

Oracle® Communications
Core Session Manager – SCZ915

Program Documentation – License Document

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- Prerequisite Products
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Version 2.0

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A. HISTORY OF THE SOFTWARE

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

All Python releases are Open Source (see <http://www.opensource.org> for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.2	2.1.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes
2.3.1	2.3	2002-2003	PSF	yes
2.3.2	2.3.1	2002-2003	PSF	yes
2.3.3	2.3.2	2002-2003	PSF	yes
2.3.4	2.3.3	2004	PSF	yes

2.3.5	2.3.4	2005	PSF	yes
2.4	2.3	2004	PSF	yes
2.4.1	2.4	2005	PSF	yes
2.4.2	2.4.1	2005	PSF	yes
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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <http://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others. In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations (now Zope Corporation, see <http://www.zope.com>). In 2001, the Python Software Foundation (PSF, see <http://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation is a sponsoring member of the PSF.

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2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2.1	2.2	2002	PSF	yes
2.2.2	2.2.1	2002	PSF	yes
2.2.3	2.2.2	2003	PSF	yes
2.3	2.2.2	2002-2003	PSF	yes
2.3.1	2.3	2002-2003	PSF	yes
2.3.2	2.3.1	2002-2003	PSF	yes
2.3.3	2.3.2	2002-2003	PSF	yes
2.3.4	2.3.3	2004	PSF	yes
2.3.5	2.3.4	2005	PSF	yes
2.4	2.3	2004	PSF	yes
2.4.1	2.4	2005	PSF	yes
2.4.2	2.4.1	2005	PSF	yes
2.4.3	2.4.2	2006	PSF	yes
2.4.4	2.4.3	2006	PSF	yes
2.5	2.4	2006	PSF	yes
2.5.1	2.5	2007	PSF	yes
2.5.2	2.5.1	2008	PSF	yes
2.5.3	2.5.2	2008	PSF	yes
2.6	2.5	2008	PSF	yes
2.6.1	2.6	2008	PSF	yes

2.6.2	2.6.1	2009	PSF	yes
2.6.3	2.6.2	2009	PSF	yes
2.6.4	2.6.3	2009	PSF	yes
2.6.5	2.6.4	2010	PSF	yes
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README File

This is Python version 2.7.5

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What's new in this release?

See the file "Misc/NEWS".

If you don't read instructions

Congratulations on getting this far. :-)

To start building right away (on UNIX): type "./configure" in the current directory and when it finishes, type "make". This creates an executable "./python"; to install in /usr/local, first do "su root" and then "make install".

The section 'Build instructions' below is still recommended reading.

What is Python anyway?

Python is an interpreted, interactive object-oriented programming language suitable (amongst other uses) for distributed application development, scripting, numeric computing and system testing. Python is often compared to Tcl, Perl, Java, JavaScript, Visual Basic or

Scheme. To find out more about what Python can do for you, point your browser to <http://www.python.org/>.
How do I learn Python?

The official tutorial is still a good place to start; see <http://docs.python.org/> for online and downloadable versions, as well as a list of other introductions, and reference documentation. There's a quickly growing set of books on Python. See <http://wiki.python.org/moin/PythonBooks> for a list.
Documentation

All documentation is provided online in a variety of formats. In order of importance for new users: Tutorial, Library Reference, Language Reference, Extending & Embedding, and the Python/C API. The Library Reference is especially of immense value since much of Python's power is described there, including the built-in data types and functions!

All documentation is also available online at the Python web site (<http://docs.python.org/>, see below). It is available online for occasional reference, or can be downloaded in many formats for faster access. The documentation is downloadable in HTML, PostScript, PDF, LaTeX, and reStructuredText (2.6+) formats; the LaTeX and reStructuredText versions are primarily for documentation authors, translators, and people with special formatting requirements.

Web sites

New Python releases and related technologies are published at <http://www.python.org/>. Come visit us!
Newsgroups and Mailing Lists

Read comp.lang.python, a high-volume discussion newsgroup about Python, or comp.lang.python.announce, a low-volume moderated newsgroup for Python-related announcements. These are also accessible as mailing lists: see <http://www.python.org/community/lists/> for an overview of these and many other Python-related mailing lists. Archives are accessible via the Google Groups Usenet archive; see <http://groups.google.com/>. The mailing lists are also archived, see <http://www.python.org/community/lists/> for details.

Bug reports

To report or search for bugs, please use the Python Bug Tracker at <http://bugs.python.org/>.
Patches and contributions

To submit a patch or other contribution, please use the Python Patch Manager at <http://bugs.python.org/>. Guidelines for patch submission may be found at <http://www.python.org/dev/patches/>. If you have a proposal to change Python, you may want to send an email to the comp.lang.python or python-ideas mailing lists for initial feedback. A Python Enhancement Proposal (PEP) may be submitted if your idea gains ground. All current PEPs, as well as guidelines for submitting a new PEP, are listed at <http://www.python.org/dev/peps/>.

Questions

For help, if you can't find it in the manuals or on the web site, it's

best to post to the comp.lang.python or the Python mailing list (see above). If you specifically don't want to involve the newsgroup or mailing list, send questions to help@python.org (a group of volunteers who answer questions as they can). The newsgroup is the most efficient way to ask public questions.

Build instructions

=====

Before you can build Python, you must first configure it. Fortunately, the configuration and build process has been automated for Unix and Linux installations, so all you usually have to do is type a few commands and sit back. There are some platforms where things are not quite as smooth; see the platform specific notes below. If you want to build for multiple platforms sharing the same source tree, see the section on VPATH below. Start by running the script `./configure`, which determines your system configuration and creates the Makefile. (It takes a minute or two -- please be patient!) You may want to pass options to the configure script -- see the section below on configuration options and variables. When it's done, you are ready to run make. To build Python, you normally type `"make"` in the toplevel directory. If you have changed the configuration, the Makefile may have to be rebuilt. In this case, you may have to run make again to correctly build your desired target. The interpreter executable is built in the top level directory.

Once you have built a Python interpreter, see the subsections below on testing and installation. If you run into trouble, see the next section.

Previous versions of Python used a manual configuration process that involved editing the file `Modules/Setup`. While this file still exists and manual configuration is still supported, it is rarely needed any more: almost all modules are automatically built as appropriate under guidance of the `setup.py` script, which is run by Make after the interpreter has been built.

Troubleshooting

See also the platform specific notes in the next section.

If you run into other trouble, see the FAQ

(<http://www.python.org/doc/faq/>) for hints on what can go wrong, and how to fix it.

If you rerun the configure script with different options, remove all object files by running `"make clean"` before rebuilding. Believe it or not, `"make clean"` sometimes helps to clean up other inexplicable problems as well. Try it before sending in a bug report!

If the configure script fails or doesn't seem to find things that should be there, inspect the `config.log` file.

If you get a warning for every file about the `-Olimit` option being no longer supported, you can ignore it. There's no foolproof way to know whether this option is needed; all we can do is test whether it is accepted without error. On some systems, e.g. older SGI compilers, it is essential for performance (specifically when compiling `ceval.c`, which has more basic blocks than the default limit of 1000). If the warning bothers you, edit the Makefile to remove `"-Olimit 1500"` from the `OPT` variable.

If you get failures in `test_long`, or `sys.maxint` gets set to `-1`, you are probably experiencing compiler bugs, usually related to optimization. This is a common problem with some versions of gcc, and

some vendor-supplied compilers, which can sometimes be worked around by turning off optimization. Consider switching to stable versions (gcc 2.95.2, gcc 3.x, or contact your vendor.)
From Python 2.0 onward, all Python C code is ANSI C. Compiling using old K&R-C-only compilers is no longer possible. ANSI C compilers are available for all modern systems, either in the form of updated compilers from the vendor, or one of the free compilers (gcc).
If "make install" fails mysteriously during the "compiling the library" step, make sure that you don't have any of the PYTHONPATH or PYTHONHOME environment variables set, as they may interfere with the newly built executable which is compiling the library.
Unsupported systems

A number of systems are not supported in Python 2.7 anymore. Some support code is still present, but will be removed in later versions. If you still need to use current Python versions on these systems, please send a message to python-dev@python.org indicating that you volunteer to support this system. For a more detailed discussion regarding no-longer-supported and resupporting platforms, as well as a list of platforms that became or will be unsupported, see PEP 11. More specifically, the following systems are not supported any longer:

- SunOS 4
- DYNIX
- dgux
- Minix
- NeXT
- Irix 4 and --with-sgi-dl
- Linux 1
- Systems defining __d6_pthread_create (configure.ac)
- Systems defining PY_PTHREAD_D4, PY_PTHREAD_D6, or PY_PTHREAD_D7 in thread_pthread.h
- Systems using --with-dl-dld
- Systems using --without-universal-newlines
- MacOS 9
- Systems using --with-wctype-functions
- Win9x, WinME

Platform specific notes

(Some of these may no longer apply. If you find you can build Python on these platforms without the special directions mentioned here, submit a documentation bug report to SourceForge (see Bug Reports above) so we can remove them!)

Unix platforms: If your vendor still ships (and you still use) Berkeley DB 1.85 you will need to edit Modules/Setup to build the bsddb185 module and add a line to sitecustomize.py which makes it the default. In Modules/Setup a line like
bsddb185 bsddbmodule.c
should work. (You may need to add -I, -L or -l flags to direct the compiler and linker to your include files and libraries.)

XXX I think this next bit is out of date:

64-bit platforms: The modules audioop, and imageop don't work. The setup.py script disables them on 64-bit installations. Don't try to enable them in the Modules/Setup file. They contain code that is quite wordsize sensitive. (If you have a fix, let us know!)

Solaris: When using Sun's C compiler with threads, at least on Solaris 2.5.1, you need to add the "-mt" compiler option (the simplest way is probably to specify the compiler with this option as the "CC" environment variable when running the configure script).

When using GCC on Solaris, beware of binutils 2.13 or GCC versions built using it. This mistakenly enables the -zcombreloc option which creates broken shared libraries on Solaris. binutils 2.12 works, and the binutils maintainers are aware of the problem. Binutils 2.13.1 only partially fixed things. It appears that 2.13.2 solves the problem completely. This problem is known to occur with Solaris 2.7 and 2.8, but may also affect earlier and later versions of the OS.

When the dynamic loader complains about errors finding shared libraries, such as

```
ld.so.1: ./python: fatal: libstdc++.so.5: open failed:
No such file or directory
```

you need to first make sure that the library is available on your system. Then, you need to instruct the dynamic loader how to find it. You can choose any of the following strategies:

1. When compiling Python, set LD_RUN_PATH to the directories containing missing libraries.
2. When running Python, set LD_LIBRARY_PATH to these directories.
3. Use crle(8) to extend the search path of the loader.
4. Modify the installed GCC specs file, adding -R options into the *link: section.

The complex object fails to compile on Solaris 10 with gcc 3.4 (at least up to 3.4.3). To work around it, define Py_HUGE_VAL as HUGE_VAL(), e.g.:

```
make CPPFLAGS='-D"Py_HUGE_VAL=HUGE_VAL()" -I. -I$(srcdir)/Include'
./python setup.py CPPFLAGS='-D"Py_HUGE_VAL=HUGE_VAL()"'
```

Linux: A problem with threads and fork() was tracked down to a bug in the pthreads code in glibc version 2.0.5; glibc version 2.0.7 solves the problem. This causes the popen2 test to fail; problem and solution reported by Pablo Bleyer.

Red Hat Linux: Red Hat 9 built Python2.2 in UCS-4 mode and hacked Tcl to support it. To compile Python2.3 with Tkinter, you will need to pass --enable-unicode=ucs4 flag to ./configure. There's an executable /usr/bin/python which is Python 1.5.2 on most older Red Hat installations; several key Red Hat tools require this version. Python 2.1.x may be installed as /usr/bin/python2. The Makefile installs Python as /usr/local/bin/python, which may or may not take precedence over /usr/bin/python, depending on how you have set up \$PATH.

FreeBSD 3.x and probably platforms with NCurses that use libmytinfo or similar: When using cursesmodule, the linking is not done in the correct order with the defaults. Remove "-ltermcap" from the readline entry in Setup, and use as curses entry: "curses cursesmodule.c -lmytinfo -lncurses -ltermcap" - "mytinfo" (so called on FreeBSD) should be the name of the auxiliary library required on your platform. Normally, it would be linked automatically, but not necessarily in the correct order.

BSDI: BSDI versions before 4.1 have known problems with threads, which can cause strange errors in a number of modules (for instance, the 'test_signal' test script will hang forever.)

Turning off threads (with `--with-threads=no`) or upgrading to BSDI 4.1 solves this problem.

DEC Unix: Run configure with `--with-dec-threads`, or with `--with-threads=no` if no threads are desired (threads are on by default). When using GCC, it is possible to get an internal compiler error if optimization is used. This was reported for GCC 2.7.2.3 on `selectmodule.c`. Manually compile the affected file without optimization to solve the problem.

DEC Ultrix: compile with GCC to avoid bugs in the native compiler, and pass `SHELL=/bin/sh5` to Make when installing.

AIX: A complete overhaul of the shared library support is now in place. See `Misc/AIX-NOTES` for some notes on how it's done. (The optimizer bug reported at this place in previous releases has been worked around by a minimal code change.) If you get errors about `pthread_*` functions, during compile or during testing, try setting `CC` to a thread-safe (reentrant) compiler, like `"cc_r"`. For full C++ module support, set `CC="xlc_r"` (or `CC="xlc"` without thread support).

AIX 5.3: To build a 64-bit version with IBM's compiler, I used the following:

```
export PATH=/usr/bin:/usr/vacpp/bin
./configure --with-gcc="xlc_r -q64" --with-cxx="xlc_r -q64" \
    --disable-ipv6 AR="ar -X64"

make
```

HP-UX: When using threading, you may have to add `-D_REENTRANT` to the `OPT` variable in the top-level Makefile; reported by Pat Knight, this seems to make a difference (at least for HP-UX 10.20) even though `pyconfig.h` defines it. This seems unnecessary when using HP/UX 11 and later - threading seems to work "out of the box".

HP-UX ia64: When building on the ia64 (Itanium) platform using HP's compiler, some experience has shown that the compiler's optimiser produces a completely broken version of python (see <http://bugs.python.org/814976>). To work around this, edit the Makefile and remove `-O` from the `OPT` line. To build a 64-bit executable on an Itanium 2 system using HP's compiler, use these environment variables:

```
CC=cc
CXX=aCC
BASECFLAGS="+DD64"
LD_FLAGS="+DD64 -lxnet"
```

and call configure as:

```
./configure --without-gcc
```

then `*unset*` the environment variables again before running `make`. (At least one of these flags causes the build to fail if it remains set.) You still have to edit the Makefile and remove `-O` from the `OPT` line.

HP PA-RISC 2.0: A recent bug report (<http://bugs.python.org/546117>) suggests that the C compiler in this 64-bit system has bugs in the optimizer that break Python. Compiling without optimization solves the problems.

SCO: The following apply to SCO 3 only; Python builds out of the box on SCO 5 (or so we've heard).

- 1) Everything works much better if you add `-U__STDC__` to the `defs`. This is because all the SCO header files are broken. Anything that isn't mentioned in the C standard is

conditionally excluded when `__STDC__` is defined.

2) Due to the U.S. export restrictions, SCO broke the crypt stuff out into a separate library, `libcrypt_i.a` so the LIBS needed be set to:

`LIBS='-lsocket -lcrypt_i'`

UnixWare: There are known bugs in the math library of the system, as well as problems in the handling of threads (calling fork in one thread may interrupt system calls in others). Therefore, `test_math`

and

tests involving threads will fail until those problems are fixed.

QNX: Chris Herborth (chrish@qnx.com) writes:

configure works best if you use GNU bash; a port is available on `ftp.qnx.com` in `/usr/free`. I used the following process to build, test and install Python 1.5.x under QNX:

- 1) `CONFIG_SHELL=/usr/local/bin/bash CC=cc RANLIB=: \`
`./configure --verbose --without-gcc --with-libm=""`
- 2) edit `Modules/Setup` to activate everything that makes sense for your system... tested here at QNX with the following modules:
`array, audioop, binascii, cPickle, cStringIO, cmath,`
`crypt, curses, errno, fcntl, gdbm, grp, imageop,`
`_locale, math, md5, new, operator, parser, pcre,`
`posix, pwd, readline, regex, reop,`
`select, signal, socket, soundex, strop, struct,`
`syslog, termios, time, timing, zlib, audioop, imageop`

- 3) `make SHELL=/usr/local/bin/bash`
or, if you feel the need for speed:
`make SHELL=/usr/local/bin/bash OPT="-5 -O1+nrt"`

- 4) `make SHELL=/usr/local/bin/bash test`
Using GNU readline 2.2 seems to behave strangely, but I think that's a problem with my readline 2.2 port. :-\

- 5) `make SHELL=/usr/local/bin/bash install`
If you get SIGSEGVs while running Python (I haven't yet, but I've only run small programs and the test cases), you're probably running out of stack; the default 32k could be a little tight. To increase the stack size, edit the Makefile to read: `LDFLAGS = -N 48k`

BeOS: See `Misc/BeOS-NOTES` for notes about compiling/installing Python on BeOS R3 or later. Note that only the PowerPC platform is supported for R3; both PowerPC and x86 are supported for R4.

Cray T3E: Mark Hadfield (m.hadfield@niwa.co.nz) writes:

Python can be built satisfactorily on a Cray T3E but based on my experience with the NIWA T3E (2002-05-22, version 2.2.1) there are a few bugs and gotchas. For more information see a thread on `comp.lang.python` in May 2002 entitled "Building Python on Cray T3E".

- 1) Use Cray's `cc` and not `gcc`. The latter was reported not to work by Konrad Hinsen. It may work now, but it may not.
- 2) To set `sys.platform` to something sensible, pass the following environment variable to the configure script:
`MACHDEP=unicosmk`
- 2) Run configure with option `"--enable-unicode=ucs4"`.
- 3) The Cray T3E does not support dynamic linking, so extension modules have to be built by adding (or uncommenting) lines in `Modules/Setup`. The minimum set of modules is
`posix, new, _sre, unicodedata`

On NIWA's vanilla T3E system the following have also been included successfully:

`_codecs, _locale, _socket, _symtable, _testcapi, _weakref
array, binascii, cmath, cPickle, crypt, cStringIO, dbm
errno, fcntl, grp, math, md5, operator, parser, pcre, pwd
regex, rotor, select, struct, strop, syslog, termios
time, timing, xreadlines`

- 4) Once the python executable and library have been built, make will execute `setup.py`, which will attempt to build remaining extensions and link them dynamically. Each of these attempts will fail but should not halt the make process. This is normal.
- 5) Running "make test" uses a lot of resources and causes problems on our system. You might want to try running tests singly or in small groups.

SGI: SGI's standard "make" utility (`/bin/make` or `/usr/bin/make`) does not check whether a command actually changed the file it is supposed to build. This means that whenever you say "make" it will redo the link step. The remedy is to use SGI's much smarter "smake" utility (`/usr/sbin/smake`), or GNU make. If you set the first line of the Makefile to `#!/usr/sbin/smake` smake will be invoked by make (likewise for GNU make).
WARNING: There are bugs in the optimizer of some versions of SGI's compilers that can cause bus errors or other strange behavior, especially on numerical operations. To avoid this, try building with "make OPT=".

OS/2: If you are running Warp3 or Warp4 and have IBM's VisualAge C/C++ compiler installed, just change into the `pc\os2vacpp` directory and type NMAKE. Threading and sockets are supported by default in the resulting binaries of `PYTHON15.DLL` and `PYTHON.EXE`.

Reliant UNIX: The thread support does not compile on Reliant UNIX, and there is a (minor) problem in the configure script for that platform as well. This should be resolved in time for a future release.

MacOSX: The tests will crash on both 10.1 and 10.2 with SEGV in `test_re` and `test_sre` due to the small default stack size. If you set the stack size to 2048 before doing a "make test" the failure can be avoided. If you're using the `tcsh` or `csh` shells, use "limit stacksize 2048" and for the bash shell (the default as of OSX 10.3), use "ulimit -s 2048".
On naked Darwin you may want to add the configure option "`--disable-toolbox-glue`" to disable the glue code for the Carbon interface modules. The modules themselves are currently only built if you add the `--enable-framework` option, see below.
On a clean OSX `/usr/local` does not exist. Do a "sudo mkdir -m 775 /usr/local" before you do a make install. It is probably not a good idea to do "sudo make install" which installs everything as superuser, as this may later cause problems when installing distutils-based additions.

Some people have reported problems building Python after using "fink" to install additional unix software. Disabling fink (remove all references to `/sw` from your `.profile` or `.login`) should solve this. You may want to try the configure option "`--enable-framework`" which installs Python as a framework. The location can be set

as argument to the --enable-framework option (default /Library/Frameworks). A framework install is probably needed if you want to use any Aqua-based GUI toolkit (whether Tkinter, wxPython, Carbon, Cocoa or anything else).

You may also want to try the configure option "--enable-universalsdk" which builds Python as a universal binary with support for the i386 and PPC architectures. This requires Xcode 2.1 or later to build.

See Mac/README for more information on framework and universal builds.

Cygwin: With recent (relative to the time of writing, 2001-12-19) Cygwin installations, there are problems with the interaction of dynamic linking and fork(). This manifests itself in build failures during the execution of setup.py.

There are two workarounds that both enable Python (albeit without threading support) to build and pass all tests on NT/2000 (and most likely XP as well, though reports of testing on XP would be appreciated).

The workarounds:

(a) the band-aid fix is to link the _socket module statically rather than dynamically (which is the default). To do this, run "./configure --with-threads=no" including any other options you need (--prefix, etc.). Then in Modules/Setup uncomment the lines:

```
#SSL=/usr/local/ssl
#_socket socketmodule.c \
#       -DUSE_SSL -I$(SSL)/include -I$(SSL)/include/openssl \
#       -L$(SSL)/lib -lssl -lcrypto
```

and remove "local/" from the SSL variable. Finally, just run "make"!

(b) The "proper" fix is to rebase the Cygwin DLLs to prevent base address conflicts. Details on how to do this can be found in the following mail:

<http://sources.redhat.com/ml/cygwin/2001-12/msg00894.html>

It is hoped that a version of this solution will be incorporated into the Cygwin distribution fairly soon.

Two additional problems:

(1) Threading support should still be disabled due to a known bug in Cygwin pthreads that causes test_threadedtempfile to hang.

(2) The _curses module does not build. This is a known Cygwin ncurses problem that should be resolved the next time that this package is released.

On older versions of Cygwin, test_poll may hang and test_strftime may fail.

The situation on 9X/Me is not accurately known at present. Some time ago, there were reports that the following regression tests failed:

```
test_pwd
test_select (hang)
test_socket
```

Due to the test_select hang on 9X/Me, one should run the regression test using the following:

```
make TESTOPTS='-l -x test_select' test
```

News regarding these platforms with more recent Cygwin

versions would be appreciated!

Windows: When executing Python scripts on the command line using file type associations (i.e. starting "script.py" instead of "python script.py"), redirects may not work unless you set a specific registry key. See the Knowledge Base article .

Configuring the bsddb and dbm modules

Beginning with Python version 2.3, the PyBsddb package was adopted into Python as the bsddb package, exposing a set of package-level functions which provide backwards-compatible behavior. Only versions 3.3 through 4.4 of Sleepycat's libraries provide the necessary API, so older versions aren't supported through this interface. The old bsddb module has been retained as bsddb185, though it is not built by default. Users wishing to use it will have to tweak Modules/Setup to build it. The dbm module will still be built against the Sleepycat libraries if other preferred alternatives (ndbm, gdbm) are not found.

Building the sqlite3 module

To build the sqlite3 module, you'll need the sqlite3 or libsqlite3 packages installed, including the header files. Many modern operating systems distribute the headers in a separate package to the library - often it will be the same name as the main package, but with a -dev or -devel suffix.

The version of pysqlite2 that's including in Python needs sqlite3 3.0.8 or later. setup.py attempts to check that it can find a correct version.

Configuring threads

As of Python 2.0, threads are enabled by default. If you wish to compile without threads, or if your thread support is broken, pass the --with-threads=no switch to configure. Unfortunately, on some platforms, additional compiler and/or linker options are required for threads to work properly. Below is a table of those options, collected by Bill Janssen. We would love to automate this process more, but the information below is not enough to write a patch for the configure.ac file, so manual intervention is required. If you patch the configure.ac file and are confident that the patch works, please send in the patch. (Don't bother patching the configure script itself -- it is regenerated each time the configure.ac file changes.)

Compiler switches for threads

.....

The definition of _REENTRANT should be configured automatically, if that does not work on your system, or if _REENTRANT is defined incorrectly, please report that as a bug.

OS/Compiler/threads	Switches for use with threads
(POSIX is draft 10, DCE is draft 4)	compile & link
SunOS 5.{1-5}/{gcc,SunPro cc}/solaris	-mt
SunOS 5.5/{gcc,SunPro cc}/POSIX	(nothing)
DEC OSF/1 3.x/cc/DCE	-threads
(butenhof@zko.dec.com)	
Digital UNIX 4.x/cc/DCE	-threads
(butenhof@zko.dec.com)	
Digital UNIX 4.x/cc/POSIX	-pthread
(butenhof@zko.dec.com)	
AIX 4.1.4/cc_r/d7	(nothing)

```

        (buhrt@iquest.net)
AIX 4.1.4/cc_r4/DCE                      (nothing)
        (buhrt@iquest.net)
IRIX 6.2/cc/POSIX                        (nothing)
        (robert1@cwi.nl)
Linker (ld) libraries and flags for threads
.....
OS/threads                               Libraries/switches for use with
threads
SunOS 5.{1-5}/solaris                    -lthread
SunOS 5.5/POSIX                          -lpthread
DEC OSF/1 3.x/DCE                        -lpthreads -lmach -lc_r -lc
        (butenhof@zko.dec.com)
Digital UNIX 4.x/DCE                     -lpthreads -lpthread -lmach -lexc -
lc
        (butenhof@zko.dec.com)
Digital UNIX 4.x/POSIX                   -lpthread -lmach -lexc -lc
        (butenhof@zko.dec.com)
AIX 4.1.4/{draft7,DCE}                   (nothing)
        (buhrt@iquest.net)
IRIX 6.2/POSIX                           -lpthread
        (jph@emilia.engr.sgi.com)

```

Building a shared libpython

Starting with Python 2.3, the majority of the interpreter can be built into a shared library, which can then be used by the interpreter executable, and by applications embedding Python. To enable this feature, configure with `--enable-shared`.

If you enable this feature, the same object files will be used to create a static library. In particular, the static library will contain object files using position-independent code (PIC) on platforms where PIC flags are needed for the shared library.

Configuring additional built-in modules

Starting with Python 2.1, the `setup.py` script at the top of the source distribution attempts to detect which modules can be built and automatically compiles them. Autodetection doesn't always work, so you can still customize the configuration by editing the `Modules/Setup` file; but this should be considered a last resort. The rest of this section only applies if you decide to edit the `Modules/Setup` file.

You also need this to enable static linking of certain modules (which is needed to enable profiling on some systems).

This file is initially copied from `Setup.dist` by the configure script; if it does not exist yet, create it by copying `Modules/Setup.dist` yourself (configure will never overwrite it). Never edit `Setup.dist` -- always edit `Setup` or `Setup.local` (see below). Read the comments in the file for information on what kind of edits are allowed. When you have edited `Setup` in the `Modules` directory, the interpreter will automatically be rebuilt the next time you run `make` (in the `toplevel` directory).

Many useful modules can be built on any Unix system, but some optional modules can't be reliably autodetected. Often the quickest way to determine whether a particular module works or not is to see if it will build: enable it in `Setup`, then if you get compilation or link errors, disable it -- you're either missing support or need to adjust the compilation and linking parameters for that module.

On SGI IRIX, there are modules that interface to many SGI specific system libraries, e.g. the GL library and the audio hardware. These modules will not be built by the setup.py script.

In addition to the file Setup, you can also edit the file Setup.local. (the makesetup script processes both). You may find it more convenient to edit Setup.local and leave Setup alone. Then, when installing a new Python version, you can copy your old Setup.local file.

Setting the optimization/debugging options

If you want or need to change the optimization/debugging options for the C compiler, assign to the OPT variable on the toplevel make command; e.g. "make OPT=-g" will build a debugging version of Python on most platforms. The default is OPT=-O; a value for OPT in the environment when the configure script is run overrides this default (likewise for CC; and the initial value for LIBS is used as the base set of libraries to link with).

When compiling with GCC, the default value of OPT will also include the -Wall and -Wstrict-prototypes options.

Additional debugging code to help debug memory management problems can be enabled by using the --with-pydebug option to the configure script. For flags that change binary compatibility, use the EXTRA_CFLAGS variable.

Profiling

If you want C profiling turned on, the easiest way is to run configure with the CC environment variable to the necessary compiler invocation. For example, on Linux, this works for profiling using gprof(1):

```
CC="gcc -pg" ./configure
```

Note that on Linux, gprof apparently does not work for shared libraries. The Makefile/Setup mechanism can be used to compile and link most extension modules statically.

Coverage checking

For C coverage checking using gcov, run "make coverage". This will build a Python binary with profiling activated, and a ".gcno" and ".gcda" file for every source file compiled with that option. With the built binary, now run the code whose coverage you want to check. Then, you can see coverage statistics for each individual source file by running gcov, e.g.

```
gcov -o Modules zlibmodule
```

This will create a "zlibmodule.c.gcov" file in the current directory containing coverage info for that source file.

This works only for source files statically compiled into the executable; use the Makefile/Setup mechanism to compile and link extension modules you want to coverage-check statically.

Testing

To test the interpreter, type "make test" in the top-level directory. This runs the test set twice (once with no compiled files, once with the compiled files left by the previous test run). The test set produces some output. You can generally ignore the messages about skipped tests due to optional features which can't be imported. If a message is printed about a failed test or a traceback or core dump is produced, something is wrong. On some Linux systems (those

that are not yet using glibc 6), test_strftime fails due to a non-standard implementation of strftime() in the C library. Please ignore this, or upgrade to glibc version 6.

By default, tests are prevented from overusing resources like disk space and memory. To enable these tests, run "make testall".

IMPORTANT: If the tests fail and you decide to mail a bug report, *don't* include the output of "make test". It is useless. Run the failing test manually, as follows:

```
./python Lib/test/regtest.py -v test_whatever
```

(substituting the top of the source tree for '.' if you built in a different directory). This runs the test in verbose mode.

Installing

To install the Python binary, library modules, shared library modules (see below), include files, configuration files, and the manual page, just type

```
make install
```

This will install all platform-independent files in subdirectories of the directory given with the --prefix option to configure or to the 'prefix' Make variable (default /usr/local). All binary and other platform-specific files will be installed in subdirectories if the directory given by --exec-prefix or the 'exec_prefix' Make variable (defaults to the --prefix directory) is given.

If DESTDIR is set, it will be taken as the root directory of the installation, and files will be installed into \$(DESTDIR)\$(prefix), \$(DESTDIR)\$(exec_prefix), etc.

All subdirectories created will have Python's version number in their name, e.g. the library modules are installed in "/usr/local/lib/python/" by default, where is the . release number (e.g. "2.1"). The Python binary is installed as "python" and a hard link named "python" is created. The only file not installed with a version number in its name is the manual page, installed as "/usr/local/man/man1/python.1" by default.

If you want to install multiple versions of Python see the section below entitled "Installing multiple versions".

The only thing you may have to install manually is the Python mode for Emacs found in Misc/python-mode.el. (But then again, more recent versions of Emacs may already have it.) Follow the instructions that came with Emacs for installation of site-specific files.

On Mac OS X, if you have configured Python with --enable-framework, you should use "make frameworkinstall" to do the installation. Note that this installs the Python executable in a place that is not normally on your PATH, you may want to set up a symlink in /usr/local/bin.

Installing multiple versions

On Unix and Mac systems if you intend to install multiple versions of Python using the same installation prefix (--prefix argument to the configure script) you must take care that your primary python executable is not overwritten by the installation of a different version. All files and directories installed using "make altinstall" contain the major and minor version and can thus live side-by-side. "make install" also creates \${prefix}/bin/python which refers to \${prefix}/bin/pythonX.Y. If you intend to install multiple versions using the same prefix you must decide which version (if any) is your "primary" version. Install that version using "make install". Install all other versions using "make altinstall".

For example, if you want to install Python 2.5, 2.6 and 3.0 with 2.6 being the primary version, you would execute "make install" in your 2.6 build directory and "make altinstall" in the others.

Configuration options and variables

Some special cases are handled by passing options to the configure script.

WARNING: if you rerun the configure script with different options, you must run "make clean" before rebuilding. Exceptions to this rule: after changing --prefix or --exec-prefix, all you need to do is remove Modules/getpath.o.

--with(out)-gcc: The configure script uses gcc (the GNU C compiler) if it finds it. If you don't want this, or if this compiler is installed but broken on your platform, pass the option --without-gcc. You can also pass "CC=cc" (or whatever the name of the proper C compiler is) in the environment, but the advantage of using --without-gcc is that this option is remembered by the config.status script for its --recheck option.

--prefix, --exec-prefix: If you want to install the binaries and the Python library somewhere else than in /usr/local/{bin,lib}, you can pass the option --prefix=DIRECTORY; the interpreter binary will be installed as DIRECTORY/bin/python and the library files as DIRECTORY/lib/python/*. If you pass --exec-prefix=DIRECTORY (as well) this overrides the installation prefix for architecture-dependent files (like the interpreter binary). Note that --prefix=DIRECTORY also affects the default module search path (sys.path), when Modules/config.c is compiled. Passing make the option prefix=DIRECTORY (and/or exec_prefix=DIRECTORY) overrides the prefix set at configuration time; this may be more convenient than re-running the configure script if you change your mind about the install prefix.

--with-readline: This option is no longer supported. GNU readline is automatically enabled by setup.py when present.

--with-threads: On most Unix systems, you can now use multiple threads, and support for this is enabled by default. To disable this, pass --with-threads=no. If the library required for threads lives in a peculiar place, you can use --with-thread=DIRECTORY. IMPORTANT: run "make clean" after changing (either enabling or disabling) this option, or you will get link errors! Note: for DEC Unix use --with-dec-threads instead.

--with-sgi-dl: On SGI IRIX 4, dynamic loading of extension modules is supported by the "dl" library by Jack Jansen, which is ftp'able from ftp://ftp.cwi.nl/pub/dynload/dl-1.6.tar.Z. This is enabled (after you've ftp'ed and compiled the dl library) by passing --with-sgi-dl=DIRECTORY where DIRECTORY is the absolute pathname of the dl library. (Don't bother on IRIX 5, it already has dynamic linking using SunOS style shared libraries.) THIS OPTION IS UNSUPPORTED.

--with-dl-dld: Dynamic loading of modules is rumored to be supported on some other systems: VAX (Ultrix), Sun3 (SunOS 3.4), Sequent Symmetry (Dynix), and Atari ST. This is done using a combination of the GNU dynamic loading package (ftp://ftp.cwi.nl/pub/dynload/dl-dld-1.1.tar.Z) and an

emulation of the SGI dl library mentioned above (the emulation can be found at <ftp://ftp.cwi.nl/pub/dynload/dld-3.2.3.tar.Z>). To enable this, ftp and compile both libraries, then call configure, passing it the option

--with-dl-dld=DL_DIRECTORY,DLD_DIRECTORY where DL_DIRECTORY is the absolute pathname of the dl emulation library and DLD_DIRECTORY is the absolute pathname of the GNU dld library. (Don't bother on SunOS 4 or 5, they already have dynamic linking using shared libraries.) THIS OPTION IS UNSUPPORTED.

--with-libm, --with-libc: It is possible to specify alternative versions for the Math library (default -lm) and the C library (default the empty string) using the options

--with-libm=STRING and --with-libc=STRING, respectively. For example, if your system requires that you pass -lc_s to the C compiler to use the shared C library, you can pass --with-libc=-lc_s. These libraries are passed after all other libraries, the C library last.

--with-libs='libs': Add 'libs' to the LIBS that the python interpreter is linked against.

--with-cxx-main=: If you plan to use C++ extension modules, then -- on some platforms -- you need to compile python's main() function with the C++ compiler. With this option, make will use to compile main() *and* to link the python executable. It is likely that the resulting executable depends on the C++ runtime library of . (The default is --without-cxx-main.) There are platforms that do not require you to build Python with a C++ compiler in order to use C++ extension modules. E.g., x86 Linux with ELF shared binaries and GCC 3.x, 4.x is such a platform. We recommend that you configure Python --without-cxx-main on those platforms because a mismatch between the C++ compiler version used to build Python and to build a C++ extension module is likely to cause a crash at runtime.

The Python installation also stores the variable CXX that determines, e.g., the C++ compiler distutils calls by default to build C++ extensions. If you set CXX on the configure command line to any string of non-zero length, then configure won't change CXX. If you do not preset CXX but pass --with-cxx-main=, then configure sets CXX=.

In all other cases, configure looks for a C++ compiler by some common names (c++, g++, gcc, CC, cxx, cc++, cl) and sets CXX to the first compiler it finds. If it does not find any C++ compiler, then it sets CXX="".

Similarly, if you want to change the command used to link the python executable, then set LINKCC on the configure command line.

--with-pydebug: Enable additional debugging code to help track down memory management problems. This allows printing a list of all live objects when the interpreter terminates.

--with(out)-universal-newlines: enable reading of text files with foreign newline convention (default: enabled). In other words, any of \r, \n or \r\n is acceptable as end-of-line character. If enabled import and execfile will automatically accept any newline in files. Python code can open a file with open(file, 'U') to read it in universal newline mode. THIS OPTION IS UNSUPPORTED.

--with-tsc: Profile using the Pentium timestamping counter (TSC).

--with-system-ffi: Build the _ctypes extension module using an ffi library installed on the system.
--with-dbmliborder=db1:db2:....: Specify the order that backends for the dbm extension are checked. Valid value is a colon separated string with the backend names `ndbm', `gdbm' and `bdb'.

Building for multiple architectures (using the VPATH feature)

If your file system is shared between multiple architectures, it usually is not necessary to make copies of the sources for each architecture you want to support. If the make program supports the VPATH feature, you can create an empty build directory for each architecture, and in each directory run the configure script (on the appropriate machine with the appropriate options). This creates the necessary subdirectories and the Makefiles therein. The Makefiles contain a line VPATH=... which points to a directory containing the actual sources. (On SGI systems, use "smake -J1" instead of "make" if you use VPATH -- don't try gnumake.)

For example, the following is all you need to build a minimal Python in /usr/tmp/python (assuming ~guido/src/python is the toplevel directory and you want to build in /usr/tmp/python):

```
$ mkdir /usr/tmp/python
$ cd /usr/tmp/python
$ ~guido/src/python/configure
[...]
$ make
[...]
$
```

Note that configure copies the original Setup file to the build directory if it finds no Setup file there. This means that you can edit the Setup file for each architecture independently. For this reason, subsequent changes to the original Setup file are not tracked automatically, as they might overwrite local changes. To force a copy of a changed original Setup file, delete the target Setup file. (The makesetup script supports multiple input files, so if you want to be fancy you can change the rules to create an empty Setup.local if it doesn't exist and run it with arguments \$(srcdir)/Setup Setup.local; however this assumes that you only need to add modules.)

Also note that you can't use a workspace for VPATH and non VPATH builds. The object files left behind by one version confuses the other.

Building on non-UNIX systems

For Windows (2000/NT/ME/98/95), assuming you have MS VC++ 7.1, the project files are in PCbuild, the workspace is pcbuild.dsw. See PCbuild\readme.txt for detailed instructions.

For other non-Unix Windows compilers, in particular MS VC++ 6.0 and for OS/2, enter the directory "PC" and read the file "readme.txt". For the Mac, a separate source distribution will be made available, for use with the CodeWarrior compiler. If you are interested in Mac development, join the PythonMac Special Interest Group (<http://www.python.org/sigs/pythonmac-sig/>, or send email to pythonmac-sig-request@python.org).

Of course, there are also binary distributions available for these platforms -- see <http://www.python.org/>.

To port Python to a new non-UNIX system, you will have to fake the effect of running the configure script manually (for Mac and PC, this has already been done for you). A good start is to copy the file

pyconfig.h.in to pyconfig.h and edit the latter to reflect the actual configuration of your system. Most symbols must simply be defined as 1 only if the corresponding feature is present and can be left alone otherwise; however the *_t type symbols must be defined as some variant of int if they need to be defined at all. For all platforms, it's important that the build arrange to define the preprocessor symbol NDEBUB on the compiler command line in a release build of Python (else assert() calls remain in the code, hurting release-build performance). The Unix, Windows and Mac builds already do this.

Miscellaneous issues

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Emacs mode

There's an excellent Emacs editing mode for Python code; see the file Misc/python-mode.el. Originally written by the famous Tim Peters, it is now maintained by the equally famous Barry Warsaw. The latest version, along with

various other contributed Python-related Emacs goodies, is online at <http://launchpad.net/python-mode/>.

Tkinter

The setup.py script automatically configures this when it detects a usable Tcl/Tk installation. This requires Tcl/Tk version 8.0 or higher.

For more Tkinter information, see the Tkinter Resource page:

<http://www.python.org/topics/tkinter/>

There are demos in the Demo/tkinter directory.

Note that there's a Python module called "Tkinter" (capital T) which lives in Lib/lib-tk/Tkinter.py, and a C module called "_tkinter"

(lower case t and leading underscore) which lives in

Modules/_tkinter.c. Demos and normal Tk applications import only the Python Tkinter module -- only the latter imports the C _tkinter

module. In order to find the C _tkinter module, it must be compiled and linked into the Python interpreter -- the setup.py script does

this. In order to find the Python Tkinter module, sys.path must be set correctly -- normal installation takes care of this.

Distribution structure

Most subdirectories have their own README files. Most files have comments.

Demo/	Demonstration scripts, modules and programs
Doc/	Documentation sources (reStructuredText)
Grammar/	Input for the parser generator
Include/	Public header files
LICENSE	Licensing information
Lib/	Python library modules
Mac/	Macintosh specific resources
Makefile.pre.in	Source from which config.status creates the Makefile.pre
Misc/	Miscellaneous useful files
Modules/	Implementation of most built-in modules
Objects/	Implementation of most built-in object types
PC/	Files specific to PC ports (DOS, Windows, OS/2)
PCbuild/	Build directory for Microsoft Visual C++
Parser/	The parser and tokenizer and their input handling
Python/	The byte-compiler and interpreter

README The file you're reading now
 RISCOS/ Files specific to RISC OS port
 Tools/ Some useful programs written in Python
 pyconfig.h.in Source from which pyconfig.h is created (GNU autoheader
 output)
 configure Configuration shell script (GNU autoconf output)
 configure.ac Configuration specification (input for GNU autoconf)
 install-sh Shell script used to install files
 setup.py Python script used to build extension modules
 The following files will (may) be created in the toplevel directory by
 the configuration and build processes:
 Makefile Build rules
 Makefile.pre Build rules before running Modules/makesetup
 buildno Keeps track of the build number
 config.cache Cache of configuration variables
 pyconfig.h Configuration header
 config.log Log from last configure run
 config.status Status from last run of the configure script
 getbuildinfo.o Object file from Modules/getbuildinfo.c
 libpython.a The library archive
 python The executable interpreter
 reflog.txt Output from running the regression suite with the -R flag
 tags, TAGS Tags files for vi and Emacs
 That's all, folks!

 --Guido van Rossum (home page: <http://www.python.org/~guido/>)

Appendix H: Patent License

Patent License:

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Last Updated: December 6, 2010

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"Compatibility Test" means the test script supplied with the Skype Silk Software to determine whether a Licensed Product is Fully Compatible. At the user's request, the test script will invoke the decoder of the Licensed Product, input the encoder output Test Vectors, and compare the output from the Licensed Product with the decoder output Test Vectors using the Compare Tool.

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