



Red Hat Developer Toolset 2.x 2.1 Release Notes

Release Notes for Red Hat Developer Toolset 2.1

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Abstract

Red Hat Developer Toolset is a Red Hat offering for developers 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 2.1 provides current versions of the GNU Compiler Collection, GNU Debugger a number of Performance Tools and a variety of other utilities. 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 2.1. Known problems, resources, and other issues are discussed here. Read this document before beginning to use Red Hat Developer Toolset 2.1.

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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 2.1.

1.1. Installation Prerequisites

Red Hat Developer Toolset 2.1 contains RPM packages for both Red Hat Enterprise Linux 5 and Red Hat Enterprise Linux 6 running on 32-bit or 64-bit Intel or AMD architectures. Installation on PowerPC architecture is not supported. The correct packages must be installed according to the host operating system in use.

Red Hat Enterprise Linux 5 RPM packages can be used on supported versions of Red Hat Enterprise Linux 5 only, and Red Hat Enterprise Linux 6 RPM packages can be used on supported versions of Red Hat Enterprise Linux 6 only.



Important

Red Hat Developer Toolset 2.1 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. This can be achieved by following the instructions at <https://access.redhat.com/site/solutions/70019>. Users of Red Hat Enterprise Linux 6 can add this channel by selecting **System** → **Administration** → **Add/Remove Software** from the panel, navigating to **System** → **Software sources**, and then enabling the **Optional** channel for their system.

1.2. Installation and Upgrading



Important

Use of Red Hat Developer Toolset requires the removal of any earlier pre-release versions of this product. Additionally, it is not possible to update to Red Hat Developer Toolset 2.1 from a pre-release version of Red Hat Developer Toolset, including beta releases. If you have previously installed any pre-release 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 2.1 User Guide*.

Note that installing Red Hat Developer Toolset 2.x in parallel with Red Hat Developer Toolset 1.x is supported.

For detailed information on installation of Red Hat Developer Toolset refer to the [Installing Red Hat Developer Toolset](#) chapter of the *Red Hat Developer Toolset 2.1 User Guide*.

Chapter 2. Red Hat Developer Toolset 2.1 Release

2.1. Changes in Red Hat Developer Toolset 2.1

2.1.1. New Component: Git

Red Hat Developer Toolset 2.1 adds **Git** as a new component available only for Red Hat Enterprise Linux 6. Git is a fast, scalable, distributed revision control system with a rich command set that provides both high-level operations and full access to internals.

2.1.2. Other Changes

For detailed information on changes in Red Hat Developer Toolset 2.1, refer to [Red Hat Developer Toolset User Guide](#).

2.2. Features

2.2.1. Main Features

The Red Hat Developer Toolset version of the **GNU Compiler Collection (GCC)** provides the following features:

- ▶ A new register allocator (LRA) has been added, improving code performance
- ▶ A fast memory error detector called AddressSanitizer has been added
- ▶ A fast data race detector called ThreadSanitizer has been added
- ▶ Extremely large functions can now be compiled faster using less memory
- ▶ A new "general" optimization level has been introduced
- ▶ GCC diagnostic messages now highlight the exact problem in the source code
- ▶ Various new optimization options have been added
- ▶ DWARF4 is now used as the default debug format
- ▶ GCC now fully implements the C++11 language standard
- ▶ C++11 library support has been extended though it is still experimental
- ▶ GCC now supports dynamic initialization of thread-local variables
- ▶ Support has been added for Intel FXSR, XSAVE, and XSAVEOPT instructions
- ▶ New built-in functions added to detect run-time Intel CPU Type and ISA
- ▶ Intel function multi-versioning support added
- ▶ Intel RTM/HLE intrinsics, built-ins and code generation have been added
- ▶ Transactions (-fgnu-tm option) can now be run using Intel TSX extensions
- ▶ Support for AMD family 15h and 16h processors has been added
- ▶ Various Fortran changes have been included

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

- ▶ Improved and expanded support for Python scripting.
- ▶ Improved handling of C++ debuggee executables.
- ▶ Improved inferior control commands.
- ▶ Improved support for ambiguous line specifications.

- ▶ Improved tracepoint support.
- ▶ Multi-program debugging.

Additionally, the Red Hat Developer Toolset version of **binutils** provides these features:

- ▶ The new **gold** linker, which is smaller and faster than **ld**. Note that **gold** is not the default linker and must be explicitly enabled by using the **alternatives** command.
- ▶ Support for link-time optimization (LTO) in conjunction with GCC.
- ▶ Support for build-IDs, unique numbers to identify executables.
- ▶ Support for the **IFUNC** and **UNIQUE** symbols that are used by **glibc** to improve performance. Due to dependencies on a particular version of the **glibc** library, these symbols are only available on Red Hat Enterprise Linux 6.
- ▶ Compressed debug sections for smaller debug info files.

2.2.2. Other Features

C++ Compatibility

Objects compiled with Developer Toolset 1.1 and 2.1 in C++98 mode (the default mode) are compatible with each other, and with objects compiled with the Red Hat Enterprise Linux system compilers in C++98 mode. Objects compiled in C++11 mode (that is, with `-std=c++11`) are compatible with all of the above C++98 objects, but are not guaranteed to be compatible with C++11 objects compiled with a different major version of the compiler. That is, if some C++11 objects previously compiled with Developer Toolset 1.1 are rebuilt with Developer Toolset 2.1, all C++11 objects should be rebuilt.

		<i>An object compiled with</i>					
		DTS 1.1 in C++98 mode	DTS 2.1 in C++98 mode	the RHEL system compilers in C++98 mode	DTS 1.1 in C++11 mode	DTS 2.1 in C++11 mode	
<i>An object compiled with</i>	DTS 1.1 in C++98 mode	✓	✓	✓	✓	✓	
	DTS 2.1 in C++98 mode	✓	✓	✓	✓	✓	
	the RHEL system compilers in C++98 mode	✓	✓	✓	✓	✓	
	DTS 1.1 in C++11 mode	✓	✓	✓	✓	✗	
	DTS 2.1 in C++11 mode	✓	✓	✓	✗	✓	
		✓ Supported					
		✗ Unsupported					

Figure 2.1. C++ Compatibility Matrix

For more information on features in this release, refer to the [Red Hat Developer Toolset User Guide](#).

2.3. Known Issues

gcc component

On Red Hat Enterprise Linux 5 and 6, attempting to install Red Hat Developer Toolset 2.1 in parallel with Red Hat Developer Toolset 1.1 can fail with an error message similar to the following;

```
file /usr/lib/debug/usr/lib/libitm.so.1.0.0.debug from install of libitm-  
debuginfo-4.7.0-5.1.1.el6.i686 conflicts with file from package devtoolset-  
1.1-gcc-debuginfo-4.7.2-5.el6.i686
```

To work around the problem, manually uninstall the *devtoolset-1.1-gcc-debuginfo* package prior to installing Red Hat Developer Toolset 2.1.

valgrind component

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 *--vgdb=full* parameter. Note that programs can run slower under **Valgrind** when this parameter is used.

valgrind component

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 binaries shipped by Red Hat are build using system *gcc*. For any testing, Red Hat Developer Toolset's *gdb* should be used.

elfutils component

elfutils must be rebuilt without Red Hat Developer Toolset enabled, otherwise the compilation will end with an error.

oprofile component

OProfile provides access to performance monitoring hardware only on physical machines. If you are using OProfile on a virtual machine guest, you need to force OProfile to use the timer mechanism with the following command:

```
~]$ opcontrol --deinit; modprobe oprofile timer=1
```

oprofile component

To allow OProfile to use the hardware performance units on Red Hat Enterprise Linux 5 or Red Hat Enterprise Linux 6, you need to disable watchdog timers with the following command:

```
~]$ echo 0 > /proc/sys/kernel/nmi_watchdog
```

dyninst component

The **dyninst** component works correctly only when the "allow_execmod" and "allow_execstack" SELinux boolean values are turned on. To do so, run the following commands:

```
~]# setsebool allow_execmod on
```

```
~]# setsebool allow_execstack on
```

binutils component

Under certain circumstances, printing out information from an Executable Linking Format (ELF) file by using the `eu-readelf` utility fails with the following error message:

```
invalid CIE reference in FDE
```

To work around this problem, use the "`-Wl,--traditional-format`" option when linking the object files in the GNU Compiler Collection (GCC). Alternatively, use the "`-flto -fno-fat-lto-objects`" option for generating all object files.

oprofile component

Under certain circumstances, on some Red Hat Enterprise Linux 5 systems, the **oprofiled** daemon terminates unexpectedly with a segmentation fault during the profiling process when the **opcontrol --save=<name>** command is executed while the daemon is running. As a consequence, some profiling data collected by the daemon can be lost. To work around this problem, use the **opcontrol --shutdown; opcontrol --save=<name>** command instead of **opcontrol --save=<name>** while the `oprofile` utility is running.

eclipse component

Under certain circumstances, on some Red Hat Enterprise Linux 6.5 systems, the **perf** utility returns improperly formatted data when the `report` command is run to show the number of samples for each symbol (the `-n` option) using a particular field separator (the `-t` option) for columns. This problem has been addressed by a bug fix to the underlying `perf` utility in *kernel-2.6.32-421.el6*. Also, on 32-bit Intel architecture, the reported sample values are incorrect and appear to have underflowed. As a consequence, the Eclipse Perf plug-in parses the data incorrectly and either does not report any samples captured, or displays them improperly.

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.
- ▶ After installing Red Hat Developer Toolset, it is recommended to apply all available Red Hat Enterprise Linux errata updates to enable all Red Hat Developer Toolset features and apply fixes that may otherwise impact the tools or built code.
- ▶ Red Hat Developer Toolset 2.1 supports C, C++ and Fortran development only. For other languages, please invoke the system version of **GCC** available on Red Hat Enterprise Linux.
- ▶ Red Hat Developer Toolset 2.1 **Valgrind** contains experimental support for some AVX2 instructions.

- ▶ Building an application with Red Hat Developer Toolset 2.1 on Red Hat Enterprise Linux (for example: Red Hat Enterprise Linux 5.9) and then executing that application on an earlier minor version (such as Red Hat Enterprise Linux 5.6) 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 only supports 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 2.1 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 as normal 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 via 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
```

- ▶ The **ccache** utility can be used with **GCC** included in Red Hat Developer Toolset by setting your environment correctly. For example:

```
~]$ scl enable devtoolset-2.1 '/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-2.1 'bash'
```

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

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

```
~]$ gcc -c -o a.o a.c
```

- ▶ Because the **elfutils** libraries contained in Red Hat Developer Toolset 2.1 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 2.1 version of **elfutils** (or vice versa).

Generally, data structures used in the Red Hat Developer Toolset 2.1 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 2.1 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 2.1.

- ▶ **elfutils** EBL, a library 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 / Intel 64 (x86_64), Intel Itanium, and IBM System z. Some functionality may not be available if the client wishes to work with ELF files from architectures other than those mentioned above.
- ▶ With the Red Hat Developer Toolset 2.1 release, you can now use **Valgrind**'s **libmpiwrap** wrapper with either the *openmpi* package or the *compat-openmpi* compatibility package. When using **Valgrind** on Red Hat Enterprise Linux 6, specify whether you want use the *openmpi* or *compat-openmpi* package by updating the **LD_PRELOAD** environment variable.

To use the *openmpi* package with the **libmpiwrap** wrapper, update **LD_PRELOAD** as follows:

```
LD_PRELOAD=/opt/rh/devtoolset-2/root/usr/lib64/valgrind/libmpiwrap-amd64-
linux.so:/usr/lib64/openmpi/lib/libmpi.so /usr/lib64/openmpi/bin/mpirun
valgrind ./mpi-hello
```

Where **mpi-hello** is compiled with the appropriate **mpicc** compiler.

To use the *compat-openmpi* package with the **libmpiwrap** wrapper, update **LD_PRELOAD** as follows:

```
LD_PRELOAD=/opt/rh/devtoolset-2/root/usr/lib64/valgrind/libmpiwrap-amd64-
linux.so:/usr/lib64/compat-openmpi/lib/libmpi.so /usr/lib64/compat-
openmpi/bin/mpirun valgrind ./mpi-hello
```

Where **mpi-hello** is compiled with the appropriate **mpicc** compiler.

To test that the above works as expected and the MPI calls are intercepted by the wrapper, set the environment variable **MPIWRAP_DEBUG** to **verbose**.

- ▶ 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 **scl** from within a Red Hat Developer Toolset-enabled shell, please use the **/usr/bin/sudo** binary.

Chapter 3. Additional Resources

For more information about Red Hat Developer Toolset 2.1 and Red Hat Enterprise Linux, refer to 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 [Customer Portal](#), click **Products** at the top of the page, choose **Our Services**, and then **Red Hat Enterprise Linux Developer Program** from the list.

3.2. Accessing Red Hat Documentation

The **Red Hat Documentation** portal located at <https://access.redhat.com/site/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 2.1 User Guide](#) – The *User Guide* for Red Hat Developer Toolset 2.1 contains more information about installing and using this product.
- ▶ [Red Hat Developer Toolset 2.1 Software Collections Guide](#) – The *Software Collections Guide* for Red Hat Developer Toolset 2.1 explains the concept of Software Collections and documents Software Collections packaging.
- ▶ [Red Hat Enterprise Linux 6 Developer Guide](#) – The *Developer Guide* for Red Hat Enterprise Linux 6 provides detailed information on the Eclipse IDE, libraries and runtime support, compiling and building, debugging, and profiling.

Revision History

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Release of Developer Toolset 2.1 Release Notes.		