



Red Hat Developer Toolset 6.x

6.0 Release Notes

Release Notes for Red Hat Developer Toolset 6.0

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Abstract

Red Hat Developer Toolset is a Software Collection from the Red Hat Software Collections offering. It is designed for developers working on the Red Hat Enterprise Linux platform. Using a framework called Software Collections, an additional set of tools is installed into the /opt/ directory, as recommended by the UNIX Filesystem Hierarchy Standard. These tools are enabled by the user on demand using the supplied scl utility. Red Hat Developer Toolset 6.0 provides current versions of the GNU Compiler Collection, GNU Debugger, and other development, debugging, and performance monitoring tools. These do not replace the Red Hat Enterprise Linux system versions of these tools, nor will they be used in preference to those system versions unless explicitly invoked using the scl utility. These Release Notes contain important information

available at the time of release of Red Hat Developer Toolset 6.0. Known problems, resources, and other issues are discussed here. Read this document before beginning to use Red Hat Developer Toolset 6.0. For information on other components of Red Hat Software Collections, see the Red Hat Software Collections Release Notes. For details about length of support for individual components, refer to the Red Hat Software Collections Product Life Cycle document. The version number of Red Hat Developer Toolset has been raised from 4.1 to 6.0 to align with the major version of GCC. There is no Red Hat Developer Toolset 5.

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CHAPTER 1. SYSTEM REQUIREMENTS

This chapter specifies hardware requirements and contains information related to the installation of Red Hat Developer Toolset 6.0.

1.1. INSTALLATION PREREQUISITES

Red Hat Developer Toolset 6.0 contains packages for both Red Hat Enterprise Linux 6 and Red Hat Enterprise Linux 7 running on AMD64 and Intel 64 architectures. Generation and manipulation of 32-bit binaries is also supported.

Red Hat Developer Toolset 6.0 introduces support for the following architectures on Red Hat Enterprise Linux 7:

- The 64-bit ARM architecture (AArch64)
- IBM POWER, big endian
- IBM POWER, little endian
- IBM z Systems

The correct packages must be installed according to the host operating system in use. Red Hat Enterprise Linux 6 RPM packages can be used only on supported versions of Red Hat Enterprise Linux 6, and Red Hat Enterprise Linux 7 RPM packages can be used only on supported versions of Red Hat Enterprise Linux 7.

Before installing Red Hat Developer Toolset 6.0, it is recommended to apply all available Red Hat Enterprise Linux errata updates. This will enable all Red Hat Developer Toolset features and apply fixes that can otherwise impact the tools or built code.

Red Hat Developer Toolset 6.0 requires systems to be subscribed to the **Optional** channel in order to access all the necessary dependent packages required by the Red Hat Developer Toolset toolchain. Packages from the **Optional** channel are listed in the [Red Hat Software Collections 2.3 Release Notes](#).

If you use Red Hat Subscription Manager:

- On Red Hat Enterprise Linux 6, select **System** → **Administration** → **Add/Remove Software** from the panel and navigate to **System** → **Software Sources**.
- On Red Hat Enterprise Linux 7, you can add these repositories by navigating to **Applications** → **System Tools** → **Red Hat Subscription Manager**.

Then enable the **Optional** channel for your system. For detailed information, see <https://access.redhat.com/solutions/392003>.

Users of RHN Classic or Red Hat Satellite can enable the **Optional** channel by following the instructions at <https://access.redhat.com/solutions/70019>.

Since Red Hat Developer Toolset 4.1, the content is available also in the ISO format at <https://access.redhat.com/downloads>, specifically for [Server](#) and [Workstation](#).

**NOTE**

Packages that require the **Optional** channel cannot be installed from the ISO image. A list of packages that require enabling of the **Optional** channel is provided in the [Red Hat Software Collections Release Notes](#).

Beta content is unavailable in the ISO format.

1.2. INSTALLATION AND UPGRADING

Use of Red Hat Developer Toolset 6.0 requires the removal of any earlier pre-release versions, including Beta releases. If you have installed any previous version of Red Hat Developer Toolset, uninstall it from your system as described in the [Uninstalling Red Hat Developer Toolset](#) section of the *Red Hat Developer Toolset User Guide*.

Note that installing Red Hat Developer Toolset 6.x in parallel with Red Hat Developer Toolset 4.x is supported.

**NOTE**

The version number of Red Hat Developer Toolset has been raised from 4.1 to 6.0 to signify the major improvements brought by **GCC 6.2.1**, which has been upgraded from version 5.3.1 in the previous release of Red Hat Developer Toolset. There is no Red Hat Developer Toolset 5.

For detailed information on installation of Red Hat Developer Toolset 6.0 see the [Installing Red Hat Developer Toolset](#) chapter of the *Red Hat Developer Toolset User Guide*.

The in-place upgrade from Red Hat Enterprise Linux 6 to Red Hat Enterprise Linux 7 is not supported by Red Hat Developer Toolset. As a consequence, the installed components might not work correctly after the upgrade. If you want to upgrade from Red Hat Enterprise Linux 6 to Red Hat Enterprise Linux 7, it is strongly recommended to remove all Red Hat Developer Toolset packages, perform the in-place upgrade, update the Red Hat Developer Toolset repository, and install the Red Hat Developer Toolset packages again. It is advisable to back up all data before upgrading.

CHAPTER 2. RED HAT DEVELOPER TOOLSET 6.0 RELEASE

This chapter serves as an overview of Red Hat Developer Toolset 6.0. It sums up its main features and changes, and provides a list of known issues.

2.1. CHANGES IN RED HAT DEVELOPER TOOLSET 6.0

2.1.1. Upgraded Components

All components in Red Hat Developer Toolset 6.0 are shipped with the `devtoolset-6-` prefix.

Red Hat Developer Toolset 6.0 includes a new component, **make 4.1**, a tool for controlling the generation of executables and other non-source files of a program from the program's source files.

The following components have been upgraded in Red Hat Developer Toolset 6.0 compared to the previous release of Red Hat Developer Toolset:

- **GCC** to version 6.2.1
- **binutils** to version 2.27
- **elfutils** to version 0.167
- **GDB** to version 7.12
- **strace** to version 4.12
- **SystemTap** to version 3.0
- **Valgrind** to version 3.12.0
- **Dyninst** to version 9.2.0

For detailed information on changes in Red Hat Developer Toolset 6.0, see [Red Hat Developer Toolset User Guide](#).



NOTE

The **Eclipse** component is now shipped as a separate `rh-eclipse46` Software Collection for Red Hat Enterprise Linux 7. For details, see the [Red Hat Software Collections Release Notes](#).

2.1.2. Container Images

Red Hat Developer Toolset 6.0 includes two pre-built docker-formatted container images:

- The `rhsc1/devtoolset-6-toolchain-rhel7` image, which contains the following Red Hat Developer Toolset components:
 - `devtoolset-6-gcc`
 - `devtoolset-6-gcc-c++`
 - `devtoolset-6-gcc-fortran`

- devtoolset-6-gdb
- The `rhsc1/devtoolset-6-perftools-rhel7` image, which contains the following components:
 - devtoolset-6-oprofile
 - devtoolset-6-systemtap
 - devtoolset-6-valgrind
 - devtoolset-6-dyninst
 - devtoolset-6-elfutils

The container images are available from the Red Hat Container Registry. For details on how to obtain the images and how to run Red Hat Developer Toolset components using these images, see [Red Hat Developer Toolset User Guide](#).

2.2. FEATURES

2.2.1. List of Components

Red Hat Developer Toolset 6.0 provides the following components:

Development Tools

- GNU Compiler Collection (GCC)
- binutils
- elfutils
- dwz
- make

Debugging Tools

- GNU Debugger (GDB)
- strace
- ltrace
- memstomp

Performance Monitoring Tools

- SystemTap
- Valgrind
- OProfile
- Dyninst

For details, see the [Red Hat Developer Toolset Components](#) table in the *Red Hat Developer Toolset User Guide*.

2.2.2. Main Features

The Red Hat Developer Toolset version of the **GNU Compiler Collection (GCC)** has been upgraded to version 6.2.1 with major improvements and many bug fixes.

The version of the **GNU Debugger (GDB)** included in Red Hat Developer Toolset provides new features, including the following:

- Support for recording `bt` trace without maintaining an active **GDB** connection.
- Support for running interpreters on specified input or output devices.

The Red Hat Developer Toolset 6.0 version of `binutils` provides these features:

- Support has been added for generating and using compressed debug sections.
- The linker now automatically enables the read-only run-time relocations unless explicitly told otherwise. This helps to enhance the security of executables.
- The assembler now supports the ARM v8.1 and ARM v8-M architectures, including the Adv.SIMD, LOR, PAN, Security, and DSP extensions.

For a full list of changes and features introduced in this release, see [Red Hat Developer Toolset User Guide](#).

2.3. KNOWN ISSUES

`oprofile` component

OProfile 1.1.0 shipped in Red Hat Developer Toolset 6.0 works on all supported architectures, with the exception of IBM z Systems, where only the `ocount` tool works on the following models: z196, zEC12, and z13. `operf` and the other tools, such as `oparchive` or `opannotate`, do not work on IBM z Systems. For profiling purposes, users are recommended to use the Red Hat Enterprise Linux 7 system **OProfile 0.9.9** version, which supports `opcontrol` with `TIMER` software interrupts.

Note that for correct reporting of data collected by **OProfile 0.9.9**, the corresponding `opreport` utility is necessary. Thus `opcontrol`-based profiling should be performed with Red Hat Developer Toolset disabled because the reporting tools from Red Hat Developer Toolset cannot process data collected within `opcontrol` legacy mode correctly.

`gcc` component

The `libatomic` library is unavailable for the 64-bit ARM architecture on Red Hat Enterprise Linux 7.2 and earlier versions. As a consequence, the `devtoolset-6-libatomic-devel` package cannot be installed on such systems. In Red Hat Enterprise Linux 7.3, the `libatomic` package for the 64-bit ARM architecture is shipped in the `gcc-libraries` package.

`gcc` component

Under certain circumstances, the source RPM package for **GCC** (`devtoolset-6-gcc.src.rpm`) cannot be rebuilt on Red Hat Enterprise Linux 6 or Red Hat Enterprise Linux 7.

`ltrace` component

Under certain circumstances, the source RPM package for **ltrace** (`devtoolset-6-ltrace.src.rpm`) cannot be rebuilt.

systemtap component

The source RPM package for **SystemTap** (`devtoolset-6-systemtap.src.rpm`) cannot be rebuilt on Red Hat Enterprise Linux 6.

multiple components

The `devtoolset-6-package_name-debuginfo` packages can conflict with the corresponding packages from the base Red Hat Enterprise Linux system or from other versions of Red Hat Developer Toolset. This namely applies to `devtoolset-6-gcc-debuginfo`, `devtoolset-6-ltrace-debuginfo`, `devtoolset-6-valgrind-debuginfo`, and might apply to other `debuginfo` packages, too. A similar conflict can also occur in a multilib environment, where 64-bit `debuginfo` packages conflict with 32-bit `debuginfo` packages.

For example, on Red Hat Enterprise Linux 7, `devtoolset-6-gcc-debuginfo` conflicts with three packages: `gcc-base-debuginfo`, `gcc-debuginfo`, and `gcc-libraries-debuginfo`. On Red Hat Enterprise Linux 6, `devtoolset-6-gcc-debuginfo` conflicts with one package: `gcc-libraries-debuginfo`. As a consequence, if conflicting `debuginfo` packages are installed, attempts to install Red Hat Developer Toolset 6.0 can fail with a transaction check error message similar to the following examples:

```
file /usr/lib/debug/usr/lib64/libitm.so.1.0.0.debug from install of gcc-base-debuginfo-4.8.3-9.el7.x86_64 conflicts with file from package devtoolset-6-gcc-debuginfo-6.2.1-2.el7.x86_64
```

```
file /usr/lib/debug/usr/lib64/libtsan.so.0.0.0.debug from install of gcc-debuginfo-4.8.3-9.el7.x86_64 conflicts with file from package devtoolset-6-gcc-debuginfo-6.2.1-2.el7.x86_64
```

```
file /usr/src/debug/gcc-5.2.1-20150716/obj-x86_64-redhat-linux/x86_64-redhat-linux/libstdc++-v3/include/x86_64-redhat-linux/bits/c++config.h from install of gcc-libraries-debuginfo-5.2.1-2.1.el7.x86_64 conflicts with file from package devtoolset-6-gcc-debuginfo-6.2.1-2.el7.x86_64
```

```
file /usr/lib/debug/usr/lib64/libcilkrts.so.5.0.0.debug from install of gcc-libraries-debuginfo-4.9.0-6.1.1.el6.x86_64 conflicts with file from package devtoolset-6-gcc-debuginfo-6.2.1-2.el7.x86_64
```

To work around the problem, manually uninstall the conflicting `debuginfo` packages prior to installing Red Hat Developer Toolset 6.0. It is advisable to install only the relevant `debuginfo` packages when necessary and expect such problems to happen.

valgrind component, BZ# [869184](#)

The default **Valgrind** `gdbserver` support (`--vgdb=yes`) can cause certain register and flags values to be not always up-to-date due to optimizations done by the **Valgrind** core. The **GDB** utility is therefore unable to show certain parameters or variables of programs running under **Valgrind**. To work around this problem, use the `--vgdb=full` parameter. Note that programs might run slower under **Valgrind** when this parameter is used.

valgrind component, BZ# [990931](#)

Valgrind must be rebuilt without Red Hat Developer Toolset's **GCC** installed, or it will be used in

preference to Red Hat Enterprise Linux system **GCC**. The binary files shipped by Red Hat are build using the system **GCC**. For any testing, Red Hat Developer Toolset's **GDB** should be used.

Other Notes

- Red Hat Developer Toolset primarily aims to provide a compiler for development of user applications for deployment on multiple versions of Red Hat Enterprise Linux. Operating system components, kernel modules and device drivers generally correspond to a specific version of Red Hat Enterprise Linux, for which the supplied base OS compiler is recommended.
- Red Hat Developer Toolset 6.0 supports only C, C++ and Fortran development. For other languages, invoke the system version of **GCC** available on Red Hat Enterprise Linux.
- Building an application with Red Hat Developer Toolset 6.0 on Red Hat Enterprise Linux (for example, Red Hat Enterprise Linux 7) and then executing that application on an earlier minor version (such as Red Hat Enterprise Linux 6.6.z) may result in runtime errors due to differences in non-toolchain components between Red Hat Enterprise Linux releases. Users are advised to check compatibility carefully. Red Hat supports only execution of an application built with Red Hat Developer Toolset on the same, or a later, supported release of Red Hat Enterprise Linux than the version used to build that application.
- All code in the non-shared library `libstdc++_nonshared.a` in Red Hat Developer Toolset 6.0 is licensed under the GNU General Public License v3 with additional permissions granted under Section 7, described in the GCC Runtime Library Exception version 3.1, as published by the Free Software Foundation.
- The compiler included in Red Hat Developer Toolset emits newer DWARF debugging records than previous compilers available on Red Hat Enterprise Linux. These new debugging records improve the debugging experience in a variety of ways, particularly for C++ and optimized code. However, certain tools are not yet capable of handling the newer DWARF debug records. To generate the older style debugging records, use the options `-gdwarf-2 -gstrict-dwarf` or `-gdwarf-3 -gstrict-dwarf`.
- Some newer library features are statically linked into applications built with Red Hat Developer Toolset to support execution on multiple versions of Red Hat Enterprise Linux. This adds a small additional security risk because regular Red Hat Enterprise Linux errata would not change this code. If the need for developers to rebuild their applications due to such an issue arises, Red Hat will signal this in a security erratum. Developers are strongly advised not to statically link their entire application for the same reasons.
- Note that error messages related to a missing `libitm` library when using the `-fgnu-tm` option require the `libitm` package to be installed. You can install the package with the following command:

```
yum install libitm
```

- To use the `ccache` utility with **GCC** included in Red Hat Developer Toolset, set your environment correctly. For example:

```
~]$ scl enable devtoolset-6 '/usr/lib64/ccache/gcc -c foo.c'
```

Alternatively, you can create a shell with the Red Hat Developer Toolset version of **GCC** as the default compiler:

```
~]$ scl enable devtoolset-6 'bash'
```

After you have created the shell, run the following two commands:

```
~]$ export PATH=/usr/lib64/ccache${PATH:+:${PATH}}
```

```
~]$ gcc -c foo.c
```

- Because the `elfutils` libraries contained in Red Hat Developer Toolset 6.0 are linked to a client application statically, caution is advised when passing handles to `libelf`, `libdw`, and `libasm` data structures to external code and when passing handles received from external code to `libelf`, `libdw`, and `libasm`.

Be especially careful when an external library, which is linked dynamically against the system version of `elfutils`, is passed a pointer to a structure that comes from the Red Hat Developer Toolset 6.0 version of `elfutils` (or vice versa).

Generally, data structures used in the Red Hat Developer Toolset 6.0 version of `elfutils` are not compatible with the Red Hat Enterprise Linux system versions, and structures coming from one should never be touched by the other.

In applications that use the Red Hat Developer Toolset 6.0 libraries, all code that was linked against the system version of the libraries should be recompiled against the libraries included in Red Hat Developer Toolset 6.0.

- The `elfutils` EBL library, which is used internally by `libdw`, was amended not to open back ends dynamically. Instead, a selection of back ends is compiled in the library itself: Intel x86 (i386), AMD64 and Intel 64 (x86_64), Intel Itanium, and IBM z Systems. Some functionality may not be available if the client wishes to work with ELF files from architectures other than those mentioned above.
- Some packages managed by the `scl` utility include privileged services that require `sudo`. The system `sudo` clears environment variables and so Red Hat Developer Toolset includes its own `sudo` shell script, wrapping `scl enable`. This script does not currently parse or pass normal `sudo` options, only `sudo COMMAND ARGS . . .`. In order to use the system version of `sudo` from within a Red Hat Developer Toolset-enabled shell, use the `/usr/bin/sudo` binary.
- Red Hat Developer Toolset 6.0 includes **GCC 6.2**, which provides support for **Cilk+**, an extension to the C and C++ languages for parallel programming. A runtime library, `libcilkrts`, is included in this release to support the feature. The `libcilkrts` library will be a part of the `gcc-libraries` package in the future Red Hat Enterprise Linux releases but the package is not included in all supported Red Hat Enterprise Linux releases. To enable dynamic linkage of binaries and libraries built with Red Hat Developer Toolset 6.0 **GCC** using **Cilk+** features on supported Red Hat Enterprise Linux releases that do not contain `libcilkrts`, install the `libcilkrts.so` shared library from Red Hat Developer Toolset 6.0 with such binaries or libraries.
- Intel have issued erratum [HSW136](#) concerning **TSX** (Transactional Synchronization Extensions) instructions. Under certain circumstances, software using the Intel **TSX** instructions may result in unpredictable behavior. **TSX** instructions may be executed by applications built with Red Hat Developer Toolset **GCC** under certain conditions. These include use of **GCC**'s experimental Transactional Memory support (using the `-fgnu-tm` option) when executed on

hardware with TSX instructions enabled. The users of Red Hat Developer Toolset are advised to exercise further caution when experimenting with Transaction Memory at this time, or to disable TSX instructions by applying an appropriate hardware or firmware update.

- To use the Memory Protection Extensions (MPX) feature in **GCC**, the Red Hat Developer Toolset version of the **libmpx** library is required, otherwise the application might not link properly.
- The two **binutils** linkers, **gold** and **ld**, have different ways of handling hidden symbols, which leads to incompatibilities in their behavior. Previously, the **gold** and **ld** linkers had inconsistent and incorrect behavior with regard to shared libraries and hidden symbols. There were two scenarios:
 - If a shared library referenced a symbol that existed elsewhere in both hidden and non-hidden versions, the **gold** linker produced a bogus warning message about the hidden version.
 - If a shared library referenced a symbol that existed elsewhere only as a hidden symbol, the **gold** linker created an executable, even though it could not work.

The **gold** linker has been updated so that it no longer issues bogus warning messages about hidden symbols that also exist in a non-hidden version. The second scenario cannot be solved in the linker. It is up to the programmer to ensure that a non-hidden version of the symbol is available when the application is run.

As a result, the two linkers' behavior is closer, but they still differ in case of a reference to a hidden symbol that cannot be found elsewhere in a non-hidden version. Unfortunately, there is not a single correct behavior for this situation, so the linkers are allowed to differ.

- The **valgrind-openmpi** subpackage is no longer provided with **Valgrind** in Red Hat Developer Toolset. The **devtoolset-<version>-valgrind-openmpi** subpackages previously caused incompatibility issues with various Red Hat Enterprise Linux minor releases and problems with rebuilding. Users are recommended to use the latest Red Hat Enterprise Linux system version of the **valgrind** and **valgrind-openmpi** packages if they need to run **Valgrind** against their programs that are built against the **openmpi-devel** libraries.

CHAPTER 3. ADDITIONAL RESOURCES

For more information about Red Hat Developer Toolset 6.0 and Red Hat Enterprise Linux, see the resources listed below.

3.1. RED HAT ENTERPRISE LINUX DEVELOPER PROGRAM GROUP

Users of Red Hat Developer Toolset can access the Red Hat Enterprise Linux Developer Program Group in the Red Hat Customer Portal to get developer related information for the development tools available for Red Hat Enterprise Linux. In addition, users can find there developer related papers and videos on topics that are of interest to developers, for example RPM building, threaded programming, performance tuning, debugging, and so on.

- To visit the Red Hat Enterprise Linux Developer Program Group, log in to the [Red Hat Customer Portal](#), click **Products & Services** at the top of the page, choose **Services**, and then **Red Hat Enterprise Linux Developer Program** from the list.

3.2. RED HAT PRODUCT DOCUMENTATION

The **Red Hat Documentation** portal located at <https://access.redhat.com/documentation/> serves as a central source of all product documentation. It is translated in 22 languages and for each product, it provides different kinds of books from release and technical notes to installation, user, and reference guides in HTML, PDF, and EPUB formats.

The following is a brief list of documents that are directly or indirectly relevant to this book:

- [Red Hat Developer Toolset 6.0 User Guide](#) – The *User Guide* for Red Hat Developer Toolset contains more information about installing and using this content set.
- [Red Hat Software Collections 2.3 Packaging Guide](#) – The *Packaging Guide* for Red Hat Software Collections explains the concept of Software Collections, documents the `sc1` utility, and provides a detailed explanation of how to create a custom Software Collection or extend an existing one.
- [Red Hat Software Collections 2.3 Release Notes](#) – The *Release Notes* for Red Hat Software Collections document known problems, possible issues, and other important information available at the time of release of the content set. They also contain useful information on installing, rebuilding, migrating etc.
- [Red Hat Enterprise Linux 6 Developer Guide](#) – The *Developer Guide* for Red Hat Enterprise Linux 6 provides detailed information on compiling and building, debugging, and profiling.
- [Red Hat Enterprise Linux 7 Developer Guide](#) – The *Developer Guide* for Red Hat Enterprise Linux 7 provides an introduction to application development tools in Red Hat Enterprise Linux 7.

3.3. RED HAT DEVELOPER BLOG

[Red Hat Developer Blog](#) content is directed to designers and developers of applications based on Red Hat technologies. It contains links to product team blogs and other relevant internal and external resources. Its goal is to inform and engage the developer community with up-to-date information, best practices, opinion, product and program announcements as well as pointers to sample code and other resources.

APPENDIX A. REVISION HISTORY

Revision 6.0-7 Updated Known Issues.	Wed Apr 05 2017	Lenka Špačková
Revision 6.0-6 Fixed information regarding the <code>rhsc1/devtoolset-6-perftools-rhel7</code> container image.	Tue Apr 04 2017	Lenka Špačková
Revision 6.0-5 Release of Red Hat Developer Toolset 6.0 Release Notes.	Tue Nov 15 2016	Lenka Špačková
Revision 6.0-3 Added an <code>OProfile</code> known issue.	Tue Nov 01 2016	Lenka Špačková
Revision 6.0-2 Release of Red Hat Developer Toolset 6.0 Beta Release Notes.	Thu Oct 20 2016	Lenka Špačková