

Quant Roll: Users Guide

Version 0.5.1 Edition

Quant Roll: Users Guide :

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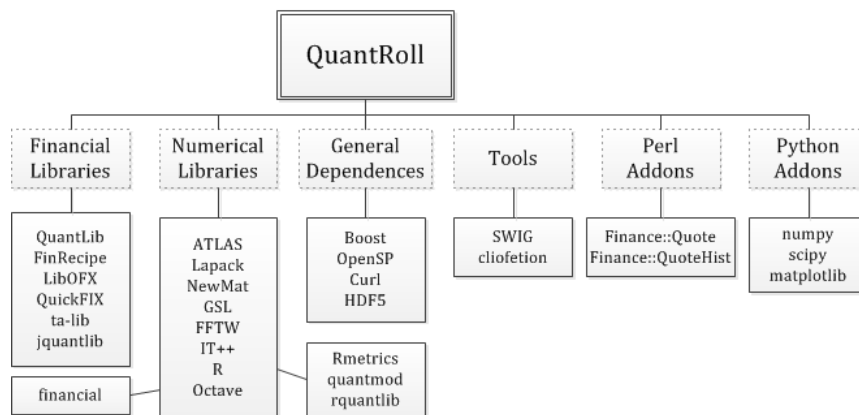
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Preface

Financial engineering is a cross-disciplinary field which relies on computational intelligence, mathematical finance, numerical methods and computer simulations to make trading, hedging and investment decisions, as well as facilitating the risk management of those decisions. Utilizing various methods, practitioners of financial engineering, frequently called "quants", aim to precisely determine the financial risk that certain financial instruments create.

To address the requirements of these efforts, a wide spectrum of financial engineering libraries and tools are available. However, these libraries and tools are packaged in various ways and often require additional pre-dependencies.

With the roll packaging technique from Rocks Clusters, the Quant Roll is a collection of the most popular cfinancial engineering libraries and tools that are widely used by both the academic and industrial fields. Pre-dependencies are included as well. The purpose of developing this roll is to simplify the packaging, installation and configuration of these libraries and tools.



Chapter 1. Overview

Table 1-1. Summary

Name	quant
Version	0.5.1
Maintained By	SJTU HPC Lab
Architecture	i386, x86_64
Compatible with Rocks®	0.5.1

Table 1-2. Roll Compatibility

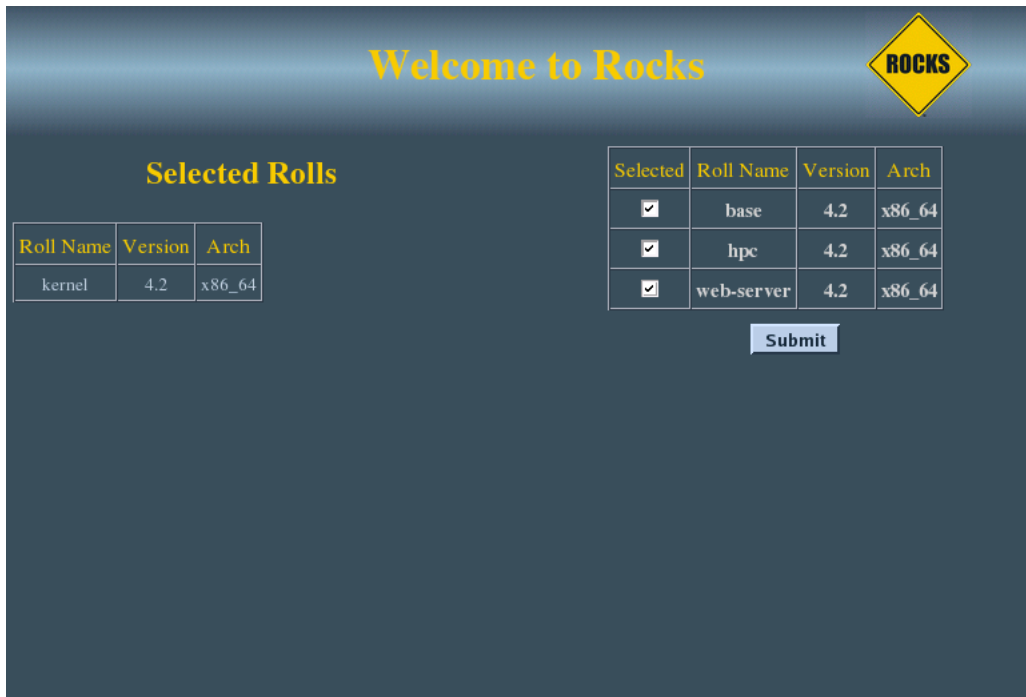
Roll	Requires ^a	Optional ^b	Conflicts
alpha		X	
area51		X	
base	X		
bio		X	
condor		X	
ganglia		X	
grid		X	
hpc	X		
java	X		
kernel	X		
os (disk 1)	X		
os (disk 2)	X		
os (disk 3)		X	
os (disk 4)		X	
os (disk 5)		X	
os (disk 6)		X	
os (disk 7)		X	
pbs		X	
service-pack		X	
sge		X	
viz		X	
web-server	X		
xen		X	

Roll	Requires ^a	Optional ^b	Conflicts
<p>Notes:</p> <p>a. You may also substitute your own OS CDs for the Rocks® OS Roll CDs. In this case you must use all the CDs from your distribution and not use any of the Rocks® OS Roll CDs.</p> <p>b. Only Rolls that have been verified as compatible with this Roll are listed. Other Rolls will likely work, but have not been tested by the maintainer of this Roll.</p>			

Chapter 2. Installing the quant Roll

2.1. On a New Server

The quant Roll should be installed during the initial installation of your server (or cluster). This procedure is documented in section 1.2 of the Rocks® usersguide. You should select the quant Roll from the list of available rolls when you see a screen that is similar to the one below.



The screenshot shows a 'Welcome to Rocks' installation screen. At the top right is a yellow diamond logo with the word 'ROCKS' in black. Below the title, there are two tables. The first table, titled 'Selected Rolls', has three columns: 'Roll Name', 'Version', and 'Arch'. It contains one row with 'kernel', '4.2', and 'x86_64'. The second table has four columns: 'Selected', 'Roll Name', 'Version', and 'Arch'. It contains three rows, each with a checked checkbox, a roll name, and version/arch information. Below the second table is a 'Submit' button.

Roll Name	Version	Arch
kernel	4.2	x86_64

Selected	Roll Name	Version	Arch
<input checked="" type="checkbox"/>	base	4.2	x86_64
<input checked="" type="checkbox"/>	hpc	4.2	x86_64
<input checked="" type="checkbox"/>	web-server	4.2	x86_64

Submit

2.2. On an Existing Server

The quant Roll may also be added onto an existing server (or frontend). For sake of discussion, assume that you have an iso image of the roll called `quant.iso`. The following procedure will install the Roll, and after the server reboots the Roll should be fully installed and configured.

```
$ su - root
# rocks add roll quant.iso
# rocks enable roll quant
# cd /export/rocks/install
# rocks create distro
# rocks run roll quant | bash
# init 6
```


Chapter 3. Using the quant Roll

3.1. List of libraries and tools included

The list of packages is as follows:

- Financial Libraries:
 - Quantlib <http://quantlib.org/>
 - FinRecipe http://finance-old.bi.no/~bernt/gcc_prog/index.html
 - LibOFX <http://libofx.sourceforge.net/>
 - QuickFIX <http://www.quickfixengine.org/>
 - TA-Lib <http://ta-lib.org/>
 - jquantlib <http://www.jquantlib.org/>
- Numerical Libraries:
 - R <http://www.r-project.org/>
 - octave <http://www.gnu.org/software/octave/>
 - ATLAS <http://math-atlas.sourceforge.net/>
 - lapack <http://www.netlib.org/lapack/>
 - NewMat http://www.robertnz.net/nm_intro.htm
 - GSL <http://www.gnu.org/software/gsl/>
 - FFTW <http://www.fftw.org/>
 - IT++ <http://itpp.sourceforge.net/>
- General Dependences:
 - Boost <http://www.boost.org/>
 - OpenSP <http://openjade.sourceforge.net/>
 - curl <http://curl.haxx.se/>
 - hdf5 <http://www.hdfgroup.org/HDF5/>
- Tools:
 - SWIG <http://www.swig.org/>
 - cliofation <http://code.google.com/p/ofetion/>
- R Addons from CRAN:
 - Rmetrics <http://www.rmetrics.org/>
 - quantmod <http://www.quantmod.com/>
 - rquantlib <http://dirk.eddelbuettel.com/code/rquantlib.html>
- Octave Addons from Octave-Forge:

financial <http://octave.sourceforge.net/financial/index.html>

- Perl Modules from CPAN:

Finance::Quote <http://finance-quote.sourceforge.net/>

Finance::QuoteHist <http://www.mojotoad.com/sisk/projects/Finance-QuoteHist/>

- Python Modules from pypi:

numpy <http://numpy.scipy.org/>

scipy <http://www.scipy.org/>

matplotlib <http://matplotlib.sourceforge.net/>

3.2. QuantLib

A free/open-source library for quantitative finance, written in C++ and exported to different languages such as Python, Ruby and Scheme.

Documents for using QuantLib are available here¹

3.3. FinRecipe

In finance, there are areas where formulas tend to get involved. Sometimes it may be easier to follow an exact computer routine. These C++ subroutines implement common algorithms in finance. Typical examples are option/derivatives pricing, term structure calculations, mean variance analysis.

Documents for using FinRecipe are available here²

3.4. LibOFX

LibOFX is a parser and an API designed to allow applications to very easily support OFX command responses, usually provided by financial institutions for statement downloads.

Documents for using LibOFX are available here³

3.5. QuickFIX

QuickFIX is a full-featured open source FIX engine, currently compatible with the FIX 4.0-5.0 spec. API's are available for C++, .NET, Python and Ruby.

Documents for using QuickFIX are available here⁴

3.6. ta-lib

Technical analysis open-source software library to process financial data. Provides RSI, MACD, Stochastic, moving average, etc.

Documents for using QuickFIX are available here⁵

3.7. jqquantlib

JQuantLib is a free, open-source, comprehensive framework for quantitative finance, written in 100% Java. It provides "quants" and Java application developers several mathematical and statistical tools needed for the valuation of shares, options, futures, swaps, and other financial instruments, also providing tools related to risk management and money management.

JQuantLib is based on QuantLib, which is written in C++, aiming to be a complete rewrite of QuantLib, offering features Java developers expect to find. JQuantLib aims to be fast, correct, strongly typed, well-documented, and user-friendly.

Documents for using jqquantlib are available here⁶

3.8. R

R is a language and environment for statistical computing and graphics. It is a GNU project which is similar to the S language and environment which was developed at Bell Laboratories (formerly AT&T, now Lucent Technologies) by John Chambers and colleagues. R can be considered as a different implementation of S. There are some important differences, but much code written for S runs unaltered under R.

Documents for using R are available here⁷

3.9. Octave

GNU Octave is a high-level interpreted language, primarily intended for numerical computations. It provides capabilities for the numerical solution of linear and nonlinear problems, and for performing other numerical experiments. It also provides extensive graphics capabilities for data visualization and manipulation. Octave is normally used through its interactive command line interface, but it can also be used to write non-interactive programs. The Octave language is quite similar to Matlab so that most programs are easily portable.

Documents for using Octave are available here⁸

3.10. ATLAS

The ATLAS (Automatically Tuned Linear Algebra Software) project is an ongoing research effort focusing on applying empirical techniques in order to provide portable performance. At present, it provides C and Fortran77 interfaces to a portably efficient BLAS implementation, as well as a few routines from LAPACK.

Documents for using ATLAS are available here⁹

3.11. lapack

LAPACK is written in Fortran 90 and provides routines for solving systems of simultaneous linear equations, least-squares solutions of linear systems of equations, eigenvalue problems, and singular value problems. The associated matrix factorizations (LU, Cholesky, QR, SVD, Schur, generalized Schur) are also provided, as are related computations such as reordering of the Schur factorizations and estimating condition numbers. Dense and banded matrices are handled, but not general sparse matrices. In all areas, similar functionality is provided for real and complex matrices, in both single and double precision.

The lapack package in this roll is included in the ATLAS package.

Documents for using lapack are available here¹⁰

3.12. NewMat

NewMat is intended for scientists and engineers who need to manipulate a variety of types of matrices using standard matrix operations. Emphasis is on the kind of operations needed in statistical calculations such as least squares, linear equation solve and eigenvalues.

Documents for using NewMat are available here¹¹

3.13. GSL

The GNU Scientific Library (GSL) is a numerical library for C and C++ programmers. The library provides a wide range of mathematical routines such as random number generators, special functions and least-squares fitting. There are over 1000 functions in total with an extensive test suite.

Documents for using GSL are available here¹²

3.14. FFTW

FFTW is a C subroutine library for computing the discrete Fourier transform (DFT) in one or more dimensions, of arbitrary input size, and of both real and complex data (as well as of even/odd data, i.e. the discrete cosine/sine transforms or DCT/DST).

Documents for using FFTW are available here¹³

3.15. IT++

IT++ is a C++ library of mathematical, signal processing and communication classes and functions. Its main use is in simulation of communication systems and for performing research in the area of communications. The kernel of the

library consists of generic vector and matrix classes, and a set of accompanying routines. Such a kernel makes IT++ similar to MATLAB or GNU Octave.

Documents for using IT++ are available here¹⁴

3.16. Boost

Provides a repository for free peer-reviewed portable C++ source libraries. The emphasis is on libraries which work well with the C++ standard library.

Documents for using Boost are available here¹⁵

3.17. OpenSP

Jade is James Clark's implementation of DSSSL -- Document Style Semantics and Specification Language -- an ISO standard for formatting SGML (and XML) documents. OpenJade is a project undertaken by the DSSSL community to maintain and extend Jade, as well as the related SP suite of SGML/XML processing tools.

Documents for using OpenSP are available here¹⁶

3.18. curl

curl is a command line tool for transferring data with URL syntax, supporting DICT, FILE, FTP, FTPS, GOPHER, HTTP, HTTPS, IMAP, IMAPS, LDAP, LDAPS, POP3, POP3S, RTMP, RTSP, SCP, SFTP, SMTP, SMTPS, TELNET and TFTP. curl supports SSL certificates, HTTP POST, HTTP PUT, FTP uploading, HTTP form based upload, proxies, cookies, user+password authentication (Basic, Digest, NTLM, Negotiate, kerberos...), file transfer resume, proxy tunneling and a busload of other useful tricks.

Documents for using curl are available here¹⁷

3.19. HDF5

HDF5 is a data model, library, and file format for storing and managing data. It supports an unlimited variety of datatypes, and is designed for flexible and efficient I/O and for high volume and complex data. HDF5 is portable and is extensible, allowing applications to evolve in their use of HDF5. The HDF5 Technology suite includes tools and applications for managing, manipulating, viewing, and analyzing data in the HDF5 format.

Documents for using HDF5 are available here¹⁸

3.20. SWIG

SWIG is a software development tool that connects programs written in C and C++ with a variety of high-level programming languages. SWIG is used with different types of target languages including common scripting

languages such as Perl, PHP, Python, Tcl and Ruby. SWIG is most commonly used to create high-level interpreted or compiled programming environments, user interfaces, and as a tool for testing and prototyping C/C++ software. SWIG is typically used to parse C/C++ interfaces and generate the 'glue code' required for the above target languages to call into the C/C++ code. SWIG can also export its parse tree in the form of XML and Lisp s-expressions.

Documents for using SWIG are available here¹⁹

3.21. cliofetion

Fetion is an IM provided by China Mobile, with features like text chat, voice call, file sharing, etc. Openfetion is an opensource client of Fetion with limited features. It's small and fast, and is better in look. cliofetion is a simple command-line based Openfetion clients.

Usage:

```
$cliofetion -f mobileno -p password -t receive_mobileno -d message
```

Documents for using cliofetion are available here²⁰

3.22. Rmetrics

Rmetrics is an open source solution for teaching financial market analysis and valuation of financial instruments. With hundreds of functions build on modern methods, Rmetrics combines explorative data analysis and statistical modelling.

Documents for using Rmetrics are available here²¹

3.23. quantmod

The quantmod package for R is designed to assist the quantitative trader in the development, testing, and deployment of statistically based trading models. The quantmod is a rapid prototyping environment, where quant traders can quickly and cleanly explore and build trading models.

Documents for using quantmod are available here²²

3.24. rquantlib

RQuantLib connects GNU R with QuantLib.

Documents for using rquantlib are available here²³

3.25. octave-financial

Financial manipulation and plotting functions.

Documents for using octave-financial are available here²⁴

3.26. Finance::Quote

Finance::Quote is a perl module which can be used to obtain information from a variety of sources, including markets in Australia, USA, Canada, Europe, and a number of managed funds.

Documents for using Finance::Quote are available here²⁵

3.27. Finance::QuoteHist

The Finance-QuoteHist bundle is several modules designed to fetch historical stock quotes from the web.

Documents for using Finance::QuoteHist are available here²⁶

3.28. numpy

NumPy is the fundamental package needed for scientific computing with Python. It contains among other things: a powerful N-dimensional array object, sophisticated (broadcasting) functions, tools for integrating C/C++ and Fortran code, useful linear algebra, Fourier transform, and random number capabilities. Besides its obvious scientific uses, NumPy can also be used as an efficient multi-dimensional container of generic data. Arbitrary data-types can be defined. This allows NumPy to seamlessly and speedily integrate with a wide variety of databases.

Documents for using numpy are available here²⁷

3.29. scipy

SciPy (pronounced "Sigh Pie") is open-source software for mathematics, science, and engineering. It is also the name of a very popular conference on scientific programming with Python. The SciPy library is built to work with NumPy arrays, and provides many user-friendly and efficient numerical routines such as routines for numerical integration and optimization.

Documents for using scipy are available here²⁸

3.30. matplotlib

matplotlib is a python 2D plotting library which produces publication quality figures in a variety of hardcopy formats and interactive environments across platforms. matplotlib can be used in python scripts, the python and ipython shell (ala MATLAB or Mathematica), web application servers, and six graphical user interface toolkits.

Documents for using matplotlib are available here²⁹

Notes

1. <http://quantlib.org/docs.shtml>
2. http://finance-old.bi.no/~bernt/gcc_prog/recipes/recipes.pdf
3. <http://libofx.sourceforge.net/documentation.html>
4. <http://www.quickfixengine.org/documentation.html>
5. http://ta-lib.org/d_api/d_api.html
6. http://www.jquantlib.org/index.php/JQuantLib_Users_Guide
7. <http://cran.r-project.org/manuals.html>
8. <http://www.gnu.org/software/octave/docs.html>
9. <http://math-atlas.sourceforge.net/faq.html>
10. http://www.netlib.org/lapack/#_documentation
11. http://www.robertnz.net/ol_doc.htm
12. http://www.gnu.org/software/gsl/manual/html_node/
13. <http://www.fftw.org/#documentation>
14. <http://itpp.sourceforge.net/current/>
15. <http://www.boost.org/doc/>
16. <http://openjade.sourceforge.net/>
17. <http://curl.haxx.se/docs/>
18. <http://www.hdfgroup.org/HDF5/doc/doc-info.html>
19. <http://www.swig.org/doc.html>
20. <http://code.google.com/p/ofetion/w/list>
21. <https://wiki.rmetrics.org/>
22. <http://cran.r-project.org/web/packages/quantmod/quantmod.pdf>
23. <http://dirk.eddelbuettel.com/code/rquantlib.html>
24. <http://octave.sourceforge.net/financial/overview.html>
25. <http://finance-quote.sourceforge.net/documentation.html>
26. <http://search.cpan.org/dist/Finance-QuoteHist/lib/Finance/QuoteHist.pm>
27. <http://docs.scipy.org/doc/>
28. <http://docs.scipy.org/doc/>
29. <http://matplotlib.sourceforge.net/contents.html>

Chapter 4. Copyrights

This product includes software developed by Shanghai Jiaotong University HPC Lab.

The software contained in this distribution is released under the GNU GPLv3.

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Version 3, 29 June 2007

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The "source code" for a work means the preferred form of the work for making modifications to it. "Object code" means any non-source form of a work.

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The "System Libraries" of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A "Major Component", in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

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- a) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by the Corresponding Source fixed on a durable physical medium customarily used for software interchange.
- b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a

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c) Convey individual copies of the object code with a copy of the written offer to provide the Corresponding Source. This alternative is allowed only occasionally and noncommercially, and only if you received the object code with such an offer, in accord with subsection 6b.

d) Convey the object code by offering access from a designated place (gratis or for a charge), and offer equivalent access to the Corresponding Source in the same way through the same place at no further charge. You need not require recipients to copy the Corresponding Source along with the object code. If the place to copy the object code is a network server, the Corresponding Source may be on a different server (operated by you or a third party) that supports equivalent copying facilities, provided you maintain clear directions next to the object code saying where to find the Corresponding Source. Regardless of what server hosts the Corresponding Source, you remain obligated to ensure that it is available for as long as needed to satisfy these requirements.

e) Convey the object code using peer-to-peer transmission, provided you inform other peers where the object code and Corresponding Source of the work are being offered to the general public at no charge under subsection 6d.

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