00181           const stdair::BidPrice_T& lPreviousBidPrice =
00182             lLC_ptr->getPreviousBidPrice();
00183           assert (lPreviousBidPrice != 0);
00184           const double lBPVariation =
00185             std::abs((lCurrentBidPrice - lPreviousBidPrice)/lPreviousBidPrice);
00186           lMaxBPVariation = std::max(lMaxBPVariation, lBPVariation);
00187         }
00188       }
00189     }
00190     return lMaxBPVariation;
00191   }
00192
00193 }
```

43.128 rmol/command/Optimiser.hpp File Reference

```
#include <rmol/RMOL_Types.hpp>
```

Classes

- class RMOL::Optimiser

Namespaces

- namespace stdair
- namespace RMOL

43.129 Optimiser.hpp

```
00001 #ifndef __RMOL_COMMAND_OPTIMISER_HPP
00002 #define __RMOL_COMMAND_OPTIMISER_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // RMOL
00008 #include <rmol/RMOL_Types.hpp>
00009
00010 // Forward declarations
00011 namespace stdair {
00012   class FlightDate;
00013   class LegCabin;
00014 }
00015
00016 namespace RMOL {
00018   class Optimiser {
00019   public:
00020
00032     static void optimalOptimisationByMCIntegration (const int K,
00033                                                     stdair::LegCabin&);
00034
00038     static void optimalOptimisationByDP (stdair::LegCabin&);
00039
00043     static void heuristicOptimisationByEmsr (stdair::LegCabin&);
00044
00048     static void heuristicOptimisationByEmsrA (stdair::LegCabin&);
00049
00053     static void heuristicOptimisationByEmsrB (stdair::LegCabin&);
00054
00058     static void optimise (stdair::FlightDate&);
00059
00063     static void buildVirtualClassListForLegBasedOptimisation(stdair::LegCabin&);
00064
00066     static double optimiseUsingOnDForecast (stdair::FlightDate&,
00067                                             const bool& iReduceFluctuations = fal
      se);
00068
00069   };
00070 }
00071 #endif // __RMOL_COMMAND_OPTIMISER_HPP
```

43.130 rmol/config/rmol-paths.hpp File Reference

Defines

- #define PACKAGE "rmol"
- #define PACKAGE_NAME "RMOL"
- #define PACKAGE_VERSION "0.25.0"
- #define PREFIXDIR "/usr"
- #define EXEC_PREFIX "/usr"
- #define BINDIR "/usr/bin"
- #define LIBDIR "/usr/lib64"
- #define LIBEXECDIR "/usr/libexec"
- #define SBINDIR "/usr/sbin"
- #define SYSCONFDIR "/usr/etc"
- #define INCLUDEDIR "/usr/include"
- #define DATAROOTDIR "/usr/share"
- #define DATADIR "/usr/share"
- #define DOCDIR "/usr/share/doc/rmol-0.25.0"
- #define MANDIR "/usr/share/man"
- #define INFODIR "/usr/share/info"
- #define HTMLDIR "/usr/share/doc/rmol-0.25.0/html"
- #define PDFDIR "/usr/share/doc/rmol-0.25.0/html"
- #define STDAIR_SAMPLE_DIR "/usr/share/stdair/samples"

43.130.1 Define Documentation

43.130.1.1 #define PACKAGE "rmol"

Definition at line 4 of file rmol-paths.hpp.

43.130.1.2 #define PACKAGE_NAME "RMOL"

Definition at line 5 of file rmol-paths.hpp.

Referenced by readConfiguration().

43.130.1.3 #define PACKAGE_VERSION "0.25.0"

Definition at line 6 of file rmol-paths.hpp.

Referenced by readConfiguration().

43.130.1.4 #define PREFIXDIR "/usr"

Definition at line 7 of file rmol-paths.hpp.

Referenced by readConfiguration().

43.130.1.5 #define EXEC_PREFIX "/usr"

Definition at line 8 of file rmol-paths.hpp.

43.130.1.6 #define BINDIR "/usr/bin"

Definition at line 9 of file rmol-paths.hpp.

43.130.1.7 #define LIBDIR "/usr/lib64"

Definition at line 10 of file rmol-paths.hpp.

43.130.1.8 #define LIBEXECDIR "/usr/libexec"

Definition at line 11 of file rmol-paths.hpp.

43.130.1.9 #define SBINDIR "/usr/sbin"

Definition at line 12 of file rmol-paths.hpp.

43.130.1.10 #define SYSCONFDIR "/usr/etc"

Definition at line 13 of file rmol-paths.hpp.

43.130.1.11 #define INCLUDEDIR "/usr/include"

Definition at line 14 of file rmol-paths.hpp.

43.130.1.12 #define DATAROOTDIR "/usr/share"

Definition at line 15 of file rmol-paths.hpp.

43.130.1.13 #define DATADIR "/usr/share"

Definition at line 16 of file rmol-paths.hpp.

43.130.1.14 #define DOCDIR "/usr/share/doc/rmol-0.25.0"

Definition at line 17 of file rmol-paths.hpp.

43.130.1.15 #define MANDIR "/usr/share/man"

Definition at line 18 of file rmol-paths.hpp.

43.130.1.16 #define INFODIR "/usr/share/info"

Definition at line 19 of file rmol-paths.hpp.

43.130.1.17 #define HTMLDIR "/usr/share/doc/rmol-0.25.0/html"

Definition at line 20 of file rmol-paths.hpp.

43.130.1.18 #define PDFDIR "/usr/share/doc/rmol-0.25.0/html"

Definition at line 21 of file rmol-paths.hpp.

43.130.1.19 #define STDAIR_SAMPLE_DIR "/usr/share/stdair/samples"

Definition at line 22 of file rmol-paths.hpp.

43.131 rmol-paths.hpp

```
00001 #ifndef __RMOL_PATHS_HPP__
00002 #define __RMOL_PATHS_HPP__
00003
00004 #define PACKAGE "rmol"
00005 #define PACKAGE_NAME "RMOL"
00006 #define PACKAGE_VERSION "0.25.0"
00007 #define PREFIXDIR "/usr"
00008 #define EXEC_PREFIX "/usr"
00009 #define BINDIR "/usr/bin"
00010 #define LIBDIR "/usr/lib64"
00011 #define LIBEXECDIR "/usr/libexec"
00012 #define SBINDIR "/usr/sbin"
00013 #define SYSCONFDIR "/usr/etc"
00014 #define INCLUDEDIR "/usr/include"
00015 #define DATAROOTDIR "/usr/share"
00016 #define DATADIR "/usr/share"
00017 #define DOCDIR "/usr/share/doc/rmol-0.25.0"
00018 #define MANDIR "/usr/share/man"
00019 #define INFODIR "/usr/share/info"
00020 #define HTMLDIR "/usr/share/doc/rmol-0.25.0/html"
00021 #define PDFDIR "/usr/share/doc/rmol-0.25.0/html"
00022 #define STDAIR_SAMPLE_DIR "/usr/share/stdair/samples"
00023
00024 #endif // __RMOL_PATHS_HPP__
```

43.132 rmol/factory/FacRmolServiceContext.cpp File Reference

```
#include <cassert>
#include <stdair/service/FacSupervisor.hpp>
#include <rmol/factory/FacRmolServiceContext.hpp>
#include <rmol/service/RMOL_ServiceContext.hpp>
```

Namespaces

- namespace RMOL

43.133 FacRmolServiceContext.cpp

```
00001 // ////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // ////////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 // StdAir
00007 #include <stdair/service/FacSupervisor.hpp>
```

```
00008 // RMOL
00009 #include <rmol/factory/FacRmolServiceContext.hpp>
00010 #include <rmol/service/RMOL_ServiceContext.hpp>
00011
00012 namespace RMOL {
00013
00014   FacRmolServiceContext* FacRmolServiceContext::_instance = NULL;
00015
00016   // //////////////////////////////////////////////////////////////////
00017   FacRmolServiceContext::~FacRmolServiceContext() {
00018     _instance = NULL;
00019   }
00020
00021   // //////////////////////////////////////////////////////////////////
00022   FacRmolServiceContext& FacRmolServiceContext::instance() {
00023
00024     if (_instance == NULL) {
00025       _instance = new FacRmolServiceContext();
00026       assert (_instance != NULL);
00027
00028       stdair::FacSupervisor::instance().registerServiceFactory (_instance);
00029     }
00030     return *_instance;
00031   }
00032
00033   // //////////////////////////////////////////////////////////////////
00034   RMOL_ServiceContext& FacRmolServiceContext::create() {
00035     RMOL_ServiceContext* aServiceContext_ptr = NULL;
00036
00037     aServiceContext_ptr = new RMOL_ServiceContext();
00038     assert (aServiceContext_ptr != NULL);
00039
00040     // The new object is added to the Bom pool
00041     _pool.push_back (aServiceContext_ptr);
00042
00043     return *aServiceContext_ptr;
00044   }
00045
00046 }
```

43.134 rmol/factory/FacRmolServiceContext.hpp File Reference

```
#include <string>
#include <stdair/stdair_basic_types.hpp>
#include <stdair/service/FacServiceAbstract.hpp>
```

Classes

- class RMOL::FacRmolServiceContext

  Factory for the service context.

Namespaces

- namespace RMOL

43.135 FacRmolServiceContext.hpp

```
00001 #ifndef __RMOL_FAC_FACRMOLSERVICECONTEXT_HPP
00002 #define __RMOL_FAC_FACRMOLSERVICECONTEXT_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <string>
00009 // StdAir
00010 #include <stdair/stdair_basic_types.hpp>
00011 #include <stdair/service/FacServiceAbstract.hpp>
00012
00013 namespace RMOL {
00014
00016   class RMOL_ServiceContext;
00017
00018
00022   class FacRmolServiceContext : public stdair::FacServiceAbstract {
00023   public:
00024
00031     static FacRmolServiceContext& instance();
00032
00039     ~FacRmolServiceContext();
00040
00048     RMOL_ServiceContext& create();
00049
00050
00051   protected:
00057     FacRmolServiceContext() {}
00058
00059
00060   private:
00064     static FacRmolServiceContext* _instance;
00065   };
00066
00067 }
00068 #endif // __RMOL_FAC_FACRMOLSERVICECONTEXT_HPP
```

43.136 rmol/RMOL_Service.hpp File Reference

```
#include <string>
#include <stdair/stdair_basic_types.hpp>
#include <stdair/stdair_inventory_types.hpp>
#include <stdair/stdair_service_types.hpp>
#include <stdair/stdair_maths_types.hpp>
#include <stdair/basic/ForecastingMethod.hpp>
#include <stdair/basic/PartnershipTechnique.hpp>
#include <rmol/RMOL_Types.hpp>
```

Classes

- class RMOL::RMOL_Service

  Interface for the RMOL Services.

Namespaces

- namespace stdair
- namespace RMOL

43.137 RMOL_Service.hpp

```
00001 #ifndef __RMOL_SVC_RMOL_SERVICE_HPP
00002 #define __RMOL_SVC_RMOL_SERVICE_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <string>
00009 // StdAir
00010 #include <stdair/stdair_basic_types.hpp>
00011 #include <stdair/stdair_inventory_types.hpp>
00012 #include <stdair/stdair_service_types.hpp>
00013 #include <stdair/stdair_maths_types.hpp>
00014 #include <stdair/basic/ForecastingMethod.hpp>
00015 #include <stdair/basic/PartnershipTechnique.hpp>
00016 // RMOL
00017 #include <rmol/RMOL_Types.hpp>
00018
00020 namespace stdair {
00021   class FlightDate;
00022   struct BasLogParams;
00023   struct BasDBParams;
00024   class BomRoot;
00025   class AirlineClassList;
00026   class YieldFeatures;
00027   class Inventory;
00028   class OnDDate;
00029 }
00030
00031 namespace RMOL {
00032
00034   class RMOL_ServiceContext;
00035
00039   class RMOL_Service {
00040   public:
00041     // ////////// Constructors and destructors //////////
00057     RMOL_Service (const stdair::BasLogParams&, const stdair::BasDBParams&);
00058
00070     RMOL_Service (const stdair::BasLogParams&);
00071
00087     RMOL_Service (stdair::STDAIR_ServicePtr_T);
00088
00112     void parseAndLoad (const stdair::CabinCapacity_T& iCabinCapacity,
00113                        const stdair::Filename_T& iDemandAndClassDataFile);
00114
```

```
00118     void setUpStudyStatManager();
00119
00123     ~RMOL_Service();
00124
00125
00126   public:
00127     // ///////////////// Business Methods /////////////////
00133     void buildSampleBom();
00134
00138     void optimalOptimisationByMCIntegration (const int K);
00139
00143     void optimalOptimisationByDP();
00144
00148     void heuristicOptimisationByEmsr();
00149
00153     void heuristicOptimisationByEmsrA();
00154
00158     void heuristicOptimisationByEmsrB();
00159
00163     bool optimise (stdair::FlightDate&, const stdair::DateTime_T&,
00164                    const stdair::ForecastingMethod&, const stdair::PartnershipTec
      hnique&);
00165
00170     // O&D based forecast
00171     void forecastOnD (const stdair::DateTime_T&);
00172
00173     stdair::YieldFeatures* getYieldFeatures(const stdair::OnDDate&, const stdair:
      :CabinCode_T&,
00174                                             stdair::BomRoot&);
00175
00176     void forecastOnD (const stdair::YieldFeatures&, stdair::OnDDate&,
00177                       const stdair::CabinCode_T&, const stdair::DTD_T&,
00178                       stdair::BomRoot&);
00179
00180     void setOnDForecast (const stdair::AirlineClassList&, const stdair::MeanValue
      _T&,
00181                          const stdair::StdDevValue_T&, stdair::OnDDate&, const st
      dair::CabinCode_T&,
00182                          stdair::BomRoot&);
00183
00184     // Single segment O&D
00185     void setOnDForecast (const stdair::AirlineCode_T&, const stdair::Date_T&, con
      st stdair::AirportCode_T&,
00186                          const stdair::AirportCode_T&, const stdair::CabinCode_T&
      , const stdair::ClassCode_T&,
00187                          const stdair::MeanValue_T&, const stdair::StdDevValue_T&
      , const stdair::Yield_T&, stdair::BomRoot&);
00188
00189     // Multiple segment O&D
00190     void setOnDForecast (const stdair::AirlineCodeList_T&, const stdair::AirlineC
      ode_T&,const stdair::Date_T&,
00191                          const stdair::AirportCode_T&, const stdair::AirportCode_
      T&, const stdair::CabinCode_T&,
00192                          const stdair::ClassCodeList_T&, const stdair::MeanValue_
      T&, const stdair::StdDevValue_T&,
00193                          const stdair::Yield_T&, stdair::BomRoot&);
00194
00195     // Initialise (or re-initialise) the demand projections in all leg cabins
00196     void resetDemandInformation (const stdair::DateTime_T&);
00197
00198     void resetDemandInformation (const stdair::DateTime_T&, const stdair::Invento
      ry&);
```

```
00199
00200     /* Projection of demand */
00201
00202     // Aggregated demand at booking class level.
00203     void projectAggregatedDemandOnLegCabins(const stdair::DateTime_T&);
00204
00205     // Static rule prorated yield
00206     void projectOnDDemandOnLegCabinsUsingYP(const stdair::DateTime_T&);
00207
00208     // Displacement-adjusted yield
00209     void projectOnDDemandOnLegCabinsUsingDA(const stdair::DateTime_T&);
00210
00211     // Dynamic yield proration (PF = BP_i/BP_{total}, where BP_{total} = sum(BP_i
      ))
00212     void projectOnDDemandOnLegCabinsUsingDYP(const stdair::DateTime_T&);
00213
00214     void projectOnDDemandOnLegCabinsUsingDYP(const stdair::DateTime_T&, const std
      air::Inventory&);
00215
00217     // O&D-based optimisation (using demand aggregation or demand aggregation).
00218     void optimiseOnD (const stdair::DateTime_T&);
00219
00220     // O&D-based optimisation using displacement-adjusted yield.
00221     void optimiseOnDUsingRMCooperation (const stdair::DateTime_T&);
00222
00223     // Advanced version of O&D-based optimisation using displacement-adjusted yie
      ld.
00224     // Network optimisation instead of separate inventory optimisation.
00225     void optimiseOnDUsingAdvancedRMCooperation (const stdair::DateTime_T&);
00226
00227     // Update bid priceand send to partners
00228     void updateBidPrice (const stdair::DateTime_T&);
00229     void updateBidPrice (const stdair::FlightDate&, stdair::BomRoot&);
00230
00231   public:
00232     // ///////////////// Export support methods /////////////////
00243     std::string jsonExport (const stdair::AirlineCode_T&,
00244                             const stdair::FlightNumber_T&,
00245                             const stdair::Date_T& iDepartureDate) const;
00246
00247
00248   public:
00249     // ///////////////// Display support methods /////////////////
00257     std::string csvDisplay() const;
00258
00259
00260   private:
00261     // /////// Construction and Destruction helper methods ///////
00265     RMOL_Service();
00266
00270     RMOL_Service (const RMOL_Service&);
00271
00281     stdair::STDAIR_ServicePtr_T initStdAirService (const stdair::BasLogParams&,
00282                                                    const stdair::BasDBParams&);
00283
00292     stdair::STDAIR_ServicePtr_T initStdAirService (const stdair::BasLogParams&);
00293
00302     void addStdAirService (stdair::STDAIR_ServicePtr_T,
00303                            const bool iOwnStdairService);
00304
00309     void initServiceContext();
00310
```

```
00317     void initRmolService();
00318
00322     void finalise();
00323
00324
00325   private:
00326     // ////////// Service Context //////////
00330     RMOL_ServiceContext* _rmolServiceContext;
00331
00333     stdair::Date_T _previousForecastDate;
00334   };
00335 }
00336 #endif // __RMOL_SVC_RMOL_SERVICE_HPP
```

43.138 rmol/RMOL_Types.hpp File Reference

```
#include <map>
#include <vector>
#include <boost/shared_ptr.hpp>
#include <stdair/stdair_inventory_types.hpp>
#include <stdair/stdair_exceptions.hpp>
```

Classes

- class RMOL::OverbookingException

  Overbooking-related exception.
- class RMOL::UnconstrainingException

  Unconstraining-related exception.
- class RMOL::ForecastException

  Forecast-related exception.
- class RMOL::OptimisationException

  Optimisation-related exception.

Namespaces

- namespace stdair
- namespace RMOL

Typedefs

- typedef boost::shared_ptr< RMOL_Service > RMOL::RMOL_ServicePtr_T
- typedef std::vector< stdair::NbOfRequests_T > RMOL::UnconstrainedDemandVector_-T
- typedef std::vector< stdair::NbOfBookings_T > RMOL::BookingVector_T
- typedef std::vector< stdair::Flag_T > RMOL::FlagVector_T

- typedef std::map< stdair::BookingClass *, UnconstrainedDemandVector_T > RMOL::BookingClassUnconstraine T
- typedef std::map< stdair::BookingClass *, stdair::NbOfRequests_T > RMOL::BookingClassUnconstrainedDema T
- typedef std::map< const stdair::DTD_T, double > RMOL::FRAT5Curve_T

43.139 RMOL_Types.hpp

```
00001 #ifndef __RMOL_RMOL_TYPES_HPP
00002 #define __RMOL_RMOL_TYPES_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <map>
00009 #include <vector>
00010 // Boost
00011 #include <boost/shared_ptr.hpp>
00012 // StdAir
00013 #include <stdair/stdair_inventory_types.hpp>
00014 #include <stdair/stdair_exceptions.hpp>
00015
00016 // Forward declarations.
00017 namespace stdair {
00018   class BookingClass;
00019 }
00020
00021
00022 namespace RMOL {
00023
00024   // Forward declarations
00025   class RMOL_Service;
00026
00027   // ///////// Exceptions ////////////
00031   class OverbookingException : public stdair::RootException {
00032   public:
00034     OverbookingException (const std::string& iWhat)
00035       : stdair::RootException (iWhat) {}
00036   };
00037
00041   class UnconstrainingException : public stdair::RootException {
00042   public:
00044     UnconstrainingException (const std::string& iWhat)
00045       : stdair::RootException (iWhat) {}
00046   };
00047
00051   class ForecastException : public stdair::RootException {
00052   public:
00054     ForecastException (const std::string& iWhat)
00055       : stdair::RootException (iWhat) {}
00056   };
00057
00061   class OptimisationException : public stdair::RootException {
00062   public:
00064     OptimisationException (const std::string& iWhat)
00065       : stdair::RootException (iWhat) {}
00066   };
00067
```

```
00068
00069   // ///////// Type definitions /////////
00073   typedef boost::shared_ptr<RMOL_Service> RMOL_ServicePtr_T;
00074
00076   typedef std::vector<stdair::NbOfRequests_T> UnconstrainedDemandVector_T;
00077
00079   typedef std::vector<stdair::NbOfBookings_T> BookingVector_T;
00080
00082   typedef std::vector<stdair::Flag_T> FlagVector_T;
00083
00086   typedef std::map<stdair::BookingClass*, UnconstrainedDemandVector_T>
      BookingClassUnconstrainedDemandVectorMap_T;
00087
00090   typedef std::map<stdair::BookingClass*, stdair::NbOfRequests_T>
      BookingClassUnconstrainedDemandMap_T;
00091
00093   typedef std::map<const stdair::DTD_T, double> FRAT5Curve_T;
00094
00095 }
00096 #endif // __RMOL_RMOL_TYPES_HPP
```

43.140 rmol/service/RMOL_Service.cpp File Reference

```
#include <cassert>
#include <boost/make_shared.hpp>
#include <stdair/stdair_inventory_types.hpp>
#include <stdair/basic/BasChronometer.hpp>
#include <stdair/basic/ContinuousAttributeLite.hpp>
#include <stdair/bom/BomManager.hpp>
#include <stdair/bom/BomRoot.hpp>
#include <stdair/bom/Inventory.hpp>
#include <stdair/bom/FlightDate.hpp>
#include <stdair/bom/LegCabin.hpp>
#include <stdair/bom/LegDate.hpp>
#include <stdair/bom/YieldFeatures.hpp>
#include <stdair/bom/AirportPair.hpp>
#include <stdair/bom/PosChannel.hpp>
#include <stdair/bom/DatePeriod.hpp>
#include <stdair/bom/TimePeriod.hpp>
#include <stdair/bom/AirlineClassList.hpp>
#include <stdair/basic/BasConst_Request.hpp>
#include <stdair/basic/BasConst_Inventory.hpp>
#include <stdair/bom/SegmentDate.hpp>
```

```
#include <stdair/bom/SegmentCabin.hpp>
#include <stdair/bom/BookingClass.hpp>
#include <stdair/bom/OnDDate.hpp>
#include <stdair/bom/OnDDateTypes.hpp>
#include <stdair/command/CmdBomManager.hpp>
#include <stdair/service/Logger.hpp>
#include <stdair/STDAIR_Service.hpp>
#include <rmol/basic/BasConst_RMOL_Service.hpp>
#include <rmol/factory/FacRmolServiceContext.hpp>
#include <rmol/command/InventoryParser.hpp>
#include <rmol/command/Optimiser.hpp>
#include <rmol/command/Forecaster.hpp>
#include <rmol/service/RMOL_ServiceContext.hpp>
#include <rmol/RMOL_Service.hpp>
```

Namespaces

- namespace RMOL

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```
00001 // //////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 // Boost
00007 #include <boost/make_shared.hpp>
00008 // StdAir
00009 #include <stdair/stdair_inventory_types.hpp>
00010 #include <stdair/basic/BasChronometer.hpp>
00011 #include <stdair/basic/ContinuousAttributeLite.hpp>
00012 #include <stdair/bom/BomManager.hpp>
00013 #include <stdair/bom/BomRoot.hpp>
00014 #include <stdair/bom/Inventory.hpp>
00015 #include <stdair/bom/FlightDate.hpp>
00016 #include <stdair/bom/LegCabin.hpp>
00017 #include <stdair/bom/LegDate.hpp>
00018 #include <stdair/bom/YieldFeatures.hpp>
00019 #include <stdair/bom/AirportPair.hpp>
00020 #include <stdair/bom/PosChannel.hpp>
00021 #include <stdair/bom/DatePeriod.hpp>
00022 #include <stdair/bom/TimePeriod.hpp>
00023 #include <stdair/bom/AirlineClassList.hpp>
00024 #include <stdair/basic/BasConst_Request.hpp>
00025 #include <stdair/basic/BasConst_Inventory.hpp>
00026 #include <stdair/bom/Inventory.hpp>
```

```
00027 #include <stdair/bom/FlightDate.hpp>
00028 #include <stdair/bom/SegmentDate.hpp>
00029 #include <stdair/bom/SegmentCabin.hpp>
00030 #include <stdair/bom/BookingClass.hpp>
00031 #include <stdair/bom/OnDDate.hpp>
00032 #include <stdair/bom/OnDDateTypes.hpp>
00033 #include <stdair/command/CmdBomManager.hpp>
00034 #include <stdair/service/Logger.hpp>
00035 #include <stdair/STDAIR_Service.hpp>
00036 // RMOL
00037 #include <rmol/basic/BasConst_RMOL_Service.hpp>
00038 #include <rmol/factory/FacRmolServiceContext.hpp>
00039 #include <rmol/command/InventoryParser.hpp>
00040 #include <rmol/command/Optimiser.hpp>
00041 #include <rmol/command/Forecaster.hpp>
00042 #include <rmol/service/RMOL_ServiceContext.hpp>
00043 #include <rmol/RMOL_Service.hpp>
00044
00045 namespace RMOL {
00046
00047   // ////////////////////////////////////////////////////////////////////
00048   RMOL_Service::RMOL_Service()
00049   : _rmolServiceContext (NULL),
00050     _previousForecastDate (stdair::Date_T (2000, 1, 1)) {
00051     assert (false);
00052   }
00053
00054   // ////////////////////////////////////////////////////////////////////
00055   RMOL_Service::RMOL_Service (const RMOL_Service& iService) :
00056     _rmolServiceContext (NULL),
00057     _previousForecastDate (stdair::Date_T (2000, 1, 1)) {
00058     assert (false);
00059   }
00060
00061   // ////////////////////////////////////////////////////////////////////
00062   RMOL_Service::RMOL_Service (const stdair::BasLogParams& iLogParams) :
00063     _rmolServiceContext (NULL),
00064     _previousForecastDate (stdair::Date_T (2000, 1, 1)) {
00065
00066     // Initialise the STDAIR service handler
00067     stdair::STDAIR_ServicePtr_T lSTDAIR_Service_ptr =
00068       initStdAirService (iLogParams);
00069
00070     // Initialise the service context
00071     initServiceContext();
00072
00073     // Add the StdAir service context to the RMOL service context
00074     // \note RMOL owns the STDAIR service resources here.
00075     const bool ownStdairService = true;
00076     addStdAirService (lSTDAIR_Service_ptr, ownStdairService);
00077
00078     // Initialise the (remaining of the) context
00079     initRmolService();
00080   }
00081
00082   // ////////////////////////////////////////////////////////////////////
00083   RMOL_Service::RMOL_Service (const stdair::BasLogParams& iLogParams,
00084                               const stdair::BasDBParams& iDBParams) :
00085     _rmolServiceContext (NULL),
00086     _previousForecastDate (stdair::Date_T (2000, 1, 1)) {
00087
00088     // Initialise the STDAIR service handler
```

```
00089     stdair::STDAIR_ServicePtr_T lSTDAIR_Service_ptr =
00090       initStdAirService (iLogParams, iDBParams);
00091
00092     // Initialise the service context
00093     initServiceContext();
00094
00095     // Add the StdAir service context to the RMOL service context
00096     // \note RMOL owns the STDAIR service resources here.
00097     const bool ownStdairService = true;
00098     addStdAirService (lSTDAIR_Service_ptr, ownStdairService);
00099
00100     // Initialise the (remaining of the) context
00101     initRmolService();
00102   }
00103
00104   // ////////////////////////////////////////////////////////////////////
00105   RMOL_Service::RMOL_Service (stdair::STDAIR_ServicePtr_T ioSTDAIRServicePtr)
00106     : _rmolServiceContext (NULL),
00107       _previousForecastDate (stdair::Date_T (2000, 1, 1)) {
00108
00109     // Initialise the context
00110     initServiceContext();
00111
00112     // Add the StdAir service context to the RMOL service context.
00113     // \note RMOL does not own the STDAIR service resources here.
00114     const bool doesNotOwnStdairService = false;
00115     addStdAirService (ioSTDAIRServicePtr, doesNotOwnStdairService);
00116
00117     // Initialise the (remaining of the) context
00118     initRmolService();
00119   }
00120
00121   // ////////////////////////////////////////////////////////////////////
00122   RMOL_Service::~RMOL_Service() {
00123     // Delete/Clean all the objects from memory
00124     finalise();
00125   }
00126
00127   // ////////////////////////////////////////////////////////////////////
00128   void RMOL_Service::finalise() {
00129     assert (_rmolServiceContext != NULL);
00130     // Reset the (Boost.)Smart pointer pointing on the STDAIR_Service object.
00131     _rmolServiceContext->reset();
00132   }
00133
00134   // ////////////////////////////////////////////////////////////////////
00135   void RMOL_Service::initServiceContext() {
00136     // Initialise the service context
00137     RMOL_ServiceContext& lRMOL_ServiceContext =
00138       FacRmolServiceContext::instance().create();
00139     _rmolServiceContext = &lRMOL_ServiceContext;
00140   }
00141
00142   // ////////////////////////////////////////////////////////////////////
00143   void RMOL_Service::
00144   addStdAirService (stdair::STDAIR_ServicePtr_T ioSTDAIR_Service_ptr,
00145                     const bool iOwnStdairService) {
00146
00147     // Retrieve the RMOL service context
00148     assert (_rmolServiceContext != NULL);
00149     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00150
```

```
00151     // Store the STDAIR service object within the (AIRINV) service context
00152     lRMOL_ServiceContext.setSTDAIR_Service (ioSTDAIR_Service_ptr,
00153                                             iOwnStdairService);
00154   }
00155
00156   // ////////////////////////////////////////////////////////////////////
00157   stdair::STDAIR_ServicePtr_T RMOL_Service::
00158   initStdAirService (const stdair::BasLogParams& iLogParams) {
00159
00167     stdair::STDAIR_ServicePtr_T lSTDAIR_Service_ptr =
00168       boost::make_shared<stdair::STDAIR_Service> (iLogParams);
00169
00170     return lSTDAIR_Service_ptr;
00171   }
00172
00173   // ////////////////////////////////////////////////////////////////////
00174   stdair::STDAIR_ServicePtr_T RMOL_Service::
00175   initStdAirService (const stdair::BasLogParams& iLogParams,
00176                      const stdair::BasDBParams& iDBParams) {
00177
00185     stdair::STDAIR_ServicePtr_T lSTDAIR_Service_ptr =
00186       boost::make_shared<stdair::STDAIR_Service> (iLogParams, iDBParams);
00187
00188     return lSTDAIR_Service_ptr;
00189   }
00190
00191   // ////////////////////////////////////////////////////////////////////
00192   void RMOL_Service::initRmolService() {
00193     // Do nothing at this stage. A sample BOM tree may be built by
00194     // calling the buildSampleBom() method
00195   }
00196
00197   // ////////////////////////////////////////////////////////////////////
00198   void RMOL_Service::
00199   parseAndLoad (const stdair::CabinCapacity_T& iCabinCapacity,
00200                 const stdair::Filename_T& iInputFileName) {
00201
00202     // Retrieve the RMOL service context
00203     if (_rmolServiceContext == NULL) {
00204       throw stdair::NonInitialisedServiceException ("The RMOL service has not"
00205                                                     " been initialised");
00206     }
00207     assert (_rmolServiceContext != NULL);
00208     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00209
00210     // Retrieve the StdAir service object from the (RMOL) service context
00211     stdair::STDAIR_Service& lSTDAIR_Service =
00212       lRMOL_ServiceContext.getSTDAIR_Service();
00213     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
00214
00215     // Build a dummy inventory with a leg-cabin which has the given capacity.
00216     lSTDAIR_Service.buildDummyInventory (iCabinCapacity);
00217
00218     // Complete the BOM tree with the optimisation problem specification
00219     InventoryParser::parseInputFileAndBuildBom (iInputFileName, lBomRoot);
00220   }
00221
00222   // ////////////////////////////////////////////////////////////////////
00223   void RMOL_Service::buildSampleBom() {
00224
00225     // Retrieve the RMOL service context
00226     if (_rmolServiceContext == NULL) {
```

```
00227       throw stdair::NonInitialisedServiceException ("The RMOL service has not"
00228                                                     " been initialised");
00229     }
00230     assert (_rmolServiceContext != NULL);
00231
00232     // Retrieve the RMOL service context and whether it owns the Stdair
00233     // service
00234     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00235     const bool doesOwnStdairService =
00236       lRMOL_ServiceContext.getOwnStdairServiceFlag();
00237
00238     // Retrieve the StdAir service object from the (RMOL) service context
00239     stdair::STDAIR_Service& lSTDAIR_Service =
00240       lRMOL_ServiceContext.getSTDAIR_Service();
00241
00246     if (doesOwnStdairService == true) {
00247       //
00248       lSTDAIR_Service.buildSampleBom();
00249     }
00250
00268   }
00269
00270   // ////////////////////////////////////////////////////////////////////
00271   void RMOL_Service::optimalOptimisationByMCIntegration (const int K) {
00272     assert (_rmolServiceContext != NULL);
00273     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00274
00275     // Retrieve the StdAir service
00276     stdair::STDAIR_Service& lSTDAIR_Service =
00277       lRMOL_ServiceContext.getSTDAIR_Service();
00278     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
00279
00280     //
00281     stdair::LegCabin& lLegCabin = InventoryParser::getSampleLegCabin (lBomRoot);
00282
00283     stdair::BasChronometer lOptimisationChronometer;
00284     lOptimisationChronometer.start();
00285
00286     Optimiser::optimalOptimisationByMCIntegration (K, lLegCabin);
00287
00288     const double lOptimisationMeasure = lOptimisationChronometer.elapsed();
00289
00290     // DEBUG
00291     STDAIR_LOG_DEBUG ("Optimisation by Monte-Carlo performed in "
00292                       << lOptimisationMeasure);
00293     STDAIR_LOG_DEBUG ("Result: " << lLegCabin.displayVirtualClassList());
00294
00295     std::ostringstream logStream;
00296     stdair::BidPriceVector_T lBidPriceVector = lLegCabin.getBidPriceVector();
00297     logStream << "Bid-Price Vector (BPV): ";
00298     unsigned int size = lBidPriceVector.size();
00299
00300     for (unsigned int i = 0; i < size - 1; ++i) {
00301       const double bidPrice = lBidPriceVector.at(i);
00302       logStream << std::fixed << std::setprecision (2) << bidPrice << ", ";
00303     }
00304     const double bidPrice = lBidPriceVector.at(size -1);
00305     logStream << std::fixed << std::setprecision (2) << bidPrice;
00306     STDAIR_LOG_DEBUG (logStream.str());
00307   }
00308
00309   // ////////////////////////////////////////////////////////////////////
```

```
00310   void RMOL_Service::optimalOptimisationByDP() {
00311   }
00312
00313   // ////////////////////////////////////////////////////////////////////
00314   void RMOL_Service::heuristicOptimisationByEmsr() {
00315     assert (_rmolServiceContext != NULL);
00316     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00317
00318     // Retrieve the StdAir service
00319     stdair::STDAIR_Service& lSTDAIR_Service =
00320       lRMOL_ServiceContext.getSTDAIR_Service();
00321     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
00322
00323     //
00324     stdair::LegCabin& lLegCabin = InventoryParser::getSampleLegCabin (lBomRoot);
00325
00326     stdair::BasChronometer lOptimisationChronometer;
00327     lOptimisationChronometer.start();
00328
00329     Optimiser::heuristicOptimisationByEmsr (lLegCabin);
00330
00331     const double lOptimisationMeasure = lOptimisationChronometer.elapsed();
00332     // DEBUG
00333     STDAIR_LOG_DEBUG ("Optimisation EMSR performed in "
00334                       << lOptimisationMeasure);
00335     STDAIR_LOG_DEBUG ("Result: " << lLegCabin.displayVirtualClassList());
00336
00337     stdair::BidPriceVector_T lBidPriceVector = lLegCabin.getBidPriceVector();
00338     std::ostringstream logStream;
00339     logStream << "Bid-Price Vector (BPV): ";
00340     unsigned int idx = 0;
00341     for (stdair::BidPriceVector_T::const_iterator itBP = lBidPriceVector.begin();
00342          itBP != lBidPriceVector.end(); ++itBP) {
00343       if (idx != 0) {
00344         logStream << ", ";
00345       }
00346       const stdair::BidPrice_T& lBidPrice = *itBP;
00347       logStream << std::fixed << std::setprecision (2) << lBidPrice;
00348     }
00349     // DEBUG
00350     STDAIR_LOG_DEBUG (logStream.str());
00351   }
00352
00353   // ////////////////////////////////////////////////////////////////////
00354   void RMOL_Service::heuristicOptimisationByEmsrA() {
00355     assert (_rmolServiceContext != NULL);
00356     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00357
00358     // Retrieve the StdAir service
00359     stdair::STDAIR_Service& lSTDAIR_Service =
00360       lRMOL_ServiceContext.getSTDAIR_Service();
00361     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
00362
00363     //
00364     stdair::LegCabin& lLegCabin = InventoryParser::getSampleLegCabin (lBomRoot);
00365
00366     Optimiser::heuristicOptimisationByEmsrA (lLegCabin);
00367
00368     // DEBUG
00369     STDAIR_LOG_DEBUG ("Result: " << lLegCabin.displayVirtualClassList());
00370
```

```
00371   }
00372
00373   // ////////////////////////////////////////////////////////////////////
00374   void RMOL_Service::heuristicOptimisationByEmsrB() {
00375     assert (_rmolServiceContext != NULL);
00376     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00377
00378     // Retrieve the StdAir service
00379     stdair::STDAIR_Service& lSTDAIR_Service =
00380       lRMOL_ServiceContext.getSTDAIR_Service();
00381     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
00382
00383     //
00384     stdair::LegCabin& lLegCabin = InventoryParser::getSampleLegCabin (lBomRoot);
00385
00386     Optimiser::heuristicOptimisationByEmsrB (lLegCabin);
00387
00388     // DEBUG
00389     STDAIR_LOG_DEBUG ("Result: " << lLegCabin.displayVirtualClassList());
00390   }
00391
00392   // ////////////////////////////////////////////////////////////////////
00393   bool RMOL_Service::
00394   optimise (stdair::FlightDate& ioFlightDate,
00395             const stdair::DateTime_T& iRMEventTime,
00396             const stdair::ForecastingMethod& iForecastingMethod,
00397             const stdair::PartnershipTechnique& iPartnershipTechnique) {
00398
00399
00400     STDAIR_LOG_DEBUG ("Forecast & Optimisation");
00401
00402     const stdair::PartnershipTechnique::EN_PartnershipTechnique& lPartnershipTech
      nique =
00403       iPartnershipTechnique.getTechnique();
00404
00405     switch (lPartnershipTechnique) {
00406     case stdair::PartnershipTechnique::RAE_DA:
00407     case stdair::PartnershipTechnique::IBP_DA:{
00408       if (_previousForecastDate < iRMEventTime.date()) {
00409         forecastOnD (iRMEventTime);
00410         resetDemandInformation (iRMEventTime);
00411         projectAggregatedDemandOnLegCabins (iRMEventTime);
00412         optimiseOnD (iRMEventTime);
00413       }
00414       break;
00415     }
00416     case stdair::PartnershipTechnique::RAE_YP:
00417     case stdair::PartnershipTechnique::IBP_YP:
00418     case stdair::PartnershipTechnique::IBP_YP_U:{
00419       if (_previousForecastDate < iRMEventTime.date()) {
00420         forecastOnD (iRMEventTime);
00421         resetDemandInformation (iRMEventTime);
00422         projectOnDDemandOnLegCabinsUsingYP (iRMEventTime);
00423         optimiseOnD (iRMEventTime);
00424       }
00425       break;
00426     }
00427     case stdair::PartnershipTechnique::RMC:{
00428       if (_previousForecastDate < iRMEventTime.date()) {
00429         forecastOnD (iRMEventTime);
00430         resetDemandInformation (iRMEventTime);
00431         updateBidPrice (iRMEventTime);
```

```
00432         projectOnDDemandOnLegCabinsUsingDYP (iRMEventTime);
00433         optimiseOnDUsingRMCooperation (iRMEventTime);
00434       }
00435       break;
00436     }
00437     case stdair::PartnershipTechnique::A_RMC:{
00438       if (_previousForecastDate < iRMEventTime.date()) {
00439         forecastOnD (iRMEventTime);
00440         resetDemandInformation (iRMEventTime);
00441         updateBidPrice (iRMEventTime);
00442         projectOnDDemandOnLegCabinsUsingDYP (iRMEventTime);
00443         optimiseOnDUsingAdvancedRMCooperation (iRMEventTime);
00444       }
00445       break;
00446     }
00447     case stdair::PartnershipTechnique::NONE:{
00448       // DEBUG
00449       STDAIR_LOG_DEBUG ("Forecast");
00450
00451       // 1. Forecast
00452       bool isForecasted = false;
00453       const stdair::ForecastingMethod::EN_ForecastingMethod& lForecastingMethod=
00454         iForecastingMethod.getMethod();
00455       switch (lForecastingMethod) {
00456       case stdair::ForecastingMethod::ADD_PK: {
00457         isForecasted = Forecaster::forecastUsingAdditivePickUp (ioFlightDate,
00458                                                                 iRMEventTime);
00459         break;
00460       }
00461       case stdair::ForecastingMethod::MUL_PK: {
00462         isForecasted =
00463           Forecaster::forecastUsingMultiplicativePickUp (ioFlightDate,
00464                                                          iRMEventTime);
00465         break;
00466       }
00467       default: {
00468         assert (false);
00469         break;
00470       }
00471       }
00472
00473       // DEBUG
00474       STDAIR_LOG_DEBUG ("Forecast successful: " << isForecasted);
00475
00476       // 2. Optimisation
00477       if (isForecasted == true) {
00478         // DEBUG
00479         STDAIR_LOG_DEBUG ("Optimise");
00480
00481         Optimiser::optimise (ioFlightDate);
00482         return true;
00483       }
00484       break;
00485     }
00486     default:{
00487       assert (false);
00488       break;
00489     }
00490     }
00491     return false;
00492   }
00493
```

```
00494   // ////////////////////////////////////////////////////////////////////
00495   void RMOL_Service::forecastOnD (const stdair::DateTime_T& iRMEventTime) {
00496
00497     if (_rmolServiceContext == NULL) {
00498       throw stdair::NonInitialisedServiceException ("The Rmol service "
00499                                                     "has not been initialised");
00500     }
00501     assert (_rmolServiceContext != NULL);
00502     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00503
00504     // Retrieve the bom root
00505     stdair::STDAIR_Service& lSTDAIR_Service =
00506       lRMOL_ServiceContext.getSTDAIR_Service();
00507     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
00508
00509     // Retrieve the date from the RM event
00510     const stdair::Date_T lDate = iRMEventTime.date();
00511
00512     _previousForecastDate = lDate;
00513
00514     const stdair::InventoryList_T& lInventoryList =
00515       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
00516     assert (!lInventoryList.empty());
00517     for (stdair::InventoryList_T::const_iterator itInv = lInventoryList.begin();
00518          itInv != lInventoryList.end(); ++itInv) {
00519       const stdair::Inventory* lInventory_ptr = *itInv;
00520       assert (lInventory_ptr != NULL);
00521       if (stdair::BomManager::hasList<stdair::OnDDate> (*lInventory_ptr)) {
00522         const stdair::OnDDateList_T lOnDDateList =
00523         stdair::BomManager::getList<stdair::OnDDate> (*lInventory_ptr);
00524
00525         for (stdair::OnDDateList_T::const_iterator itOD = lOnDDateList.begin();
00526              itOD != lOnDDateList.end(); ++itOD) {
00527           stdair::OnDDate* lOnDDate_ptr = *itOD;
00528           assert (lOnDDate_ptr != NULL);
00529
00530           const stdair::Date_T& lDepartureDate = lOnDDate_ptr->getDate();
00531           stdair::DateOffset_T lDateOffset = lDepartureDate - lDate;
00532           stdair::DTD_T lDTD = short (lDateOffset.days());
00533
00534           stdair::DCPList_T::const_iterator itDCP =
00535             std::find (stdair::DEFAULT_DCP_LIST.begin(),
00536                        stdair::DEFAULT_DCP_LIST.end(), lDTD);
00537           // Check if the forecast for this O&D date needs to be forecasted.
00538           if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
00539             // Retrieve the total forecast map.
00540             const stdair::CabinForecastMap_T& lTotalForecastMap =
00541               lOnDDate_ptr->getTotalForecastMap();
00542
00543             // Browse the map and make a forecast for every cabin.
00544             for (stdair::CabinForecastMap_T::const_iterator itCF =
00545                    lTotalForecastMap.begin();
00546                  itCF != lTotalForecastMap.end(); ++itCF) {
00547               const stdair::CabinCode_T lCabinCode = itCF->first;
00548               stdair::YieldFeatures* lYieldFeatures_ptr =
00549                 getYieldFeatures(*lOnDDate_ptr, lCabinCode, lBomRoot);
00550               if (lYieldFeatures_ptr == NULL) {
00551                 STDAIR_LOG_ERROR ("Cannot find yield corresponding to "
00552                                   << "the O&D date"
00553                                   << lOnDDate_ptr->toString()
00554                                   << " Cabin " << lCabinCode);
00555                 assert (false);
```

```
00556               }
00557               forecastOnD (*lYieldFeatures_ptr, *lOnDDate_ptr, lCabinCode, lDTD,
00558                            lBomRoot);
00559             }
00560           }
00561         }
00562       }
00563     }
00564   }
00565
00566   // ////////////////////////////////////////////////////////////////////
00567   stdair::YieldFeatures* RMOL_Service::
00568   getYieldFeatures(const stdair::OnDDate& iOnDDate,
00569                    const stdair::CabinCode_T& iCabinCode,
00570                    stdair::BomRoot& iBomRoot) {
00571
00572     const stdair::AirportCode_T& lOrigin = iOnDDate.getOrigin();
00573     const stdair::AirportCode_T& lDestination = iOnDDate.getDestination();
00574
00575     const stdair::Date_T& lDepartureDate = iOnDDate.getDate();
00576
00577     // Build the airport pair key out of O&D and get the airport pair object
00578     const stdair::AirportPairKey lAirportPairKey(lOrigin, lDestination);
00579     stdair::AirportPair* lAirportPair_ptr = stdair::BomManager::
00580       getObjectPtr<stdair::AirportPair> (iBomRoot,
00581                                          lAirportPairKey.toString());
00582     if (lAirportPair_ptr == NULL) {
00583       STDAIR_LOG_ERROR ("Cannot find yield corresponding to the airport "
00584                         << "pair: " << lAirportPairKey.toString());
00585       assert (false);
00586     }
00587
00588     // Retrieve the corresponding date period to lDepartureDate.
00589     const stdair::DatePeriodList_T lDatePeriodList =
00590       stdair::BomManager::getList<stdair::DatePeriod> (*lAirportPair_ptr);
00591     for (stdair::DatePeriodList_T::const_iterator itDatePeriod =
00592            lDatePeriodList.begin();
00593          itDatePeriod != lDatePeriodList.end(); ++itDatePeriod) {
00594       const stdair::DatePeriod* lDatePeriod_ptr = *itDatePeriod;
00595       assert (lDatePeriod_ptr != NULL);
00596
00597       const bool isDepartureDateValid =
00598         lDatePeriod_ptr->isDepartureDateValid (lDepartureDate);
00599
00600       if (isDepartureDateValid == true) {
00601         // Retrieve the PoS-Channel.
00602         // TODO: Use POS and Channel from demand instead of default
00603         const stdair::PosChannelKey lPosChannelKey (stdair::DEFAULT_POS,
00604                                                     stdair::DEFAULT_CHANNEL);
00605         stdair::PosChannel* lPosChannel_ptr = stdair::BomManager::
00606           getObjectPtr<stdair::PosChannel> (*lDatePeriod_ptr,
00607                                             lPosChannelKey.toString());
00608         if (lPosChannel_ptr == NULL) {
00609           STDAIR_LOG_ERROR ("Cannot find yield corresponding to the PoS-"
00610                             << "Channel: " << lPosChannelKey.toString());
00611           assert (false);
00612         }
00613         // Retrieve the yield features.
00614         const stdair::TimePeriodList_T lTimePeriodList = stdair::
00615           BomManager::getList<stdair::TimePeriod> (*lPosChannel_ptr);
00616         for (stdair::TimePeriodList_T::const_iterator itTimePeriod =
00617                lTimePeriodList.begin();
```

```
00618             itTimePeriod != lTimePeriodList.end(); ++itTimePeriod) {
00619           const stdair::TimePeriod* lTimePeriod_ptr = *itTimePeriod;
00620           assert (lTimePeriod_ptr != NULL);
00621
00622           // TODO: Use trip type from demand instead of default value.
00623           const stdair::YieldFeaturesKey lYieldFeaturesKey (stdair::TRIP_TYPE_ONE
      _WAY,
00624                                                             iCabinCode);
00625           stdair::YieldFeatures* oYieldFeatures_ptr = stdair::BomManager::
00626             getObjectPtr<stdair::YieldFeatures>(*lTimePeriod_ptr,
00627                                                 lYieldFeaturesKey.toString());
00628           if (oYieldFeatures_ptr != NULL) {
00629             return oYieldFeatures_ptr;
00630           }
00631         }
00632       }
00633     }
00634     return NULL;
00635
00636   }
00637
00638
00639   // ////////////////////////////////////////////////////////////////////
00640   void RMOL_Service::
00641   forecastOnD (const stdair::YieldFeatures& iYieldFeatures,
00642                stdair::OnDDate& iOnDDate,
00643                const stdair::CabinCode_T& iCabinCode,
00644                const stdair::DTD_T& iDTD,
00645                stdair::BomRoot& iBomRoot) {
00646
00647     const stdair::AirlineClassListList_T lAirlineClassListList =
00648       stdair::BomManager::getList<stdair::AirlineClassList> (iYieldFeatures);
00649     assert (lAirlineClassListList.begin() != lAirlineClassListList.end());
00650
00651     // Yield order check
00652     stdair::AirlineClassListList_T::const_iterator  itACL =
00653       lAirlineClassListList.begin();
00654     stdair::Yield_T lPreviousYield((*itACL)->getYield());
00655     ++itACL;
00656     for (; itACL != lAirlineClassListList.end(); ++itACL) {
00657       const stdair::AirlineClassList* lAirlineClassList = *itACL;
00658       const stdair::Yield_T& lYield = lAirlineClassList->getYield();
00659       if (lYield <= lPreviousYield) {
00660         lPreviousYield = lYield;
00661       }
00662       else{
00663         STDAIR_LOG_ERROR ("Yields should be given in a descendant order"
00664                           << " in the yield input file") ;
00665         assert (false);
00666       }
00667     }
00668     // Proportion factor list initialisation
00669     // Each element corresponds to a yield rule
00670     stdair::ProportionFactorList_T lProportionFactorList;
00671     stdair::ProportionFactor_T lPreviousProportionFactor = 0;
00672
00673     // Retrieve the minimal willingness to pay associated to the demand
00674     const stdair::WTPDemandPair_T& lTotalForecast =
00675       iOnDDate.getTotalForecast (iCabinCode);
00676     const stdair::WTP_T& lMinWTP = lTotalForecast.first;
00677
00678     // Retrieve the remaining percentage of booking requests
```

```
00679     const stdair::ContinuousAttributeLite<stdair::FloatDuration_T>
00680       lArrivalPattern (stdair::DEFAULT_DTD_PROB_MAP);
00681
00682     STDAIR_LOG_DEBUG (lArrivalPattern.displayCumulativeDistribution());
00683     const stdair::Probability_T lRemainingProportion =
00684       lArrivalPattern.getRemainingProportion(-float(iDTD));
00685
00686     // Compute the characteristics (mean and std dev) of the total
00687     // forecast demand to come
00688     const stdair::MeanStdDevPair_T lForecatsMeanStdDevPair =
00689       lTotalForecast.second;
00690     const stdair::MeanValue_T& lMeanValue =
00691       lForecatsMeanStdDevPair.first;
00692     const stdair::MeanValue_T& lRemainingMeanValue =
00693       lRemainingProportion*lMeanValue;
00694     const stdair::StdDevValue_T& lStdDevValue =
00695       lForecatsMeanStdDevPair.second;
00696     const stdair::StdDevValue_T& lRemainingStdDevValue =
00697       lRemainingProportion*lStdDevValue;
00698
00699     // Retrieve the frat5 coef corresponding to the input dtd
00700     stdair::DTDFratMap_T::const_iterator itDFC =
00701       stdair::DEFAULT_DTD_FRAT5COEF_MAP.find(iDTD);
00702     if (itDFC == stdair::DEFAULT_DTD_FRAT5COEF_MAP.end()) {
00703       STDAIR_LOG_ERROR ("Cannot find frat5 coef for DTD = " << iDTD );
00704       assert (false);
00705     }
00706     stdair::RealNumber_T lFrat5Coef =
00707       stdair::DEFAULT_DTD_FRAT5COEF_MAP.at(iDTD);
00708
00709     STDAIR_LOG_DEBUG ("Remaining proportion " << lRemainingProportion
00710                       << " Total " << lMeanValue
00711                       << " StdDev " << lStdDevValue
00712                       << "Frat5 Coef " << lFrat5Coef);
00713
00714     std::ostringstream oStr;
00715     // Compute the "forecast demand to come" proportion by class
00716     itACL = lAirlineClassListList.begin();
00717     for (; itACL != lAirlineClassListList.end(); ++itACL) {
00718       const stdair::AirlineClassList* lAirlineClassList_ptr = *itACL;
00719       const stdair::Yield_T& lYield = lAirlineClassList_ptr->getYield();
00720       stdair::ProportionFactor_T lProportionFactor =
00721         exp ((lYield - lMinWTP)*log(0.5)/(lMinWTP*(lFrat5Coef-1.0)));
00722       // If the yield is smaller than minimal WTP, the factor is greater than 1.
00723       // In that case it should be modified and put to 1.
00724       lProportionFactor = std::min (lProportionFactor, 1.0);
00725       lProportionFactorList.push_back(lProportionFactor - lPreviousProportionFact
      or);
00726       lPreviousProportionFactor = lProportionFactor;
00727       oStr << lAirlineClassList_ptr->toString() << lProportionFactor << " ";
00728     }
00729
00730     STDAIR_LOG_DEBUG (oStr.str());
00731
00732     // Sanity check
00733     assert (lAirlineClassListList.size() == lProportionFactorList.size());
00734
00735     STDAIR_LOG_DEBUG ("Forecast for " << iOnDDate.describeKey()
00736                       << " " << iDTD << " days to departure");
00737
00738     // store the forecast demand to come characteristics in the booking classes
00739     stdair::ProportionFactorList_T::const_iterator itPF =
```

```
00740       lProportionFactorList.begin();
00741     itACL = lAirlineClassListList.begin();
00742     for (; itACL != lAirlineClassListList.end(); ++itACL, ++itPF) {
00743       const stdair::AirlineClassList* lAirlineClassList_ptr = *itACL;
00744       const stdair::ProportionFactor_T& lProportionFactor = *itPF;
00745       stdair::MeanValue_T lMeanValue = lProportionFactor*lRemainingMeanValue;
00746       stdair::StdDevValue_T lStdDevValue =
00747         lProportionFactor*lRemainingStdDevValue;
00748       setOnDForecast(*lAirlineClassList_ptr, lMeanValue, lStdDevValue,
00749                      iOnDDate, iCabinCode, iBomRoot);
00750     }
00751
00752   }
00753
00754   // ////////////////////////////////////////////////////////////////////
00755   void RMOL_Service::
00756   setOnDForecast (const stdair::AirlineClassList& iAirlineClassList,
00757                   const stdair::MeanValue_T& iMeanValue,
00758                   const stdair::StdDevValue_T& iStdDevValue,
00759                   stdair::OnDDate& iOnDDate,
00760                   const stdair::CabinCode_T& iCabinCode,
00761                   stdair::BomRoot& iBomRoot) {
00762
00763     const stdair::AirportCode_T& lOrigin = iOnDDate.getOrigin();
00764     const stdair::AirportCode_T& lDestination = iOnDDate.getDestination();
00765
00766     const stdair::Date_T& lDepartureDate = iOnDDate.getDate();
00767
00768     const stdair::AirlineCodeList_T& lAirlineCodeList =
00769       iAirlineClassList.getAirlineCodeList();
00770
00771     // Retrieve the class list (one class per airline)
00772     const stdair::ClassList_StringList_T& lClassList_StringList =
00773       iAirlineClassList.getClassCodeList();
00774     assert (!lClassList_StringList.empty());
00775     stdair::ClassCodeList_T lClassCodeList;
00776     for (stdair::ClassList_StringList_T::const_iterator itCL =
00777            lClassList_StringList.begin();
00778          itCL != lClassList_StringList.end(); ++itCL){
00779       const stdair::ClassList_String_T& lClassList_String = *itCL;
00780       assert (lClassList_String.size() > 0);
00781       stdair::ClassCode_T lFirstClass;
00782       lFirstClass.append (lClassList_String, 0, 1);
00783       lClassCodeList.push_back(lFirstClass);
00784     }
00785
00786     // Sanity check
00787     assert (lAirlineCodeList.size() == lClassCodeList.size());
00788     assert (!lAirlineCodeList.empty());
00789
00790     if (lAirlineCodeList.size() == 1) {
00791       // Store the forecast information in the case of a single segment
00792       stdair::AirlineCode_T lAirlineCode = lAirlineCodeList.front();
00793       stdair::ClassCode_T lClassCode = lClassCodeList.front();
00794       stdair::Yield_T lYield = iAirlineClassList.getYield();
00795       setOnDForecast(lAirlineCode, lDepartureDate, lOrigin,
00796                      lDestination, iCabinCode, lClassCode,
00797                      iMeanValue, iStdDevValue, lYield, iBomRoot);
00798     } else {
00799       // Store the forecast information in the case of a multiple segment
00800
00801       stdair::Yield_T lYield = iAirlineClassList.getYield();
```

```
00802       for (stdair::AirlineCodeList_T::const_iterator itAC =
00803              lAirlineCodeList.begin();
00804            itAC != lAirlineCodeList.end(); ++itAC) {
00805         const stdair::AirlineCode_T& lAirlineCode = *itAC;
00806         setOnDForecast(lAirlineCodeList, lAirlineCode, lDepartureDate, lOrigin,
00807                        lDestination, iCabinCode, lClassCodeList,
00808                        iMeanValue, iStdDevValue, lYield, iBomRoot);
00809       }
00810     }
00811   }
00812
00813   // ////////////////////////////////////////////////////////////////////
00814   void RMOL_Service::
00815   setOnDForecast (const stdair::AirlineCode_T& iAirlineCode,
00816                   const stdair::Date_T& iDepartureDate,
00817                   const stdair::AirportCode_T& iOrigin,
00818                   const stdair::AirportCode_T& iDestination,
00819                   const stdair::CabinCode_T& iCabinCode,
00820                   const stdair::ClassCode_T& iClassCode,
00821                   const stdair::MeanValue_T& iMeanValue,
00822                   const stdair::StdDevValue_T& iStdDevValue,
00823                   const stdair::Yield_T& iYield,
00824                   stdair::BomRoot& iBomRoot) {
00825     stdair::Inventory* lInventory_ptr = iBomRoot.getInventory(iAirlineCode);
00826     if (lInventory_ptr == NULL) {
00827       STDAIR_LOG_ERROR ("Cannot find the inventory corresponding"
00828                         << " to the airline" << iAirlineCode) ;
00829       assert(false);
00830     }
00831     const stdair::OnDDateList_T lOnDDateList =
00832       stdair::BomManager::getList<stdair::OnDDate> (*lInventory_ptr);
00833     assert (!lOnDDateList.empty());
00834     bool lFoundOnDDate = false;
00835     for (stdair::OnDDateList_T::const_iterator itOD = lOnDDateList.begin();
00836          itOD != lOnDDateList.end(); ++itOD) {
00837       stdair::OnDDate* lOnDDate_ptr = *itOD;
00838       assert (lOnDDate_ptr != NULL);
00839       const stdair::Date_T& lDepartureDate = lOnDDate_ptr->getDate();
00840       const stdair::AirportCode_T& lOrigin = lOnDDate_ptr->getOrigin();
00841       const stdair::AirportCode_T& lDestination = lOnDDate_ptr->getDestination();

00842       if (!stdair::BomManager::hasList<stdair::SegmentDate> (*lOnDDate_ptr)) {
00843         STDAIR_LOG_ERROR ("The O&D date " << lOnDDate_ptr->describeKey()
00844                           << "has not been correctly initialized : SegmentDate li
      st is missing");
00845         assert (false);
00846       }
00847       const stdair::SegmentDateList_T& lSegmentDateList =
00848         stdair::BomManager::getList<stdair::SegmentDate> (*lOnDDate_ptr);
00849       // Check if the the O&D date is the one we are looking for
00850       if (lDepartureDate == iDepartureDate && lOrigin == iOrigin &&
00851           lDestination == iDestination && lSegmentDateList.size() == 1) {
00852         stdair::CabinClassPair_T lCabinClassPair (iCabinCode, iClassCode);
00853         stdair::CabinClassPairList_T lCabinClassPairList;
00854         lCabinClassPairList.push_back(lCabinClassPair);
00855         const stdair::MeanStdDevPair_T lMeanStdDevPair (iMeanValue, iStdDevValue)
      ;
00856         const stdair::WTPDemandPair_T lWTPDemandPair (iYield, lMeanStdDevPair);
00857         lOnDDate_ptr->setDemandInformation(lCabinClassPairList, lWTPDemandPair);
00858         lFoundOnDDate = true;
00859         STDAIR_LOG_DEBUG (iAirlineCode << " Class " << iClassCode
00860                           << " Mean " << iMeanValue
```

```
00861                           << " Std Dev " << iStdDevValue);
00862         break;
00863       }
00864     }
00865
00866     if (!lFoundOnDDate) {
00867       STDAIR_LOG_ERROR ("Cannot find class " << iClassCode << " in cabin "
00868                         << iCabinCode << " for the segment "
00869                         << iOrigin << "-" << iDestination << " with"
00870                         << " the airline " << iAirlineCode);
00871       assert(false);
00872     }
00873   }
00874
00875   // ////////////////////////////////////////////////////////////////////
00876   void RMOL_Service::
00877   setOnDForecast (const stdair::AirlineCodeList_T& iAirlineCodeList,
00878                   const stdair::AirlineCode_T& iAirlineCode,
00879                   const stdair::Date_T& iDepartureDate,
00880                   const stdair::AirportCode_T& iOrigin,
00881                   const stdair::AirportCode_T& iDestination,
00882                   const stdair::CabinCode_T& iCabinCode,
00883                   const stdair::ClassCodeList_T& iClassCodeList,
00884                   const stdair::MeanValue_T& iMeanValue,
00885                   const stdair::StdDevValue_T& iStdDevValue,
00886                   const stdair::Yield_T& iYield,
00887                   stdair::BomRoot& iBomRoot) {
00888     stdair::Inventory* lInventory_ptr = iBomRoot.getInventory(iAirlineCode);
00889     if (lInventory_ptr == NULL) {
00890       STDAIR_LOG_ERROR ("Cannot find the inventory corresponding"
00891                         << " to the airline" << iAirlineCode) ;
00892       assert(false);
00893     }
00894     const stdair::OnDDateList_T lOnDDateList =
00895       stdair::BomManager::getList<stdair::OnDDate> (*lInventory_ptr);
00896     assert (!lOnDDateList.empty());
00897     bool lFoundOnDDate = false;
00898     for (stdair::OnDDateList_T::const_iterator itOD = lOnDDateList.begin();
00899          itOD != lOnDDateList.end(); ++itOD) {
00900       stdair::OnDDate* lOnDDate_ptr = *itOD;
00901       assert (lOnDDate_ptr != NULL);
00902       const stdair::Date_T& lDepartureDate = lOnDDate_ptr->getDate();
00903       const stdair::AirportCode_T& lOrigin = lOnDDate_ptr->getOrigin();
00904       const stdair::AirportCode_T& lDestination = lOnDDate_ptr->getDestination();

00905       if (!stdair::BomManager::hasList<stdair::SegmentDate> (*lOnDDate_ptr)) {
00906         STDAIR_LOG_ERROR ("The O&D date " << lOnDDate_ptr->describeKey()
00907                           << "has not been correctly initialized : SegmentDate li
      st is missing");
00908         assert (false);
00909       }
00910       const stdair::SegmentDateList_T& lSegmentDateList =
00911         stdair::BomManager::getList<stdair::SegmentDate> (*lOnDDate_ptr);
00912       // Check if the O&D date might be the one we are looking for.
00913       // There still is a test to go through to see if the combination of airline
      s is right.
00914       if (lDepartureDate == iDepartureDate && lOrigin == iOrigin &&
00915           lDestination == iDestination && lSegmentDateList.size() == iAirlineCode
      List.size()) {
00916         const stdair::SegmentDateList_T& lSegmentDateList =
00917           stdair::BomManager::getList<stdair::SegmentDate> (*lOnDDate_ptr);
```

```
00918         stdair::AirlineCodeList_T::const_iterator itAC = iAirlineCodeList.begin()
      ;
00919         stdair::SegmentDateList_T::const_iterator itSD = lSegmentDateList.begin()
      ;
00920         for (;itAC != iAirlineCodeList.end(); ++itAC, ++itSD) {
00921           const stdair::AirlineCode_T lForecastAirlineCode = *itAC;
00922           const stdair::SegmentDate* lSegmentDate_ptr = *itSD;
00923           // Get the operating airline code and check if it is the airline we are
       looking for.
00924           const bool isOtherAirlineOperating =  lSegmentDate_ptr->isOtherAirlineO
      perating();
00925           if (isOtherAirlineOperating == true) {
00926             const bool hasListSegmentDate =
00927               stdair::BomManager::hasList<stdair::SegmentDate> (*lSegmentDate_ptr
      );
00928             assert (hasListSegmentDate == true);
00929             const stdair::SegmentDateList_T& lOperatingSDList =
00930               stdair::BomManager::getList<stdair::SegmentDate> (*lSegmentDate_ptr
      );
00931             assert (lOperatingSDList.size() == 1);
00932             const stdair::SegmentDate* lOperatingSD_ptr = *lSegmentDateList.begin
      ();
00933             assert (lOperatingSD_ptr != NULL);
00934             const stdair::FlightDate* lOperatingFD_ptr =
00935               stdair::BomManager::getParentPtr<stdair::FlightDate>(*lOperatingSD_
      ptr);
00936             const stdair::AirlineCode_T lOperatingAirlineCode = lOperatingFD_ptr-
      >getAirlineCode();
00937             if (lOperatingAirlineCode != lForecastAirlineCode) {break;}
00938           } else {
00939             const stdair::AirlineCode_T lOperatingAirlineCode = lOnDDate_ptr->get
      AirlineCode();
00940             if (lOperatingAirlineCode != lForecastAirlineCode) {break;}
00941           }
00942         }
00943         if (itAC == iAirlineCodeList.end()) {lFoundOnDDate = true;}
00944       }
00945       if (lFoundOnDDate) {
00946         stdair::CabinClassPairList_T lCabinClassPairList;
00947         for (stdair::ClassCodeList_T::const_iterator itCC = iClassCodeList.begin(
      );
00948              itCC != iClassCodeList.end(); ++itCC) {
00949           const stdair::ClassCode_T lClassCode = *itCC;
00950           stdair::CabinClassPair_T lCabinClassPair (iCabinCode, lClassCode);
00951           lCabinClassPairList.push_back(lCabinClassPair);
00952         }
00953         const stdair::MeanStdDevPair_T lMeanStdDevPair (iMeanValue, iStdDevValue)
      ;
00954         const stdair::YieldDemandPair_T lYieldDemandPair (iYield, lMeanStdDevPair
      );
00955         lOnDDate_ptr->setDemandInformation(lCabinClassPairList, lYieldDemandPair)
      ;
00956         lFoundOnDDate = true;
00957         std::ostringstream oACStr;
00958         for (stdair::AirlineCodeList_T::const_iterator itAC = iAirlineCodeList.be
      gin();
00959              itAC != iAirlineCodeList.end(); ++itAC) {
00960           if (itAC == iAirlineCodeList.begin()) {
00961             oACStr << *itAC;
00962           }
00963           else {
00964             oACStr << "-" << *itAC;
```

```
00965           }
00966         }
00967         std::ostringstream oCCStr;
00968         for (stdair::ClassCodeList_T::const_iterator itCC = iClassCodeList.begin(
      );
00969              itCC != iClassCodeList.end(); ++itCC) {
00970           if (itCC == iClassCodeList.begin()) {
00971             oCCStr << *itCC;
00972           }
00973           else {
00974             oCCStr << "-" << *itCC;
00975           }
00976         }
00977
00978         STDAIR_LOG_DEBUG (oACStr.str() << " Classes " << oCCStr.str()
00979                           << " Mean " << iMeanValue << " Std Dev " << iStdDevValu
      e);
00980         break;
00981       }
00982     }
00983     if (!lFoundOnDDate) {
00984       STDAIR_LOG_ERROR ("Cannot find the required multi-segment O&D date:  "
00985                         << iOrigin << "-" << iDestination << " " << iDepartureDat
      e);
00986       assert(false);
00987     }
00988   }
00989
00990   // ////////////////////////////////////////////////////////////////////
00991   void RMOL_Service::
00992   resetDemandInformation (const stdair::DateTime_T& iRMEventTime) {
00993     if (_rmolServiceContext == NULL) {
00994       throw stdair::NonInitialisedServiceException ("The Rmol service "
00995                                                     "has not been initialised");
00996     }
00997     assert (_rmolServiceContext != NULL);
00998     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
00999
01000     // Retrieve the bom root
01001     stdair::STDAIR_Service& lSTDAIR_Service =
01002       lRMOL_ServiceContext.getSTDAIR_Service();
01003     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01004
01005     const stdair::InventoryList_T lInventoryList =
01006       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01007     assert (!lInventoryList.empty());
01008     for (stdair::InventoryList_T::const_iterator itInv = lInventoryList.begin();
01009          itInv != lInventoryList.end(); ++itInv) {
01010       const stdair::Inventory* lInventory_ptr = *itInv;
01011       assert (lInventory_ptr != NULL);
01012       resetDemandInformation (iRMEventTime, *lInventory_ptr);
01013     }
01014   }
01015
01016   // ////////////////////////////////////////////////////////////////////
01017   void RMOL_Service::
01018   resetDemandInformation (const stdair::DateTime_T& iRMEventTime,
01019                           const stdair::Inventory& iInventory) {
01020
01021     const stdair::FlightDateList_T lFlightDateList =
01022       stdair::BomManager::getList<stdair::FlightDate> (iInventory);
01023     assert (!lFlightDateList.empty());
```

```
01024     for (stdair::FlightDateList_T::const_iterator itFD = lFlightDateList.begin();

01025          itFD != lFlightDateList.end(); ++itFD) {
01026       const stdair::FlightDate* lFlightDate_ptr = *itFD;
01027       assert (lFlightDate_ptr != NULL);
01028
01029       // Retrieve the date from the RM event
01030       const stdair::Date_T lDate = iRMEventTime.date();
01031
01032       const stdair::Date_T& lDepartureDate = lFlightDate_ptr->getDepartureDate();

01033       stdair::DateOffset_T lDateOffset = lDepartureDate - lDate;
01034       stdair::DTD_T lDTD = short (lDateOffset.days());
01035
01036       stdair::DCPList_T::const_iterator itDCP =
01037         std::find (stdair::DEFAULT_DCP_LIST.begin(), stdair::DEFAULT_DCP_LIST.end
      (), lDTD);
01038       // Check if the demand forecast info corresponding to this flight date need
      s to be reset.
01039       if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01040         // Check if the flight date holds a list of leg dates.
01041         // If so, find all leg cabin and reset the forecast they are holding.
01042         if (stdair::BomManager::hasList<stdair::LegDate> (*lFlightDate_ptr)) {
01043           const stdair::LegDateList_T lLegDateList =
01044             stdair::BomManager::getList<stdair::LegDate> (*lFlightDate_ptr);
01045           assert (!lLegDateList.empty());
01046           for (stdair::LegDateList_T::const_iterator itLD = lLegDateList.begin();

01047                itLD != lLegDateList.end(); ++itLD) {
01048             const stdair::LegDate* lLegDate_ptr = *itLD;
01049             assert (lLegDate_ptr != NULL);
01050             const stdair::LegCabinList_T lLegCabinList =
01051               stdair::BomManager::getList<stdair::LegCabin> (*lLegDate_ptr);
01052             assert (!lLegCabinList.empty());
01053             for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList.begi
      n();
01054                  itLC != lLegCabinList.end(); ++itLC) {
01055               stdair::LegCabin* lLegCabin_ptr = *itLC;
01056               assert (lLegCabin_ptr != NULL);
01057               lLegCabin_ptr->emptyYieldLevelDemandMap();
01058             }
01059           }
01060         }
01061       }
01062     }
01063   }
01064
01065   // ////////////////////////////////////////////////////////////////////
01066   void RMOL_Service::projectAggregatedDemandOnLegCabins(const stdair::DateTime_T&
       iRMEventTime) {
01067
01068     if (_rmolServiceContext == NULL) {
01069       throw stdair::NonInitialisedServiceException ("The Rmol service "
01070                                                     "has not been initialised");
01071     }
01072     assert (_rmolServiceContext != NULL);
01073     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01074
01075     // Retrieve the bom root
01076     stdair::STDAIR_Service& lSTDAIR_Service =
01077       lRMOL_ServiceContext.getSTDAIR_Service();
01078     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
```

```
01079
01080     // Retrieve the date from the RM event
01081     const stdair::Date_T lDate = iRMEventTime.date();
01082
01083     const stdair::InventoryList_T lInventoryList =
01084       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01085     assert (!lInventoryList.empty());
01086     for (stdair::InventoryList_T::const_iterator itInv = lInventoryList.begin();
01087          itInv != lInventoryList.end(); ++itInv) {
01088       const stdair::Inventory* lInventory_ptr = *itInv;
01089       assert (lInventory_ptr != NULL);
01090       const stdair::OnDDateList_T lOnDDateList =
01091         stdair::BomManager::getList<stdair::OnDDate> (*lInventory_ptr);
01092       assert (!lOnDDateList.empty());
01093       for (stdair::OnDDateList_T::const_iterator itOD = lOnDDateList.begin();
01094            itOD != lOnDDateList.end(); ++itOD) {
01095         stdair::OnDDate* lOnDDate_ptr = *itOD;
01096         assert (lOnDDate_ptr != NULL);
01097
01098         const stdair::Date_T& lDepartureDate = lOnDDate_ptr->getDate();
01099         stdair::DateOffset_T lDateOffset = lDepartureDate - lDate;
01100         stdair::DTD_T lDTD = short (lDateOffset.days());
01101
01102         stdair::DCPList_T::const_iterator itDCP =
01103           std::find (stdair::DEFAULT_DCP_LIST.begin(), stdair::DEFAULT_DCP_LIST.e
      nd(), lDTD);
01104         // Check if the forecast for this O&D date needs to be projected.
01105         if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01106
01107           // Browse the demand info map.
01108           const stdair::StringDemandStructMap_T& lStringDemandStructMap =
01109             lOnDDate_ptr->getDemandInfoMap ();
01110           for (stdair::StringDemandStructMap_T::const_iterator itStrDS = lStringD
      emandStructMap.begin();
01111                itStrDS != lStringDemandStructMap.end(); ++itStrDS) {
01112             std::string lCabinClassPath = itStrDS->first;
01113             const stdair::YieldDemandPair_T& lYieldDemandPair =
01114               itStrDS->second;
01115             const stdair::CabinClassPairList_T& lCabinClassPairList =
01116               lOnDDate_ptr->getCabinClassPairList(lCabinClassPath);
01117             const unsigned int lNbOfSegments = lOnDDate_ptr->getNbOfSegments();
01118             // Sanity check
01119             assert (lCabinClassPairList.size() == lNbOfSegments);
01120
01121             const stdair::SegmentDateList_T lOnDSegmentDateList =
01122               stdair::BomManager::getList<stdair::SegmentDate> (*lOnDDate_ptr);
01123             // Sanity check
01124             assert (lOnDSegmentDateList.size() == lNbOfSegments);
01125             stdair::CabinClassPairList_T::const_iterator itCCP = lCabinClassPairL
      ist.begin();
01126             stdair::SegmentDateList_T::const_iterator itSD = lOnDSegmentDateList.
      begin();
01127             for (; itSD != lOnDSegmentDateList.end(); ++itCCP, ++itSD) {
01128               const stdair::SegmentDate* lSegmentDate_ptr = *itSD;
01129               assert (lSegmentDate_ptr != NULL);
01130               // Only operated legs receive the demand information.
01131               if (!lSegmentDate_ptr->isOtherAirlineOperating()) {
01132                 const stdair::CabinCode_T lCabinCode = itCCP->first;
01133                 const stdair::ClassCode_T lClassCode = itCCP->second;
01134                 const stdair::SegmentCabin* lSegmentCabin_ptr =
01135                   stdair::BomManager::getObjectPtr<stdair::SegmentCabin> (*lSegme
      ntDate_ptr,
```

```
01136                                                                   lCabinC
      ode);
01137                 assert (lSegmentCabin_ptr != NULL);
01138                 // Retrieve the booking class (level of aggregation of demand).
01139                 // The yield of the class is assigned to all types of demand for
      it.
01140                 const stdair::BookingClass* lBookingClass_ptr =
01141                   stdair::BomManager::getObjectPtr<stdair::BookingClass> (*lSegme
      ntCabin_ptr,
01142                                                                   lClassC
      ode);
01143                 assert (lBookingClass_ptr != NULL);
01144                 const stdair::LegCabinList_T lLegCabinList =
01145                   stdair::BomManager::getList<stdair::LegCabin> (*lSegmentCabin_p
      tr);
01146                 assert (!lLegCabinList.empty());
01147                 const int lNbOfLegs = lLegCabinList.size();
01148                 // Determine the yield (equally distributed over legs).
01149                 const stdair::Yield_T& lYield = lBookingClass_ptr->getYield()/lNb
      OfLegs;
01150                 const stdair::MeanStdDevPair_T& lMeanStdDevPair =
01151                   lYieldDemandPair.second;
01152                 const stdair::MeanValue_T& lMeanValue = lMeanStdDevPair.first;
01153                 const stdair::StdDevValue_T& lStdDevValue = lMeanStdDevPair.secon
      d;
01154                 for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList.
      begin();
01155                      itLC != lLegCabinList.end(); ++itLC) {
01156                   stdair::LegCabin* lLegCabin_ptr = *itLC;
01157                   assert (lLegCabin_ptr != NULL);
01158                   lLegCabin_ptr->addDemandInformation (lYield, lMeanValue, lStdDe
      vValue);
01159                 }
01160               }
01161             }
01162           }
01163         }
01164       }
01165     }
01166   }
01167
01168   // ////////////////////////////////////////////////////////////////////
01169   void RMOL_Service::projectOnDDemandOnLegCabinsUsingYP(const stdair::DateTime_T&
       iRMEventTime) {
01170
01171     if (_rmolServiceContext == NULL) {
01172       throw stdair::NonInitialisedServiceException ("The Rmol service "
01173                                                     "has not been initialised");
01174     }
01175     assert (_rmolServiceContext != NULL);
01176     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01177
01178     // Retrieve the bom root
01179     stdair::STDAIR_Service& lSTDAIR_Service =
01180       lRMOL_ServiceContext.getSTDAIR_Service();
01181     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01182
01183     // Retrieve the date from the RM event
01184     const stdair::Date_T lDate = iRMEventTime.date();
01185
01186     const stdair::InventoryList_T lInventoryList =
01187       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
```

```
01188     assert (!lInventoryList.empty());
01189     for (stdair::InventoryList_T::const_iterator itInv = lInventoryList.begin();
01190          itInv != lInventoryList.end(); ++itInv) {
01191       const stdair::Inventory* lInventory_ptr = *itInv;
01192       assert (lInventory_ptr != NULL);
01193       const stdair::OnDDateList_T lOnDDateList =
01194         stdair::BomManager::getList<stdair::OnDDate> (*lInventory_ptr);
01195       assert (!lOnDDateList.empty());
01196       for (stdair::OnDDateList_T::const_iterator itOD = lOnDDateList.begin();
01197            itOD != lOnDDateList.end(); ++itOD) {
01198         stdair::OnDDate* lOnDDate_ptr = *itOD;
01199         assert (lOnDDate_ptr != NULL);
01200
01201         const stdair::Date_T& lDepartureDate = lOnDDate_ptr->getDate();
01202         stdair::DateOffset_T lDateOffset = lDepartureDate - lDate;
01203         stdair::DTD_T lDTD = short (lDateOffset.days());
01204
01205         stdair::DCPList_T::const_iterator itDCP =
01206           std::find (stdair::DEFAULT_DCP_LIST.begin(), stdair::DEFAULT_DCP_LIST.e
      nd(), lDTD);
01207         // Check if the forecast for this O&D date needs to be projected.
01208         if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01209
01210           // Browse the demand info map.
01211           const stdair::StringDemandStructMap_T& lStringDemandStructMap =
01212             lOnDDate_ptr->getDemandInfoMap ();
01213           for (stdair::StringDemandStructMap_T::const_iterator itStrDS = lStringD
      emandStructMap.begin();
01214                itStrDS != lStringDemandStructMap.end(); ++itStrDS) {
01215             std::string lCabinClassPath = itStrDS->first;
01216             const stdair::YieldDemandPair_T& lYieldDemandPair =
01217               itStrDS->second;
01218             const stdair::CabinClassPairList_T& lCabinClassPairList =
01219               lOnDDate_ptr->getCabinClassPairList(lCabinClassPath);
01220             const unsigned int lNbOfSegments = lOnDDate_ptr->getNbOfSegments();
01221             // Sanity check
01222             assert (lCabinClassPairList.size() == lNbOfSegments);
01223
01224             const stdair::SegmentDateList_T lOnDSegmentDateList =
01225               stdair::BomManager::getList<stdair::SegmentDate> (*lOnDDate_ptr);
01226             // Sanity check
01227             assert (lOnDSegmentDateList.size() == lNbOfSegments);
01228             stdair::CabinClassPairList_T::const_iterator itCCP = lCabinClassPairL
      ist.begin();
01229             stdair::SegmentDateList_T::const_iterator itSD = lOnDSegmentDateList.
      begin();
01230             for (; itSD != lOnDSegmentDateList.end(); ++itCCP, ++itSD) {
01231               const stdair::SegmentDate* lSegmentDate_ptr = *itSD;
01232               assert (lSegmentDate_ptr != NULL);
01233               // Only operated legs receive the demand information.
01234               if (!lSegmentDate_ptr->isOtherAirlineOperating()) {
01235                 const stdair::CabinCode_T lCabinCode = itCCP->first;
01236                 const stdair::ClassCode_T lClassCode = itCCP->second;
01237                 const stdair::SegmentCabin* lSegmentCabin_ptr =
01238                   stdair::BomManager::getObjectPtr<stdair::SegmentCabin> (*lSegme
      ntDate_ptr,
01239                                                                           lCabinC
      ode);
01240                 assert (lSegmentCabin_ptr != NULL);
01241                 const stdair::LegCabinList_T lLegCabinList =
01242                   stdair::BomManager::getList<stdair::LegCabin> (*lSegmentCabin_p
      tr);
```

```
01243                 assert (!lLegCabinList.empty());
01244                 const int lNbOfLegs = lLegCabinList.size();
01245                 // Determine the yield (equally distributed over segments and the
      n legs).
01246                 const stdair::MeanStdDevPair_T& lMeanStdDevPair =
01247                   lYieldDemandPair.second;
01248                 const stdair::Yield_T& lYield = lYieldDemandPair.first/(lNbOfLegs
      *lNbOfSegments);
01249                 const stdair::MeanValue_T& lMeanValue = lMeanStdDevPair.first;
01250                 const stdair::StdDevValue_T& lStdDevValue = lMeanStdDevPair.secon
      d;
01251                 for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList.
      begin();
01252                      itLC != lLegCabinList.end(); ++itLC) {
01253                   stdair::LegCabin* lLegCabin_ptr = *itLC;
01254                   assert (lLegCabin_ptr != NULL);
01255                   lLegCabin_ptr->addDemandInformation (lYield, lMeanValue, lStdDe
      vValue);
01256                 }
01257               }
01258             }
01259           }
01260         }
01261       }
01262     }
01263   }
01264
01265   // ////////////////////////////////////////////////////////////////////
01266   void RMOL_Service::optimiseOnD (const stdair::DateTime_T& iRMEventTime) {
01267
01268     if (_rmolServiceContext == NULL) {
01269       throw stdair::NonInitialisedServiceException ("The Rmol service "
01270                                                     "has not been initialised");
01271     }
01272     assert (_rmolServiceContext != NULL);
01273     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01274
01275     // Retrieve the bom root
01276     stdair::STDAIR_Service& lSTDAIR_Service =
01277       lRMOL_ServiceContext.getSTDAIR_Service();
01278     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01279
01280     // Retrieve the date from the RM event
01281     const stdair::Date_T lDate = iRMEventTime.date();
01282
01283     const stdair::InventoryList_T& lInvList =
01284       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01285     for (stdair::InventoryList_T::const_iterator itInv = lInvList.begin();
01286          itInv != lInvList.end(); ++itInv) {
01287       stdair::Inventory* lCurrentInv_ptr = *itInv;
01288       assert (lCurrentInv_ptr != NULL);
01289
01290       const stdair::FlightDateList_T& lFlightDateList =
01291         stdair::BomManager::getList<stdair::FlightDate> (*lCurrentInv_ptr);
01292       for (stdair::FlightDateList_T::const_iterator itFlightDate =
01293              lFlightDateList.begin();
01294            itFlightDate != lFlightDateList.end(); ++itFlightDate) {
01295         stdair::FlightDate* lCurrentFlightDate_ptr = *itFlightDate;
01296         assert (lCurrentFlightDate_ptr != NULL);
01297
01298         const stdair::Date_T& lCurrentDepartureDate = lCurrentFlightDate_ptr->get
      DepartureDate();
```

```
01299         stdair::DateOffset_T lDateOffset = lCurrentDepartureDate - lDate;
01300         stdair::DTD_T lDTD = short (lDateOffset.days());
01301
01302         stdair::DCPList_T::const_iterator itDCP =
01303           std::find (stdair::DEFAULT_DCP_LIST.begin(), stdair::DEFAULT_DCP_LIST.e
      nd(), lDTD);
01304         // Check if the optimisation is needed.
01305         if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01306           STDAIR_LOG_DEBUG ("Optimisation using O&D forecast: " << lCurrentInv_pt
      r->getAirlineCode()
01307                             << " Departure " << lCurrentDepartureDate << " DTD "
      << lDTD);
01308           Optimiser::optimiseUsingOnDForecast (*lCurrentFlightDate_ptr);
01309         }
01310       }
01311     }
01312   }
01313
01314   // ////////////////////////////////////////////////////////////////////
01315   void RMOL_Service::updateBidPrice (const stdair::DateTime_T& iRMEventTime) {
01316
01317     if (_rmolServiceContext == NULL) {
01318       throw stdair::NonInitialisedServiceException ("The Rmol service "
01319                                                     "has not been initialised");
01320     }
01321     assert (_rmolServiceContext != NULL);
01322     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01323
01324     // Retrieve the bom root
01325     stdair::STDAIR_Service& lSTDAIR_Service =
01326       lRMOL_ServiceContext.getSTDAIR_Service();
01327     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01328
01329     // Retrieve the date from the RM event
01330     const stdair::Date_T lDate = iRMEventTime.date();
01331
01332     const stdair::InventoryList_T& lInvList =
01333       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01334
01335     for (stdair::InventoryList_T::const_iterator itInv = lInvList.begin();
01336          itInv != lInvList.end(); ++itInv) {
01337       stdair::Inventory* lCurrentInv_ptr = *itInv;
01338       assert (lCurrentInv_ptr != NULL);
01339
01340       const stdair::FlightDateList_T& lFlightDateList =
01341         stdair::BomManager::getList<stdair::FlightDate> (*lCurrentInv_ptr);
01342       for (stdair::FlightDateList_T::const_iterator itFlightDate =
01343              lFlightDateList.begin();
01344            itFlightDate != lFlightDateList.end(); ++itFlightDate) {
01345         stdair::FlightDate* lCurrentFlightDate_ptr = *itFlightDate;
01346         assert (lCurrentFlightDate_ptr != NULL);
01347
01348         const stdair::Date_T& lCurrentDepartureDate = lCurrentFlightDate_ptr->get
      DepartureDate();
01349         stdair::DateOffset_T lDateOffset = lCurrentDepartureDate - lDate;
01350         stdair::DTD_T lDTD = short (lDateOffset.days());
01351
01352         stdair::DCPList_T::const_iterator itDCP =
01353           std::find (stdair::DEFAULT_DCP_LIST.begin(), stdair::DEFAULT_DCP_LIST.e
      nd(), lDTD);
01354         // Check if the operation is needed.
01355         if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
```

```
01356           updateBidPrice (*lCurrentFlightDate_ptr, lBomRoot);
01357         }
01358       }
01359     }
01360   }
01361
01362   // ////////////////////////////////////////////////////////////////////
01363   void RMOL_Service::updateBidPrice (const stdair::FlightDate& iFlightDate,
01364                                      stdair::BomRoot& iBomRoot) {
01365     const stdair::SegmentDateList_T& lSegmentDateList =
01366       stdair::BomManager::getList<stdair::SegmentDate> (iFlightDate);
01367     const stdair::AirlineCode_T& lOptAC = iFlightDate.getAirlineCode();
01368     const std::string lFDKeyStr = iFlightDate.describeKey();
01369
01370     for (stdair::SegmentDateList_T::const_iterator itSegmentDate = lSegmentDateLi
      st.begin();
01371          itSegmentDate != lSegmentDateList.end(); ++itSegmentDate) {
01372       stdair::SegmentDate* lSegmentDate_ptr = *itSegmentDate;
01373       assert (lSegmentDate_ptr != NULL);
01374       if (stdair::BomManager::hasList<stdair::SegmentDate>(*lSegmentDate_ptr)) {
01375         const stdair::LegDateList_T& lLegDateList =
01376           stdair::BomManager::getList<stdair::LegDate>(*lSegmentDate_ptr);
01377         // Get the list of marketing carriers segments.
01378         // These are part of maketing partners inventories images held by the ope
      rating airline.
01379         const stdair::SegmentDateList_T& lMktSegmentDateList =
01380           stdair::BomManager::getList<stdair::SegmentDate>(*lSegmentDate_ptr);
01381         for (stdair::SegmentDateList_T::const_iterator itMktSD = lMktSegmentDateL
      ist.begin();
01382              itMktSD != lMktSegmentDateList.end(); ++itMktSD) {
01383           // Get the marketing airline code.
01384           stdair::SegmentDate* lMktSD_ptr = *itMktSD;
01385           assert (lMktSD_ptr != NULL);
01386           stdair::FlightDate* lMktFD_ptr =
01387             stdair::BomManager::getParentPtr<stdair::FlightDate>(*lMktSD_ptr);
01388           assert (lMktFD_ptr != NULL);
01389           const stdair::AirlineCode_T& lMktAC = lMktFD_ptr->getAirlineCode();
01390           // Get the (real) marketer inventory.
01391           const stdair::Inventory* lMktInv_ptr =
01392             stdair::BomManager::getObjectPtr<stdair::Inventory>(iBomRoot,lMktAC);

01393           assert (lMktInv_ptr != NULL);
01394           // Get the image of the operating airline inventory held by the markete
      r.
01395           const stdair::Inventory* lOptInv_ptr =
01396             stdair::BomManager::getObjectPtr<stdair::Inventory>(*lMktInv_ptr,lOpt
      AC);
01397           assert (lOptInv_ptr != NULL);
01398           // Find the image of the concerned flight date.
01399           const stdair::FlightDate* lOptFD_ptr =
01400             stdair::BomManager::getObjectPtr<stdair::FlightDate>(*lOptInv_ptr,lFD
      KeyStr);
01401           assert (lOptFD_ptr != NULL);
01402           // Browse the list of leg dates in the real operating inventory.
01403           // Retrieve the image of each leg date.
01404           for (stdair::LegDateList_T::const_iterator itLD = lLegDateList.begin();

01405                itLD != lLegDateList.end(); ++itLD) {
01406             const stdair::LegDate* lLD_ptr = *itLD;
01407             assert (lLD_ptr != NULL);
01408             const std::string lLDKeyStr = lLD_ptr->describeKey();
01409             stdair::LegDate* lOptLD_ptr =
```

```
01410               stdair::BomManager::getObjectPtr<stdair::LegDate>(*lOptFD_ptr,lLDKe
      yStr);
01411             assert (lOptLD_ptr != NULL);
01412             const stdair::LegCabinList_T& lLegCabinList_T =
01413               stdair::BomManager::getList<stdair::LegCabin>(*lLD_ptr);
01414             // Browse the list of leg cabins in the real operating inventory.
01415             // Retrieve the image of each leg cabin and update the bid price of t
      he real and send it to the image.
01416             for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList_T.be
      gin();
01417                  itLC != lLegCabinList_T.end(); ++itLC) {
01418               stdair::LegCabin* lLC_ptr = *itLC;
01419               assert (lLC_ptr != NULL);
01420               const std::string lLCKeyStr = lLC_ptr->describeKey();
01421               stdair::LegCabin* lOptLC_ptr =
01422                 stdair::BomManager::getObjectPtr<stdair::LegCabin>(*lOptLD_ptr, l
      LCKeyStr);
01423               assert (lOptLC_ptr != NULL);
01424               // Update the current bid price of the real leg.
01425               lLC_ptr->updateCurrentBidPrice();
01426               // Update the previous bid price (store the current).
01427               lOptLC_ptr->updatePreviousBidPrice();
01428               // Update the current bid price.
01429               lOptLC_ptr->setCurrentBidPrice (lLC_ptr->getCurrentBidPrice());
01430
01431               STDAIR_LOG_DEBUG ("Update bid price of " << lLC_ptr->getFullerKey()

01432                                 << " : " << lOptLC_ptr->getCurrentBidPrice()
01433                                 << " Availability pool " << lLC_ptr->getAvailabil
      ityPool());
01434             }
01435           }
01436         }
01437       }
01438     }
01439   }
01440
01441   // ////////////////////////////////////////////////////////////////////
01442   void RMOL_Service::projectOnDDemandOnLegCabinsUsingDA(const stdair::DateTime_T&
       iRMEventTime) {
01443
01444     if (_rmolServiceContext == NULL) {
01445       throw stdair::NonInitialisedServiceException ("The Rmol service "
01446                                                     "has not been initialised");
01447     }
01448     assert (_rmolServiceContext != NULL);
01449     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01450
01451     // Retrieve the bom root
01452     stdair::STDAIR_Service& lSTDAIR_Service =
01453       lRMOL_ServiceContext.getSTDAIR_Service();
01454     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01455
01456     // Retrieve the date from the RM event
01457     const stdair::Date_T lDate = iRMEventTime.date();
01458
01459     const stdair::InventoryList_T lInventoryList =
01460       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01461     assert (!lInventoryList.empty());
01462     for (stdair::InventoryList_T::const_iterator itInv = lInventoryList.begin();
01463          itInv != lInventoryList.end(); ++itInv) {
01464       const stdair::Inventory* lInventory_ptr = *itInv;
```

```
01465       assert (lInventory_ptr != NULL);
01466       const stdair::OnDDateList_T lOnDDateList =
01467         stdair::BomManager::getList<stdair::OnDDate> (*lInventory_ptr);
01468       assert (!lOnDDateList.empty());
01469       for (stdair::OnDDateList_T::const_iterator itOD = lOnDDateList.begin();
01470            itOD != lOnDDateList.end(); ++itOD) {
01471         stdair::OnDDate* lOnDDate_ptr = *itOD;
01472         assert (lOnDDate_ptr != NULL);
01473
01474         const stdair::Date_T& lDepartureDate = lOnDDate_ptr->getDate();
01475         stdair::DateOffset_T lDateOffset = lDepartureDate - lDate;
01476         stdair::DTD_T lDTD = short (lDateOffset.days());
01477
01478         stdair::DCPList_T::const_iterator itDCP =
01479           std::find (stdair::DEFAULT_DCP_LIST.begin(), stdair::DEFAULT_DCP_LIST.e
      nd(), lDTD);
01480         // Check if the forecast for this O&D date needs to be projected.
01481         if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01482
01483           // Browse the demand info map.
01484           const stdair::StringDemandStructMap_T& lStringDemandStructMap =
01485             lOnDDate_ptr->getDemandInfoMap ();
01486           for (stdair::StringDemandStructMap_T::const_iterator itStrDS = lStringD
      emandStructMap.begin();
01487                itStrDS != lStringDemandStructMap.end(); ++itStrDS) {
01488             std::string lCabinClassPath = itStrDS->first;
01489             const stdair::YieldDemandPair_T& lYieldDemandPair = itStrDS->second;
01490             const stdair::CabinClassPairList_T& lCabinClassPairList =
01491               lOnDDate_ptr->getCabinClassPairList(lCabinClassPath);
01492             const unsigned int lNbOfSegments = lOnDDate_ptr->getNbOfSegments();
01493             // Sanity check
01494             assert (lCabinClassPairList.size() == lNbOfSegments);
01495
01496             //
01497             const stdair::SegmentDateList_T lOnDSegmentDateList =
01498               stdair::BomManager::getList<stdair::SegmentDate> (*lOnDDate_ptr);
01499             // Sanity check
01500             assert (lOnDSegmentDateList.size() == lNbOfSegments);
01501             stdair::CabinClassPairList_T::const_iterator itCCP = lCabinClassPairL
      ist.begin();
01502             stdair::SegmentDateList_T::const_iterator itSD = lOnDSegmentDateList.
      begin();
01503             // List of bid prices that will be used to easily compute displacemen
      t-ajusted yields.
01504             std::list<stdair::BidPrice_T> lBidPriceList;
01505             // The sum of bid prices that will be stored in the list above.
01506             stdair::BidPrice_T lTotalBidPrice = 0;
01507             // Retrieve the bid prices
01508             for (; itSD != lOnDSegmentDateList.end(); ++itCCP, ++itSD) {
01509               // Get the operating segment cabin (it holds the bid price informat
      ion).
01510               const stdair::SegmentDate* lSegmentDate_ptr = *itSD;
01511               assert (lSegmentDate_ptr != NULL);
01512               // Get the operating airline code and check if it is the airline we
       are looking for.
01513               const bool isOtherAirlineOperating =  lSegmentDate_ptr->isOtherAirl
      ineOperating();
01514               if (isOtherAirlineOperating == true) {
01515                 const bool hasListSegmentDate =
01516                   stdair::BomManager::hasList<stdair::SegmentDate> (*lSegmentDate
      _ptr);
01517                 assert (hasListSegmentDate == true);
```

```
01518                 const stdair::SegmentDateList_T& lOperatingSDList =
01519                   stdair::BomManager::getList<stdair::SegmentDate> (*lSegmentDate
      _ptr);
01520                 assert (lOperatingSDList.size() == 1);
01521                 const stdair::SegmentDate* lOperatingSegmentDate_ptr = *lOperatin
      gSDList.begin();
01522                 assert (lOperatingSegmentDate_ptr != NULL);
01523                 lSegmentDate_ptr = lOperatingSegmentDate_ptr;
01524               }
01525               const stdair::CabinCode_T lCabinCode = itCCP->first;
01526               const stdair::SegmentCabin* lSegmentCabin_ptr =
01527                 stdair::BomManager::getObjectPtr<stdair::SegmentCabin> (*lSegment
      Date_ptr,
01528                                                                         lCabinCod
      e);
01529               assert (lSegmentCabin_ptr != NULL);
01530               stdair::BidPrice_T lBidPrice = 0;
01531               const stdair::LegCabinList_T lLegCabinList =
01532                 stdair::BomManager::getList<stdair::LegCabin>(*lSegmentCabin_ptr)
      ;
01533               for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList.be
      gin();
01534                    itLC != lLegCabinList.end(); ++itLC) {
01535                 const stdair::LegCabin* lLegCabin_ptr = *itLC;
01536                 assert (lLegCabin_ptr != NULL);
01537                 lBidPrice += lLegCabin_ptr->getCurrentBidPrice();
01538               }
01539               lBidPriceList.push_back (lBidPrice);
01540               lTotalBidPrice += lBidPrice;
01541             }
01542
01543
01544             itCCP = lCabinClassPairList.begin();
01545             itSD = lOnDSegmentDateList.begin();
01546             std::list<stdair::BidPrice_T>::const_iterator itBP = lBidPriceList.be
      gin();
01547             for (; itSD != lOnDSegmentDateList.end(); ++itCCP, ++itSD, ++itBP) {
01548               stdair::BidPrice_T lBidPrice = *itBP;
01549               stdair::BidPrice_T lComplementaryBidPrice = lTotalBidPrice - lBidPr
      ice;
01550               const stdair::SegmentDate* lSegmentDate_ptr = *itSD;
01551               assert (lSegmentDate_ptr != NULL);
01552               // Only operated legs receive the demand information.
01553               if (!lSegmentDate_ptr->isOtherAirlineOperating()) {
01554                 const stdair::CabinCode_T lCabinCode = itCCP->first;
01555                 const stdair::ClassCode_T lClassCode = itCCP->second;
01556                 const stdair::SegmentCabin* lSegmentCabin_ptr =
01557                   stdair::BomManager::getObjectPtr<stdair::SegmentCabin> (*lSegme
      ntDate_ptr,
01558                                                                           lCabinC
      ode);
01559                 assert (lSegmentCabin_ptr != NULL);
01560                 const stdair::LegCabinList_T lLegCabinList =
01561                   stdair::BomManager::getList<stdair::LegCabin> (*lSegmentCabin_p
      tr);
01562                 assert (!lLegCabinList.empty());
01563                 // Determine the displacement-adjusted yield.
01564                 // It is set to 100 (positive small value), if the computed value
       is negative.
01565                 const stdair::Yield_T& lDAYield =
01566                   std::max(100., lYieldDemandPair.first - lComplementaryBidPrice)
      ;
```

```
01567
01568
01569                 stdair::Yield_T lYield = lDAYield;
01570                 // In order to be protected against important variations of partn
      ers' bid price,
01571                 // the displacement adjusted yield is noy allowed to get out of a
       certain range.
01572                 // This range is here chosen to be from 80% to 100% of the (stati
      c rule) prorated yield.
01573                 /*
01574                 const int lNbOfLegs = lLegCabinList.size();
01575                 const stdair::Yield_T& lStaticProrationYield =
01576                   lDemandStruct.getYield()/(lNbOfLegs*lNbOfSegments);
01577                 if (lDAYield < 0.8*lStaticProrationYield){
01578                   lYield = 0.8*lStaticProrationYield;
01579                 }
01580                 if (lDAYield > lStaticProrationYield) {
01581                   lYield = lStaticProrationYield;
01582                 }
01583                 */
01584                 const stdair::MeanStdDevPair_T& lMeanStdDevPair =
01585                   lYieldDemandPair.second;
01586                 const stdair::MeanValue_T& lMeanValue = lMeanStdDevPair.first;
01587                 const stdair::StdDevValue_T& lStdDevValue = lMeanStdDevPair.secon
      d;
01588                 for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList.
      begin();
01589                      itLC != lLegCabinList.end(); ++itLC) {
01590                   stdair::LegCabin* lLegCabin_ptr = *itLC;
01591                   assert (lLegCabin_ptr != NULL);
01592                   lLegCabin_ptr->addDemandInformation (lYield, lMeanValue, lStdDe
      vValue);
01593                 }
01594               }
01595             }
01596           }
01597         }
01598       }
01599     }
01600   }
01601
01602   // ////////////////////////////////////////////////////////////////////
01603   void RMOL_Service::projectOnDDemandOnLegCabinsUsingDYP(const stdair::DateTime_T
      & iRMEventTime) {
01604
01605     if (_rmolServiceContext == NULL) {
01606       throw stdair::NonInitialisedServiceException ("The Rmol service "
01607                                                     "has not been initialised");
01608     }
01609     assert (_rmolServiceContext != NULL);
01610     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01611
01612     // Retrieve the bom root
01613     stdair::STDAIR_Service& lSTDAIR_Service =
01614       lRMOL_ServiceContext.getSTDAIR_Service();
01615     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01616
01617     const stdair::InventoryList_T lInventoryList =
01618       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01619     assert (!lInventoryList.empty());
01620     for (stdair::InventoryList_T::const_iterator itInv = lInventoryList.begin();
01621          itInv != lInventoryList.end(); ++itInv) {
```

```
01622       const stdair::Inventory* lInventory_ptr = *itInv;
01623       assert (lInventory_ptr != NULL);
01624       projectOnDDemandOnLegCabinsUsingDYP (iRMEventTime, *lInventory_ptr);
01625     }
01626   }
01627
01628   // ////////////////////////////////////////////////////////////////////
01629   void RMOL_Service::projectOnDDemandOnLegCabinsUsingDYP(const stdair::DateTime_T
      & iRMEventTime,
01630                                                          const stdair::Inventory&
       iInventory) {
01631
01632     const stdair::OnDDateList_T lOnDDateList =
01633       stdair::BomManager::getList<stdair::OnDDate> (iInventory);
01634     assert (!lOnDDateList.empty());
01635     for (stdair::OnDDateList_T::const_iterator itOD = lOnDDateList.begin();
01636          itOD != lOnDDateList.end(); ++itOD) {
01637       stdair::OnDDate* lOnDDate_ptr = *itOD;
01638       assert (lOnDDate_ptr != NULL);
01639
01640       // Retrieve the date from the RM event
01641       const stdair::Date_T lDate = iRMEventTime.date();
01642
01643       const stdair::Date_T& lDepartureDate = lOnDDate_ptr->getDate();
01644       stdair::DateOffset_T lDateOffset = lDepartureDate - lDate;
01645       stdair::DTD_T lDTD = short (lDateOffset.days());
01646
01647       stdair::DCPList_T::const_iterator itDCP =
01648         std::find (stdair::DEFAULT_DCP_LIST.begin(), stdair::DEFAULT_DCP_LIST.end
      (), lDTD);
01649       // Check if the forecast for this O&D date needs to be projected.
01650       if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01651
01652         // Browse the demand info map.
01653         const stdair::StringDemandStructMap_T& lStringDemandStructMap =
01654           lOnDDate_ptr->getDemandInfoMap ();
01655         for (stdair::StringDemandStructMap_T::const_iterator itStrDS = lStringDem
      andStructMap.begin();
01656              itStrDS != lStringDemandStructMap.end(); ++itStrDS) {
01657           std::string lCabinClassPath = itStrDS->first;
01658           const stdair::YieldDemandPair_T& lYieldDemandPair = itStrDS->second;
01659           const stdair::CabinClassPairList_T& lCabinClassPairList =
01660             lOnDDate_ptr->getCabinClassPairList(lCabinClassPath);
01661           const unsigned int lNbOfSegments = lOnDDate_ptr->getNbOfSegments();
01662           // Sanity check
01663           assert (lCabinClassPairList.size() == lNbOfSegments);
01664
01665           //
01666           const stdair::SegmentDateList_T lOnDSegmentDateList =
01667               stdair::BomManager::getList<stdair::SegmentDate> (*lOnDDate_ptr);
01668           // Sanity check
01669           assert (lOnDSegmentDateList.size() == lNbOfSegments);
01670           stdair::CabinClassPairList_T::const_iterator itCCP = lCabinClassPairLis
      t.begin();
01671           stdair::SegmentDateList_T::const_iterator itSD = lOnDSegmentDateList.be
      gin();
01672           // The sum of bid prices of all cabins.
01673           stdair::BidPrice_T lTotalBidPrice = 0;
01674           for (; itSD != lOnDSegmentDateList.end(); ++itCCP, ++itSD) {
01675             // Get the operating segment cabin (it holds the bid price informatio
      n).
01676             const stdair::SegmentDate* lSegmentDate_ptr = *itSD;
```

```
01677             assert (lSegmentDate_ptr != NULL);
01678             // Get the operating airline code and check if it is the airline we a
      re looking for.
01679             const bool isOtherAirlineOperating =  lSegmentDate_ptr->isOtherAirlin
      eOperating();
01680             if (isOtherAirlineOperating == true) {
01681               const bool hasListSegmentDate =
01682                 stdair::BomManager::hasList<stdair::SegmentDate> (*lSegmentDate_p
      tr);
01683               assert (hasListSegmentDate == true);
01684               const stdair::SegmentDateList_T& lOperatingSDList =
01685                 stdair::BomManager::getList<stdair::SegmentDate> (*lSegmentDate_p
      tr);
01686               assert (lOperatingSDList.size() == 1);
01687               const stdair::SegmentDate* lOperatingSegmentDate_ptr = *lOperatingS
      DList.begin();
01688               assert (lOperatingSegmentDate_ptr != NULL);
01689               lSegmentDate_ptr = lOperatingSegmentDate_ptr;
01690             }
01691             const stdair::CabinCode_T lCabinCode = itCCP->first;
01692             const stdair::SegmentCabin* lSegmentCabin_ptr =
01693               stdair::BomManager::getObjectPtr<stdair::SegmentCabin> (*lSegmentDa
      te_ptr,
01694                                                                       lCabinCode)
      ;
01695             assert (lSegmentCabin_ptr != NULL);
01696             const stdair::LegCabinList_T lLegCabinList =
01697               stdair::BomManager::getList<stdair::LegCabin>(*lSegmentCabin_ptr);
01698             for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList.begi
      n();
01699                  itLC != lLegCabinList.end(); ++itLC) {
01700               const stdair::LegCabin* lLegCabin_ptr = *itLC;
01701               assert (lLegCabin_ptr != NULL);
01702               lTotalBidPrice += lLegCabin_ptr->getCurrentBidPrice();
01703             }
01704           }
01705
01706
01707           itCCP = lCabinClassPairList.begin();
01708           itSD = lOnDSegmentDateList.begin();
01709           for (; itSD != lOnDSegmentDateList.end(); ++itCCP, ++itSD) {
01710             const stdair::SegmentDate* lSegmentDate_ptr = *itSD;
01711             assert (lSegmentDate_ptr != NULL);
01712             // Only operated legs receive the demand information.
01713             if (!lSegmentDate_ptr->isOtherAirlineOperating()) {
01714               const stdair::CabinCode_T lCabinCode = itCCP->first;
01715               const stdair::ClassCode_T lClassCode = itCCP->second;
01716               const stdair::SegmentCabin* lSegmentCabin_ptr =
01717                 stdair::BomManager::getObjectPtr<stdair::SegmentCabin> (*lSegment
      Date_ptr,
01718                                                                         lCabinCod
      e);
01719               assert (lSegmentCabin_ptr != NULL);
01720               const stdair::LegCabinList_T lLegCabinList =
01721                 stdair::BomManager::getList<stdair::LegCabin> (*lSegmentCabin_ptr
      );
01722               assert (!lLegCabinList.empty());
01723               const stdair::Yield_T& lYield = lYieldDemandPair.first;

01724               const stdair::MeanStdDevPair_T& lMeanStdDevPair =
01725                 lYieldDemandPair.second;
01726               const stdair::MeanValue_T& lMeanValue = lMeanStdDevPair.first;
```

```
01727               const stdair::StdDevValue_T& lStdDevValue = lMeanStdDevPair.second;

01728               for (stdair::LegCabinList_T::const_iterator itLC = lLegCabinList.be
      gin();
01729                    itLC != lLegCabinList.end(); ++itLC) {
01730                 stdair::LegCabin* lLegCabin_ptr = *itLC;
01731                 assert (lLegCabin_ptr != NULL);
01732                 const stdair::BidPrice_T& lBidPrice = lLegCabin_ptr->getCurrentBi
      dPrice();
01733                 const stdair::RealNumber_T lDynamicYieldProrationFactor = lBidPri
      ce / lTotalBidPrice;
01734                 const stdair::Yield_T lProratedYield = lDynamicYieldProrationFact
      or*lYield;
01735                 lLegCabin_ptr->addDemandInformation (lProratedYield, lMeanValue,
      lStdDevValue);
01736
01737                 // STDAIR_LOG_DEBUG ("Addding demand information to leg-cabin " <
      < lLegCabin_ptr->getFullerKey()
01738                 //                   << " Total yield " << lYield << " Proration
      factor "
01739                 //                   << lDynamicYieldProrationFactor << " Prorate
      d yield " << lProratedYield
01740                 //                   << " Mean demand " << lMeanValue << " StdDev
       " << lStdDevValue);
01741               }
01742             }
01743           }
01744         }
01745       }
01746     }
01747   }
01748
01749   // ////////////////////////////////////////////////////////////////////
01750   void RMOL_Service::optimiseOnDUsingRMCooperation (const stdair::DateTime_T& iRM
      EventTime) {
01751
01752     if (_rmolServiceContext == NULL) {
01753       throw stdair::NonInitialisedServiceException ("The Rmol service "
01754                                                     "has not been initialised");
01755     }
01756     assert (_rmolServiceContext != NULL);
01757     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01758
01759     // Retrieve the bom root
01760     stdair::STDAIR_Service& lSTDAIR_Service =
01761       lRMOL_ServiceContext.getSTDAIR_Service();
01762     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01763
01764     // Retrieve the date from the RM event
01765     const stdair::Date_T lDate = iRMEventTime.date();
01766
01767     // Browse the list of inventories and optimise within each one independently.

01768     const stdair::InventoryList_T& lInvList =
01769       stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01770     for (stdair::InventoryList_T::const_iterator itInv = lInvList.begin();
01771          itInv != lInvList.end(); ++itInv) {
01772       stdair::Inventory* lCurrentInv_ptr = *itInv;
01773       assert (lCurrentInv_ptr != NULL);
01774
01775       double lMaxBPVariation = 1.0;
01776       short lIterationCounter = 0;
```

```
01777       // Iterate until the variation is under the wanted level or the maximal num
      ber of iterations is reached.
01778       while (lMaxBPVariation > 0.01 && lIterationCounter < 10) {
01779         lMaxBPVariation = 0.0;
01780         lIterationCounter++;
01781         const stdair::FlightDateList_T& lFlightDateList =
01782           stdair::BomManager::getList<stdair::FlightDate> (*lCurrentInv_ptr);
01783         for (stdair::FlightDateList_T::const_iterator itFlightDate =
01784                lFlightDateList.begin();
01785              itFlightDate != lFlightDateList.end(); ++itFlightDate) {
01786           stdair::FlightDate* lCurrentFlightDate_ptr = *itFlightDate;
01787           assert (lCurrentFlightDate_ptr != NULL);
01788
01789           const stdair::Date_T& lCurrentDepartureDate = lCurrentFlightDate_ptr->g
      etDepartureDate();
01790           stdair::DateOffset_T lDateOffset = lCurrentDepartureDate - lDate;
01791           stdair::DTD_T lDTD = short (lDateOffset.days());
01792
01793           stdair::DCPList_T::const_iterator itDCP =
01794             std::find (stdair::DEFAULT_DCP_LIST.begin(),
      stdair::DEFAULT_DCP_LIST.end(), lDTD);
01795           // Check if the optimisation is needed.
01796           if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01797             const double lBPVariation = Optimiser::optimiseUsingOnDForecast (*lCu
      rrentFlightDate_ptr);
01798             lMaxBPVariation = std::max(lMaxBPVariation, lBPVariation);
01799           }
01800         }
01801         // Update the prorated yields for the current inventory.
01802         resetDemandInformation (iRMEventTime, *lCurrentInv_ptr);
01803         projectOnDDemandOnLegCabinsUsingDYP (iRMEventTime, *lCurrentInv_ptr);
01804       }
01805     }
01806   }
01807
01808
01809   // ////////////////////////////////////////////////////////////////////
01810   void RMOL_Service::optimiseOnDUsingAdvancedRMCooperation (const stdair::DateTim
      e_T& iRMEventTime) {
01811
01812     if (_rmolServiceContext == NULL) {
01813       throw stdair::NonInitialisedServiceException ("The Rmol service "
01814                                                     "has not been initialised");
01815     }
01816     assert (_rmolServiceContext != NULL);
01817     RMOL_ServiceContext& lRMOL_ServiceContext = *_rmolServiceContext;
01818
01819     // Retrieve the bom root
01820     stdair::STDAIR_Service& lSTDAIR_Service =
01821       lRMOL_ServiceContext.getSTDAIR_Service();
01822     stdair::BomRoot& lBomRoot = lSTDAIR_Service.getBomRoot();
01823
01824     // Retrieve the date from the RM event
01825     const stdair::Date_T lDate = iRMEventTime.date();
01826
01827     double lMaxBPVariation = 1.0;
01828     short lIterationCounter = 0;
01829     // Iterate until the variation is under the wanted level or the maximal numbe
      r of iterations is reached.
01830     // Every iteration corresponds to the optimisation of the whole network. Bid
      prices are communicated
01831     // between partners at the end of each iteration.
```

```
01832     while (lMaxBPVariation > 0.01 && lIterationCounter < 50) {
01833       lMaxBPVariation = 0.0;
01834       lIterationCounter++;
01835
01836       const stdair::InventoryList_T& lInvList =
01837         stdair::BomManager::getList<stdair::Inventory> (lBomRoot);
01838       for (stdair::InventoryList_T::const_iterator itInv = lInvList.begin();
01839            itInv != lInvList.end(); ++itInv) {
01840         stdair::Inventory* lCurrentInv_ptr = *itInv;
01841         assert (lCurrentInv_ptr != NULL);
01842         const stdair::FlightDateList_T& lFlightDateList =
01843           stdair::BomManager::getList<stdair::FlightDate> (*lCurrentInv_ptr);
01844         for (stdair::FlightDateList_T::const_iterator itFlightDate =
01845                lFlightDateList.begin();
01846              itFlightDate != lFlightDateList.end(); ++itFlightDate) {
01847           stdair::FlightDate* lCurrentFlightDate_ptr = *itFlightDate;
01848           assert (lCurrentFlightDate_ptr != NULL);
01849
01850           const stdair::Date_T& lCurrentDepartureDate = lCurrentFlightDate_ptr->g
      etDepartureDate();
01851           stdair::DateOffset_T lDateOffset = lCurrentDepartureDate - lDate;
01852           stdair::DTD_T lDTD = short (lDateOffset.days());
01853
01854           stdair::DCPList_T::const_iterator itDCP =
01855             std::find (stdair::DEFAULT_DCP_LIST.begin(),
      stdair::DEFAULT_DCP_LIST.end(), lDTD);
01856           if (itDCP != stdair::DEFAULT_DCP_LIST.end()) {
01857             const double lBPVariation = Optimiser::optimiseUsingOnDForecast (*lCu
      rrentFlightDate_ptr);
01858             lMaxBPVariation = std::max(lMaxBPVariation, lBPVariation);
01859           }
01860         }
01861       }
01862       // At the end of each iteration, communicate bid prices and compute displac
      ement adjusted yields.
01863       updateBidPrice (iRMEventTime);
01864       resetDemandInformation (iRMEventTime);
01865       projectOnDDemandOnLegCabinsUsingDYP (iRMEventTime);
01866     }
01867   }
01868
01869 }
```

43.142 rmol/service/RMOL_ServiceContext.cpp File Reference

```
#include <cassert>
#include <sstream>
#include <stdair/STDAIR_Service.hpp>
#include <rmol/basic/BasConst_RMOL_Service.hpp>
#include <rmol/service/RMOL_ServiceContext.hpp>
```

Namespaces

- namespace RMOL

43.143 RMOL_ServiceContext.cpp

```
00001 // //////////////////////////////////////////////////////////////////////
00002 // Import section
00003 // //////////////////////////////////////////////////////////////////////
00004 // STL
00005 #include <cassert>
00006 #include <sstream>
00007 // StdAir
00008 #include <stdair/STDAIR_Service.hpp>
00009 // RMOL
00010 #include <rmol/basic/BasConst_RMOL_Service.hpp>
00011 #include <rmol/service/RMOL_ServiceContext.hpp>
00012
00013 namespace RMOL {
00014
00015   // //////////////////////////////////////////////////////////////////////
00016   RMOL_ServiceContext::RMOL_ServiceContext() : _ownStdairService (false) {
00017   }
00018
00019   // //////////////////////////////////////////////////////////////////////
00020   RMOL_ServiceContext::RMOL_ServiceContext (const RMOL_ServiceContext&) {
00021     assert (false);
00022   }
00023
00024   // //////////////////////////////////////////////////////////////////////
00025   RMOL_ServiceContext::~RMOL_ServiceContext() {
00026   }
00027
00028   // //////////////////////////////////////////////////////////////////////
00029   stdair::STDAIR_Service& RMOL_ServiceContext::getSTDAIR_Service() const {
00030     assert (_stdairService != NULL);
00031     return *_stdairService;
00032   }
00033
00034   // //////////////////////////////////////////////////////////////////////
00035   const std::string RMOL_ServiceContext::shortDisplay() const {
00036     std::ostringstream oStr;
00037     oStr << "RMOL_ServiceContext -- Owns StdAir service: " << _ownStdairService;
00038     return oStr.str();
00039   }
00040
00041   // //////////////////////////////////////////////////////////////////////
00042   const std::string RMOL_ServiceContext::display() const {
00043     std::ostringstream oStr;
00044     oStr << shortDisplay();
00045     return oStr.str();
00046   }
00047
00048   // //////////////////////////////////////////////////////////////////////
00049   const std::string RMOL_ServiceContext::describe() const {
00050     return shortDisplay();
00051   }
00052
00053   // //////////////////////////////////////////////////////////////////////
00054   void RMOL_ServiceContext::reset() {
00055     if (_ownStdairService == true) {
00056       _stdairService.reset();
00057     }
00058   }
00059
00060 }
```

43.144 rmol/service/RMOL_ServiceContext.hpp File Reference

```
#include <string>
#include <stdair/stdair_basic_types.hpp>
#include <stdair/stdair_inventory_types.hpp>
#include <stdair/stdair_maths_types.hpp>
#include <stdair/stdair_service_types.hpp>
#include <stdair/service/ServiceAbstract.hpp>
#include <rmol/RMOL_Types.hpp>
```

Classes

- class RMOL::RMOL_ServiceContext

  Inner class holding the context for the RMOL Service object.

Namespaces

- namespace stdair
- namespace RMOL

43.145 RMOL_ServiceContext.hpp

```
00001 #ifndef __RMOL_SVC_RMOL_SERVICE_CONTEXT_HPP
00002 #define __RMOL_SVC_RMOL_SERVICE_CONTEXT_HPP
00003
00004 // //////////////////////////////////////////////////////////////////
00005 // Import section
00006 // //////////////////////////////////////////////////////////////////
00007 // STL
00008 #include <string>
00009 // StdAir
00010 #include <stdair/stdair_basic_types.hpp>
00011 #include <stdair/stdair_inventory_types.hpp>
00012 #include <stdair/stdair_maths_types.hpp>
00013 #include <stdair/stdair_service_types.hpp>
00014 #include <stdair/service/ServiceAbstract.hpp>
00015 // RMOL
00016 #include <rmol/RMOL_Types.hpp>
00017
00019 namespace stdair {
00020   class STDAIR_Service;
00021   class LegCabin;
00022 }
00023
00024 namespace RMOL {
00025
00029   class RMOL_ServiceContext : public stdair::ServiceAbstract {
00035     friend class RMOL_Service;
00036     friend class FacRmolServiceContext;
00037
```

```
00038   private:
00039     // ********* Getters **********
00043     stdair::STDAIR_ServicePtr_T getSTDAIR_ServicePtr() const {
00044       return _stdairService;
00045     }
00046
00050     stdair::STDAIR_Service& getSTDAIR_Service() const;
00051
00055     const bool getOwnStdairServiceFlag() const {
00056       return _ownStdairService;
00057     }
00058
00059
00060   private:
00061     // ********* Setters **********
00065     void setSTDAIR_Service (stdair::STDAIR_ServicePtr_T ioSTDAIR_ServicePtr,
00066                             const bool iOwnStdairService) {
00067       _stdairService = ioSTDAIR_ServicePtr;
00068       _ownStdairService = iOwnStdairService;
00069     }
00070
00074     void reset();
00075
00076
00077   private:
00078     // ********* Display Methods **********
00082     const std::string shortDisplay() const;
00083
00087     const std::string display() const;
00088
00092     const std::string describe() const;
00093
00094
00095   private:
00096     // ******* Construction / initialisation ********
00100     RMOL_ServiceContext();
00104     RMOL_ServiceContext (const RMOL_ServiceContext&);
00105
00109     ~RMOL_ServiceContext();
00110
00111
00112   private:
00113     // ************* Children ************
00117     stdair::STDAIR_ServicePtr_T _stdairService;
00118
00122     bool _ownStdairService;
00123   };
00124
00125 }
00126 #endif // __RMOL_SVC_RMOL_SERVICE_CONTEXT_HPP
```

43.146 test/rmol/bomsforforecaster.cpp File Reference

43.147 bomsforforecaster.cpp

```
00001
00005 // ////////////////////////////////////////////////////////////////////
00006 // Import section
00007 // ////////////////////////////////////////////////////////////////////
00008 // STL
```

```
00009 #include <cassert>
00010 #include <limits>
00011 #include <sstream>
00012 #include <fstream>
00013 #include <string>
00014 // Boost Unit Test Framework (UTF)
00015 #define BOOST_TEST_DYN_LINK
00016 #define BOOST_TEST_MAIN
00017 #define BOOST_TEST_MODULE OptimiseTestSuite
00018 #include <boost/test/unit_test.hpp>
00019 // StdAir
00020 #include <stdair/basic/BasLogParams.hpp>
00021 #include <stdair/basic/BasDBParams.hpp>
00022 #include <stdair/service/Logger.hpp>
00023 // RMOL
00024 #include <rmol/RMOL_Service.hpp>
00025 #include <rmol/config/rmol-paths.hpp>
00026
00027 namespace boost_utf = boost::unit_test;
00028
00029 // (Boost) Unit Test XML Report
00030 std::ofstream utfReportStream ("bomsforforecaster_utfresults.xml");
00031
00035 struct UnitTestConfig {
00037   UnitTestConfig() {
00038     boost_utf::unit_test_log.set_stream (utfReportStream);
00039     boost_utf::unit_test_log.set_format (boost_utf::XML);
00040     boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
00041     //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
00042   }
00043
00045   ~UnitTestConfig() {
00046   }
00047 };
00048
00049 namespace RMOL {
00050
00052   struct BookingClassData {
00053
00054     // Attributes
00055     double _bookingCount;
00056     double _fare;
00057     double _sellupFactor;
00058     bool _censorshipFlag;
00059
00060     // Constructer
00061     BookingClassData (const double iBookingCount, const double iFare,
00062                       const double iSellupFactor, const bool iCensorshipFlag)
00063       : _bookingCount(iBookingCount), _fare(iFare),
00064         _sellupFactor(iSellupFactor), _censorshipFlag(iCensorshipFlag) {
00065     }
00066
00067     // Getters
00068     double getFare () const {
00069       return _fare;
00070     }
00071
00072     bool getCensorshipFlag () const {
00073       return _censorshipFlag;
00074     }
00075
```

```
00076     // Display
00077     std::string toString() const {
00078       std::ostringstream oStr;
00079       oStr <<  std::endl
00080            << "[Booking class data information]" << std::endl
00081            << "Booking counter: " << _bookingCount << std::endl
00082            << "Fare: " << _fare << std::endl
00083            << "Sell-up Factor: " << _sellupFactor << std::endl
00084            << "censorshipFlag: " << _censorshipFlag << std::endl;
00085       return oStr.str();
00086     }
00087
00088   };
00089
00091   struct BookingClassDataSet {
00092
00093     typedef std::vector<BookingClassData*> BookingClassDataList_T;
00094
00095     // Attributes
00096     int _numberOfClass;
00097     double _minimumFare;
00098     bool _censorshipFlag; // true if any of the classes is censored
00099     BookingClassDataList_T _bookingClassDataList;
00100
00101     // Constructor
00102     BookingClassDataSet ()
00103       : _numberOfClass(0), _minimumFare(0),
00104         _censorshipFlag(false) {
00105     }
00106
00107     // Add BookingClassData
00108     void addBookingClassData (BookingClassData& ioBookingClassData) {
00109       _bookingClassDataList.push_back (&ioBookingClassData);
00110     }
00111
00112     // Getters
00113     unsigned int getNumberOfClass () const {
00114       return _bookingClassDataList.size();
00115     }
00116
00117     double getMinimumFare () const {
00118       return _minimumFare;
00119     }
00120
00121     bool getCensorshipFlag () const {
00122       return _censorshipFlag;
00123     }
00124
00125     // Setters
00126     void setMinimumFare (const double iMinFare) {
00127       _minimumFare = iMinFare;
00128     }
00129
00130     void setCensorshipFlag (const bool iCensorshipFlag) {
00131       _censorshipFlag = iCensorshipFlag;
00132     }
00133
00134     // compute minimum fare
00135     void updateMinimumFare() {
00136       double minFare = std::numeric_limits<double>::max();
00137       BookingClassDataList_T::iterator itBookingClassDataList;
00138       for (itBookingClassDataList = _bookingClassDataList.begin();
```

```
00139           itBookingClassDataList != _bookingClassDataList.end();
00140           ++itBookingClassDataList) {
00141         BookingClassData* lBookingClassData = *itBookingClassDataList;
00142         assert (lBookingClassData != NULL);
00143
00144         const double lFare = lBookingClassData->getFare();
00145         if (lFare < minFare) {
00146           minFare = lFare;
00147         }
00148       }
00149       //
00150       setMinimumFare(minFare);
00151     }
00152
00153     // compute censorship flag for the data set
00154     void updateCensorshipFlag () {
00155       bool censorshipFlag = false;
00156       BookingClassDataList_T::iterator itBookingClassDataList;
00157       for (itBookingClassDataList = _bookingClassDataList.begin();
00158            itBookingClassDataList != _bookingClassDataList.end();
00159            ++itBookingClassDataList) {
00160         BookingClassData* lBookingClassData = *itBookingClassDataList;
00161         assert (lBookingClassData != NULL);
00162
00163         const bool lCensorshipFlagOfAClass =
00164           lBookingClassData->getCensorshipFlag();
00165         if (lCensorshipFlagOfAClass) {
00166           censorshipFlag = true;
00167           break;
00168         }
00169       }
00170       //
00171       setCensorshipFlag(censorshipFlag);
00172     }
00173
00174     // Display
00175     std::string toString() const {
00176       std::ostringstream oStr;
00177       oStr << std::endl
00178            << "[Booking class data set information]" << std::endl
00179            << "Number of classes: " << _numberOfClass << std::endl
00180            << "Minimum fare: " << _minimumFare << std::endl
00181            << "The data of the class set are sensored: " << _censorshipFlag
00182            << std::endl;
00183       return oStr.str();
00184     }
00185
00186   };
00187
00188   // /**-------------- BOM : Q-Forecaster ----------------------- */
00189   // struct QForecaster {
00190
00191   //   // Function focused BOM
00192
00193   //   // 1. calculate sell up probability for Q-eq
00194
00195   //   // 2. calculate Q-Equivalent Booking
00196   //   double calculateQEqBooking (BookingClassDataSet& iBookingClassDataSet) {
00197   //     double lQEqBooking = 0.0;
00198   //     double lMinFare = iBookingClassDataSet.getMinimumFare();
00199
00200
```

```
00201   //     return lQEqBooking;
00202   //   }
00203
00204   //   /* Calculate Q-equivalent demand
00205   //      [<- performed by unconstrainer if necessary (Using ExpMax BOM)]
00206   //   */
00207
00208
00209   //   // 3. Partition to each class
00210
00211   //   //
00212
00213   // };
00214
00215 }
00216
00217 // /////////////// Main: Unit Test Suite //////////////
00218
00219 // Set the UTF configuration (re-direct the output to a specific file)
00220 BOOST_GLOBAL_FIXTURE (UnitTestConfig);
00221
00225 BOOST_AUTO_TEST_SUITE (master_test_suite)
00226
00227
00230 BOOST_AUTO_TEST_CASE (rmol_forecaster) {
00231
00232   // Output log File
00233   std::string lLogFilename ("bomsforforecaster.log");
00234   std::ofstream logOutputFile;
00235
00236   // Open and clean the log outputfile
00237   logOutputFile.open (lLogFilename.c_str());
00238   logOutputFile.clear();
00239
00240   // Initialise the RMOL service
00241   const stdair::BasLogParams lLogParams (stdair::LOG::DEBUG, logOutputFile);
00242
00243   // Initialise the RMOL service
00244   RMOL::RMOL_Service rmolService (lLogParams);
00245
00246   // Build a sample BOM tree
00247   rmolService.buildSampleBom();
00248
00249   // Register BCDataSet
00250   RMOL::BookingClassDataSet lBookingClassDataSet;
00251
00252   // Register BookingClassData
00253   RMOL::BookingClassData QClassData (10, 100, 1, false);
00254   RMOL::BookingClassData MClassData (5, 150, 0.8, true);
00255   RMOL::BookingClassData BClassData (0, 200, 0.6, false);
00256   RMOL::BookingClassData YClassData (0, 300, 0.3, false);
00257
00258   // Display
00259   STDAIR_LOG_DEBUG (QClassData.toString());
00260   STDAIR_LOG_DEBUG (MClassData.toString());
00261   STDAIR_LOG_DEBUG (BClassData.toString());
00262   STDAIR_LOG_DEBUG (YClassData.toString());
00263
00264   // Add BookingClassData into the BCDataSet
00265   lBookingClassDataSet.addBookingClassData (QClassData);
00266   lBookingClassDataSet.addBookingClassData (MClassData);
00267   lBookingClassDataSet.addBookingClassData (BClassData);
```

```
00268   lBookingClassDataSet.addBookingClassData (YClassData);
00269
00270   // DEBUG
00271   STDAIR_LOG_DEBUG (lBookingClassDataSet.toString());
00272
00273   // Number of classes
00274   const unsigned int lNoOfClass = lBookingClassDataSet.getNumberOfClass();
00275
00276   // DEBUG
00277   STDAIR_LOG_DEBUG ("Number of Classes: " << lNoOfClass);
00278
00279   // Minimum fare
00280   BOOST_CHECK_NO_THROW (lBookingClassDataSet.updateMinimumFare());
00281   const double lMinFare = lBookingClassDataSet.getMinimumFare();
00282
00283   // DEBUG
00284   STDAIR_LOG_DEBUG ("Minimum fare: " << lMinFare);
00285
00286   // Censorship flag
00287   BOOST_CHECK_NO_THROW (lBookingClassDataSet.updateCensorshipFlag());
00288   const bool lCensorshipFlag = lBookingClassDataSet.getCensorshipFlag();
00289
00290   // DEBUG
00291   STDAIR_LOG_DEBUG ("Censorship Flag: " << lCensorshipFlag);
00292
00293   // Close the log output file
00294   logOutputFile.close();
00295 }
00296
00297 // End the test suite
00298 BOOST_AUTO_TEST_SUITE_END()
00299
00300
```

43.148 test/rmol/ForecasterTestSuite.cpp File Reference

43.149 ForecasterTestSuite.cpp

```
00001
00005 // ////////////////////////////////////////////////////////////////////
00006 // Import section
00007 // ////////////////////////////////////////////////////////////////////
00008 // STL
00009 #include <sstream>
00010 #include <fstream>
00011 #include <string>
00012 #include <vector>
00013 #include <cmath>
00014 // Boost Unit Test Framework (UTF)
00015 #define BOOST_TEST_DYN_LINK
00016 #define BOOST_TEST_MAIN
00017 #define BOOST_TEST_MODULE ForecasterTestSuite
00018 #include <boost/test/unit_test.hpp>
00019 // StdAir
00020 #include <stdair/basic/BasLogParams.hpp>
00021 #include <stdair/basic/BasDBParams.hpp>
00022 #include <stdair/basic/BasFileMgr.hpp>
00023 #include <stdair/service/Logger.hpp>
00024 // RMOL
00025 #include <rmol/RMOL_Service.hpp>
```

```
00026
00027 namespace boost_utf = boost::unit_test;
00028
00029 // (Boost) Unit Test XML Report
00030 std::ofstream utfReportStream ("ForecasterTestSuite_utfresults.xml");
00031
00035 struct UnitTestConfig {
00037   UnitTestConfig() {
00038     boost_utf::unit_test_log.set_stream (utfReportStream);
00039     boost_utf::unit_test_log.set_format (boost_utf::XML);
00040     boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
00041     //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
00042   }
00043
00045   ~UnitTestConfig() {
00046   }
00047 };
00048
00049
00050 // /////////////// Main: Unit Test Suite //////////////
00051
00052 // Set the UTF configuration (re-direct the output to a specific file)
00053 BOOST_GLOBAL_FIXTURE (UnitTestConfig);
00054
00059 BOOST_AUTO_TEST_SUITE (master_test_suite)
00060
00061
00064 BOOST_AUTO_TEST_CASE (rmol_forecaster_q_forecasting) {
00065   const bool lTestFlag = true; //testForecasterHelper(0);
00066   BOOST_CHECK_EQUAL (lTestFlag, true);
00067   BOOST_CHECK_MESSAGE (lTestFlag == true,
00068                        "The test has failed. Please see the log file for "
00069                        << "more details");
00070 }
00071
00072 // End the test suite
00073 BOOST_AUTO_TEST_SUITE_END()
00074
00075
```

43.150 test/rmol/ForecasterTestSuite.hpp File Reference

`#include <sstream>`

`#include <cppunit/extensions/HelperMacros.h>`

Classes

- class ForecasterTestSuite

Functions

- CPPUNIT_TEST_SUITE_REGISTRATION (ForecasterTestSuite)

43.150.1 Function Documentation

43.150.1.1 CPPUNIT_TEST_SUITE_REGISTRATION (ForecasterTestSuite)

43.151 ForecasterTestSuite.hpp

```
00001 // STL
00002 #include <sstream>
00003 // CPPUNIT
00004 #include <cppunit/extensions/HelperMacros.h>
00005
00006 class ForecasterTestSuite : public CppUnit::TestFixture {
00007   CPPUNIT_TEST_SUITE (ForecasterTestSuite);
00008   CPPUNIT_TEST (testQForecaster);
00009   CPPUNIT_TEST_SUITE_END ();
00010 public:
00011
00013   void testQForecaster();
00014
00016   ForecasterTestSuite ();
00017
00018 protected:
00019   std::stringstream _describeKey;
00020 };
00021
00022 CPPUNIT_TEST_SUITE_REGISTRATION (ForecasterTestSuite);
```

43.152 test/rmol/OptimiseTestSuite.cpp File Reference

43.153 OptimiseTestSuite.cpp

```
00001
00005 // ////////////////////////////////////////////////////////////////////
00006 // Import section
00007 // ////////////////////////////////////////////////////////////////////
00008 // STL
00009 #include <sstream>
00010 #include <fstream>
00011 #include <string>
00012 // Boost Unit Test Framework (UTF)
00013 #define BOOST_TEST_DYN_LINK
00014 #define BOOST_TEST_MAIN
00015 #define BOOST_TEST_MODULE OptimiseTestSuite
00016 #include <boost/test/unit_test.hpp>
00017 // StdAir
00018 #include <stdair/basic/BasLogParams.hpp>
00019 #include <stdair/basic/BasDBParams.hpp>
00020 #include <stdair/basic/BasFileMgr.hpp>
00021 #include <stdair/service/Logger.hpp>
00022 // RMOL
00023 #include <rmol/RMOL_Service.hpp>
00024 #include <rmol/config/rmol-paths.hpp>
00025
00026 namespace boost_utf = boost::unit_test;
00027
00028 // (Boost) Unit Test XML Report
00029 std::ofstream utfReportStream ("OptimiseTestSuite_utfresults.xml");
00030
```

```
00034 struct UnitTestConfig {
00036   UnitTestConfig() {
00037     boost_utf::unit_test_log.set_stream (utfReportStream);
00038     boost_utf::unit_test_log.set_format (boost_utf::XML);
00039     boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
00040     //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
00041   }
00042
00044   ~UnitTestConfig() {
00045   }
00046 };
00047
00048
00049 // ////////////////////////////////////////////////////////////////////
00050 int testOptimiseHelper (const unsigned short optimisationMethodFlag) {
00051
00052   // Return value
00053   int oExpectedBookingLimit = 0;
00054
00055   // Output log File
00056   std::ostringstream oStr;
00057   oStr << "OptimiseTestSuite_" << optimisationMethodFlag << ".log";
00058   const stdair::Filename_T lLogFilename (oStr.str());
00059
00060   // Number of random draws to be generated (best if greater than 100)
00061   const int K = 100000;
00062
00063   // Methods of optimisation (0 = Monte-Carlo, 1 = Dynamic Programming,
00064   // 2 = EMSR, 3 = EMSR-a, 4 = EMSR-b, 5 = EMSR-a with sellup prob.)
00065   const unsigned short METHOD_FLAG = optimisationMethodFlag;
00066
00067   // Cabin Capacity (it must be greater then 100 here)
00068   const double cabinCapacity = 100.0;
00069
00070   // Input file name
00071   const stdair::Filename_T lRMInputFileName (STDAIR_SAMPLE_DIR "/rm02.csv");
00072
00073   // Set the log parameters
00074   std::ofstream logOutputFile;
00075   // Open and clean the log outputfile
00076   logOutputFile.open (lLogFilename.c_str());
00077   logOutputFile.clear();
00078
00079   // Initialise the RMOL service
00080   const stdair::BasLogParams lLogParams (stdair::LOG::DEBUG, logOutputFile);
00081   RMOL::RMOL_Service rmolService (lLogParams);
00082
00083   // Parse the optimisation data and build a dummy BOM tree
00084   rmolService.parseAndLoad (cabinCapacity, lRMInputFileName);
00085
00086   switch (METHOD_FLAG) {
00087   case 0: {
00088     // DEBUG
00089     STDAIR_LOG_DEBUG ("Optimisation by Monte-Carlo (MC)");
00090
00091     // Calculate the optimal protections by the Monte Carlo
00092     // Integration approach
00093     rmolService.optimalOptimisationByMCIntegration (K);
00094     break;
00095   }
00096
```

```
00097   case 1: {
00098     // DEBUG
00099     STDAIR_LOG_DEBUG ("Optimisation by Dynamic Programming (DP)");
00100
00101     // Calculate the optimal protections by DP.
00102     rmolService.optimalOptimisationByDP ();
00103     break;
00104   }
00105
00106   case 2: {
00107     // DEBUG
00108     STDAIR_LOG_DEBUG ("Calculate the Bid-Price Vectors (BPV) by EMSR");
00109
00110     // Calculate the Bid-Price Vector by EMSR
00111     rmolService.heuristicOptimisationByEmsr ();
00112     break;
00113   }
00114
00115   case 3: {
00116     // DEBUG
00117     STDAIR_LOG_DEBUG ("Calculate the Authorisation Levels (AUs) by EMSRa");
00118
00119     // Calculate the protections by EMSR-a
00120     // Test the EMSR-a algorithm implementation
00121     rmolService.heuristicOptimisationByEmsrA ();
00122
00123     // Return a cumulated booking limit value to test
00124     // oExpectedBookingLimit = static_cast<int> (lBookingLimitVector.at(2));
00125     break;
00126   }
00127
00128   case 4: {
00129     // DEBUG
00130     STDAIR_LOG_DEBUG ("Calculate the Authorisation Levels (AUs) by EMSRb");
00131
00132     // Calculate the protections by EMSR-b
00133     rmolService.heuristicOptimisationByEmsrB ();
00134     break;
00135   }
00136
00137   default: rmolService.optimalOptimisationByMCIntegration (K);
00138   }
00139
00140   // Close the log file
00141   logOutputFile.close();
00142
00143   return oExpectedBookingLimit;
00144 }
00145
00146
00147 // ///////////////// Main: Unit Test Suite //////////////
00148
00149 // Set the UTF configuration (re-direct the output to a specific file)
00150 BOOST_GLOBAL_FIXTURE (UnitTestConfig);
00151
00152 // ////////////////////////////////////////////////////////////////////
00153 // Tests are based on the following input values
00154 // price; mean; standard deviation;
00155 // 1050; 17.3; 5.8;
00156 // 567; 45.1; 15.0;
00157 // 534; 39.6; 13.2;
00158 // 520; 34.0; 11.3;
```

```
00159 // //////////////////////////////////////////////////////////////////
00160
00165 BOOST_AUTO_TEST_SUITE (master_test_suite)
00166
00167
00170 BOOST_AUTO_TEST_CASE (rmol_optimisation_monte_carlo) {
00171   BOOST_CHECK_NO_THROW (testOptimiseHelper(0););
00172 }
00173
00177 BOOST_AUTO_TEST_CASE (rmol_optimisation_dynamic_programming) {
00178   BOOST_CHECK_NO_THROW (testOptimiseHelper(1););
00179 }
00180
00185 BOOST_AUTO_TEST_CASE (rmol_optimisation_emsr_bpv) {
00186   BOOST_CHECK_NO_THROW (testOptimiseHelper(2););
00187 }
00188
00193 BOOST_AUTO_TEST_CASE (rmol_optimisation_emsr_a) {
00194   BOOST_CHECK_NO_THROW (testOptimiseHelper(3););
00195   // const int lBookingLimit = testOptimiseHelper(3);
00196   // const int lExpectedBookingLimit = 61;
00197   // BOOST_CHECK_EQUAL (lBookingLimit, lExpectedBookingLimit);
00198   // BOOST_CHECK_MESSAGE (lBookingLimit == lExpectedBookingLimit,
00199   //                      "The booking limit is " << lBookingLimit
00200   //                      << ", but it is expected to be "
00201   //                      << lExpectedBookingLimit);
00202 }
00203
00208 BOOST_AUTO_TEST_CASE (rmol_optimisation_emsr_b) {
00209   BOOST_CHECK_NO_THROW (testOptimiseHelper(4););
00210 }
00211
00212 // End the test suite
00213 BOOST_AUTO_TEST_SUITE_END()
00214
00215
```

43.154 test/rmol/OptimiseTestSuite.hpp File Reference

```
#include <sstream>
#include <cppunit/extensions/HelperMacros.h>
```

Classes

- class OptimiseTestSuite

Functions

- CPPUNIT_TEST_SUITE_REGISTRATION (OptimiseTestSuite)

43.154.1 Function Documentation

43.154.1.1 CPPUNIT_TEST_SUITE_REGISTRATION (OptimiseTestSuite)

43.155 OptimiseTestSuite.hpp

```
00001 // STL
00002 #include <sstream>
00003 // CPPUNIT
00004 #include <cppunit/extensions/HelperMacros.h>
00005
00006 class OptimiseTestSuite : public CppUnit::TestFixture {
00007   CPPUNIT_TEST_SUITE (OptimiseTestSuite);
00008   CPPUNIT_TEST (testOptimiseMC);
00009   CPPUNIT_TEST (testOptimiseDP);
00010   CPPUNIT_TEST (testOptimiseEMSR);
00011   CPPUNIT_TEST (testOptimiseEMSRa);
00012   CPPUNIT_TEST (testOptimiseEMSRb);
00013   CPPUNIT_TEST (testOptimiseEMSRaWithSU);
00014   //  CPPUNIT_TEST (errorCase);
00015   CPPUNIT_TEST_SUITE_END ();
00016 public:
00017
00019   void testOptimiseMC();
00020
00022   void testOptimiseDP();
00023
00026   void testOptimiseEMSR();
00027
00030   void testOptimiseEMSRa();
00031
00034   void testOptimiseEMSRb();
00035
00037   //  void errorCase ();
00038
00040   OptimiseTestSuite ();
00041
00042 protected:
00043   std::stringstream _describeKey;
00044 };
00045
00046 CPPUNIT_TEST_SUITE_REGISTRATION (OptimiseTestSuite);
```

43.156 test/rmol/UnconstrainerTestSuite.cpp File Reference

43.157 UnconstrainerTestSuite.cpp

```
00001
00005 // ////////////////////////////////////////////////////////////////////
00006 // Import section
00007 // ////////////////////////////////////////////////////////////////////
00008 // STL
00009 #include <sstream>
00010 #include <fstream>
00011 #include <string>
00012 // Boost Unit Test Framework (UTF)
00013 #define BOOST_TEST_DYN_LINK
00014 #define BOOST_TEST_MAIN
00015 #define BOOST_TEST_MODULE UnconstrainerTestSuite
00016 #include <boost/test/unit_test.hpp>
00017 // StdAir
00018 #include <stdair/basic/BasLogParams.hpp>
00019 #include <stdair/basic/BasDBParams.hpp>
```

```
00020 #include <stdair/basic/BasFileMgr.hpp>
00021 #include <stdair/service/Logger.hpp>
00022 // RMOL
00023 #include <rmol/RMOL_Service.hpp>
00024
00025 namespace boost_utf = boost::unit_test;
00026
00027 // (Boost) Unit Test XML Report
00028 std::ofstream utfReportStream ("UnconstrainerTestSuite_utfresults.xml");
00029
00033 struct UnitTestConfig {
00035   UnitTestConfig() {
00036     boost_utf::unit_test_log.set_stream (utfReportStream);
00037     boost_utf::unit_test_log.set_format (boost_utf::XML);
00038     boost_utf::unit_test_log.set_threshold_level (boost_utf::log_test_units);
00039     //boost_utf::unit_test_log.set_threshold_level (boost_utf::log_successful_tes
      ts);
00040   }
00041
00043   ~UnitTestConfig() {
00044   }
00045 };
00046
00047
00048 // /////////////// Main: Unit Test Suite //////////////
00049
00050 // Set the UTF configuration (re-direct the output to a specific file)
00051 BOOST_GLOBAL_FIXTURE (UnitTestConfig);
00052
00057 BOOST_AUTO_TEST_SUITE (master_test_suite)
00058
00059
00062 BOOST_AUTO_TEST_CASE (rmol_unconstraining_em) {
00063   const bool lTestFlag = true;// testUnconstrainerHelper(0);
00064   BOOST_CHECK_EQUAL (lTestFlag, true);
00065   BOOST_CHECK_MESSAGE (lTestFlag == true,
00066                        "The test has failed. Please see the log file for "
00067                        << "more details");
00068 }
00069
00070 // End the test suite
00071 BOOST_AUTO_TEST_SUITE_END()
00072
00073
```

43.158 test/rmol/UnconstrainerTestSuite.hpp File Reference

```
#include <sstream>
#include <cppunit/extensions/HelperMacros.h>
```

Classes

- class UnconstrainerTestSuite

Functions

- CPPUNIT_TEST_SUITE_REGISTRATION (UnconstrainerTestSuite)

43.158.1 Function Documentation

43.158.1.1 CPPUNIT_TEST_SUITE_REGISTRATION (UnconstrainerTestSuite)

43.159 UnconstrainerTestSuite.hpp

```
00001 // STL
00002 #include <sstream>
00003 // CPPUNIT
00004 #include <cppunit/extensions/HelperMacros.h>
00005
00006 class UnconstrainerTestSuite : public CppUnit::TestFixture {
00007   CPPUNIT_TEST_SUITE (UnconstrainerTestSuite);
00008   CPPUNIT_TEST (testUnconstrainingByEM);
00009   CPPUNIT_TEST_SUITE_END ();
00010 public:
00011
00013   void testUnconstrainingByEM();
00014
00016   UnconstrainerTestSuite ();
00017
00018 protected:
00019   std::stringstream _describeKey;
00020 };
00021
00022 CPPUNIT_TEST_SUITE_REGISTRATION (UnconstrainerTestSuite);
```

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