



Intel® Cluster Toolkit 3.2 Release Notes (Revision 20081031)

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Overview

Intel Cluster Toolkit 3.2 for Linux* OS and Microsoft* Windows* Compute Cluster Server OS (Microsoft Windows CCS*) accelerate parallel software development on homogenous cluster systems based on IA-32, or IA-64 (Itanium®), or Intel® 64 architectures. In terms of the Intel® Cluster Toolkit software for Windows*, consider references within this document to Microsoft Windows CCS OS, and Microsoft* Windows* HPC Server 2008 OS (which is newly support) **as interchangeable**. The Microsoft Windows CCS and Microsoft Windows HPC Server 2008 operating systems only support Intel® 64 architecture.

Intel Cluster Toolkit 3.2 supports application development using Intel® MPI Library with optimized parallel libraries, performance analysis, and benchmarks. Intel Cluster Toolkit 3.2 saves software developers time and improves execution performance on distributed computing systems.

Intel Cluster Toolkit 3.2 for Linux and Microsoft Windows CCS supports crucial parts of the message-passing interface (MPI) application development process including:

- Intel MPI Library 3.2 Build 0xx which is approaching conformity with the Message Passing Interface 2 Standard (MPI-2), enables multiple interconnect solutions with a single implementation. Intel seeks to be a software leader in MPI and open standards.
- The Intel® Trace Analyzer and Collector 7.2 (ITAC) Build 0xx

- Intel® Trace Collector 7.2 (ITC) provides event-based tracing in cluster applications through an instrumentation library that causes low-overhead in execution. The trace information provides performance data, statistics, multi-threaded events, and automatic instrumentation of user binaries on IA-32 architectures.
- The Intel® Trace Analyzer 7.2 (ITA) provides visual analysis of application activities gathered by the Intel Trace Collector. This software component has been completely rewritten.
- A message checking component of the Intel Trace Collector provides a novel MPI correctness technology which detects errors with data types, buffers, communicators, point-to-point messages and collective operations, deadlocks, and data corruption.
- Application tuning with optimized mathematical library functions from Intel® Math Kernel Library 10.1 (Intel® MKL 10.1) that includes ScaLAPACK solvers and Cluster DFTs (Discrete Fourier Transforms).
- Intel® MPI Benchmarks 3.2 make it easy to gather performance information about a cluster system.

Note that when the system administrator or user completes the Intel Cluster Toolkit 3.2 installation process, there will be a file called `Doc_Index.htm` in the `doc` folder on the master node of the cluster. This file can be used as a documentation map to navigate to various information resources pertaining to the Intel Cluster Toolkit. Additional information about the exact location of `Doc_Index.htm`, and its content are further described in the [Installation Notes](#) section of this release notes document.

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Product Contents

Table for product components, including documentation from these components.

Tool	Version	Manual	Revision
Intel® MPI Library	3.2	Doc_Index.html for Linux* Doc_Index.htm for Microsoft* Windows* CCS*	3.2
Intel® Trace Analyzer and Collector	7.2	ITA_Reference_Guide.pdf ITC_Reference_Guide.pdf	7.2
Intel® Math Kernel Library	10.1	mkl_documentation.htm	10.1
Intel® MPI Benchmarks	3.2	IMB_Users_Guide.pdf	3.2

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New Features

Intel® Cluster Toolkit 3.2

- As referenced earlier in this document, the Intel® Cluster Toolkit 3.2 software for Windows* now works with Microsoft* Windows* HPC Server 2008
- For Linux, regarding the input file to the Secure Shell connectivity script, the script now interprets a “#” symbol at the beginning of each input line as a comment line. This allows you to be selective in setting up secure shell connectivity (See Chapter 2.1 of the Linux Installation Guide or Chapter 3.1 of the Linux Getting Started Guide)
- The Getting Started Guide for Linux* and Windows* (See Chapter 4) describes the `mpitune` utility. It can be used to find optimal settings of Intel® MPI Library in regards to the cluster configuration or a user’s application for that cluster
- The Getting Started Guide for Linux (See Chapter 5) describes some tasks that you will need to follow if you wish to use Intel® Debugger 11.0 with Intel® MPI Library. The Intel® Debugger 11.0 now has a graphical user interface (GUI)
- For users of the Intel® Cluster Toolkit 3.2 on Microsoft* Windows CCS* the Intel® MPI Benchmarks 3.2 now includes a `WINDOWS` folder that contains Microsoft* Visual Studio* 2005 and 2008 project folders. On Microsoft* Windows*, this allows you to use a pre-existing “.vcproj” project file in conjunction with Microsoft* Visual Studio* to build and run the associated Intel® MPI Benchmark 3.2 application.
- The Message Checking Component of Intel® Trace Collector 7.2 now generates instrumentation data that can be displayed by the Intel® Trace Analyzer 7.2 (see Chapter 6 of the Getting Started Guide for Linux*). This is available for both Linux* and Microsoft* Windows*
- On Linux*, for the ScaLAPACK test suite, the makefile variable “`INSLIB`” is now available for instrumenting each of the ScaLAPACK executables with instrumentation from the Intel® Trace Collector(see Chapter 7 of the Getting Started Guide for Linux*)
- On Microsoft* Windows*, for the ScaLAPACK test suite, the makefile variable `msvs=2008` can be used to resolve link errors regarding the library `bufferoverflowu.lib`, if only Microsoft* Visual Studio* 2008 is installed on the cluster (see Chapter 7 of the Getting Started Guide for Windows*)
- With one installation session, the Intel Cluster Tools installer on Linux and/or Windows* will install:
 - Intel® MPI Benchmarks 3.2
 - Intel® MKL 10.1
 - Intel® MPI Library 3.2 for both Linux and Windows
 - Intel® Trace Analyzer and Collector 7.2 for both Linux and Windows

Intel® MPI Library 3.2 for Linux* OS

This release includes the following updates compared to the Intel® MPI Library 3.1 for Linux* OS (see product documentation for more details):

- Performance enhancements
 - Automatic application-specific performance tuning through the `mpitune` utility
 - Simplified selection of IPoIB for sock and ssm communication through the `I_MPI_NETMASK` variable
 - Greater scalability for the sock and ssm devices

- Faster RDMA and RDSSM wait mode through I_MPI_RDMA_WRITE_IMM variable
- Further optimized Gather, Scatter, and Bcast collective operation algorithms with essential flat latency graph for larger message sizes
- Usability improvements
 - Advanced shared memory segment size control
 - Flexible OS, Python, compiler, and DAPL compatibility check control
 - LD_LIBRARY_PATH prioritization over built-in -rpath setting in compiler drivers
 - Loadable 3rd party process manager libraries on Linux* and Windows* OS
- Extended interoperability
 - Intel® Compiler 11.0 support
 - DAPL* 2.0 support

Intel® MPI Library 3.2 for Windows* OS

The Intel® MPI Library 3.2 for Windows* OS includes the following updates compared to the Intel® MPI Library 3.1 for Windows* (see product documentation for more details):

- Performance enhancements
 - Automatic performance tuning
 - Automatic application-specific performance tuning thru the mpitune utility
 - Simplified selection of IPoIB for sock and ssm communication through the I_MPI_NETMASK variable
 - Greater scalability for the sock and ssm devices
 - Faster RDMA and RDSSM wait mode through I_MPI_RDMA_WRITE_IMM variable
 - Further optimized Gather, Scatter, and Bcast collective operation algorithms, with essentially flat latency graph for larger message sizes
- Usability improvements
 - Intelligent process pinning
 - Advanced shared memory segment size control
 - Loadable 3rd party process manager libraries on Linux and Windows
- Extended interoperability
 - Intel® Compiler 11.0 support
 - Microsoft* Windows* HPC Server 2008 support
 - DAPL* 2.0 support

Intel® Math Kernel Library (MKL) 10.1

New in Intel® MKL 10.1 for Linux* OS

- Performance Improvements in the BLAS:
 - Performance improvements on Quad-Core Intel® Xeon® processor 5400 series systems with 64-bit OS's:
 - SGEMM: 2% on 1 thread and 6% on 8 threads
 - DGEMM: 7% on 8 threads
 - CGEMM: 2% on 1 thread and 10% on 8 threads
 - ZGEMM: 7% on 1 thread and 11% on 8 threads
 - Performance improvements on Quad-Core Intel® Xeon® processor 5400 series systems with 32-bit OS's:
 - SGEMM: 7-15% on 8 threads
 - DGEMM: 7-15% on 8 threads
 - Performance improvement on Intel® Core™ i7 processors with 64-bit OS's:
 - SGEMM: 50% on 1 thread and 50% on 8 threads
 - DGEMM: 11% on 1 thread and 12% on 8 threads
 - CGEMM: 2-3% on 1 thread and 2-3% on 8 threads
 - ZGEMM: 2% on 1 thread

- DTRSM: 20% on 1 thread and 20% on 8 threads for some cases.
- Improvements to the direct sparse solver (DSS/PARDISO):
 - The performance of out-of-core PARDISO was improved by 35% on average.
 - Support of separate backward/forward substitution for DSS/PARDISO has been added.
 - A new parameter for turning off iterative refinement for DSS interface has been introduced.
 - A new parameter for checking sparse matrix structure has been introduced for PARDISO interface.
 - The sparse solver functionality has now been integrated into the core math library and it is no longer necessary to link a separate solver library. See the user guide for more information.
 - The sparse solver functionality can now be linked dynamically.
- The capability to track and/or interrupt the progress of lengthy LAPACK computations has been added via a callback function mechanism. A function called `mkl_progress` can be defined in a user application, which will be called regularly from a subset of the MKL LAPACK routines. See the LAPACK Auxiliary and Utility Routines chapter in the reference manual for more information. Refer to the specific function descriptions to see which LAPACK functions support the feature.
- Transposition functions have been added to Intel MKL. See the "BLAS-like Extensions" section of chapter 2 in reference manual for further detail.
- The C++ `std::complex` type can now be used instead of MKL-specific complex types.
- Improvements to the Discrete Fourier Transform Interface (DFTI)
 - Addition of the `DftiCopyDescriptor` convenience function
 - Reduction in the size of statically linked executables calling DFTI functions
 - Support for `DFTI_REAL_REAL` storage (i.e., real and imaginary parts in separate arrays) in complex-to-complex transforms
- An implementation of the Boost uBLAS matrix-matrix multiplication routine is now provided which will make use of the highly optimized version of DGEMM in the Intel MKL BLAS. See the User guide for more information.
- Improvements to the sparse BLAS:
 - Support for all data types (single precision, complex and double complex) has been added.
 - Routines for computing the sum and product of two sparse matrices stored, both stored in the compressed sparse row format have been added.
 - Routines for converting between different support sparse matrix formats have been added.
- ScaLAPACK functionality can now be dynamically linked.
- Optimized versions of the Cumulative Normal Distribution (`CdfNorm`), its inverse (`CdfNormInv`), and the inverse complementary error function (`ErfcInv`) have been added to the Vector Math Library.
- Performance improvements on Intel® Core™ i7 processors:
 - 3-17% improvement for the following VML functions: `Asin`, `Asinh`, `Acos`, `Acosh`, `Atan`, `Atan2`, `Atanh`, `Cbrt`, `CIS`, `Cos`, `Cosh`, `Conj`, `Div`, `ErfInv`, `Exp`, `Hypot`, `Inv`, `InvCbrt`, `InvSqrt`, `Ln`, `Log10`, `MulByConj`, `Sin`, `SinCos`, `Sinh`, `Sqrt`, `Tanh`.
 - 7-67% improvement for uniform random number generation.
 - 3-10% improvement for VSL distribution generators based on Wichmann-Hill, Sobol, and Niederreiter BRNGs (64-bit only).
- The configuration file functionality has been removed. See the user guide for alternative means to configure the behavior of Intel MKL.

- When functions in Intel MKL are called from an MPI program they will be run on 1 thread by default (that is in cases where the number of threads are not explicitly set) if the single-threaded MPI is linked. This differs from default Intel MKL behavior in programs without use of MPI. See chapter 6 of the User's Guide for more information on controlling parallelism.
- Documentation updates:
 - The FFTW Wrappers for MKL Notes have been removed from the product package and their content was integrated into the Intel MKL Reference Manual (Appendix G).
 - The parallel BLAS (PBLAS) which support ScaLAPACK are now documented in the Intel MKL reference manual.
 - Added FORTRAN 77 support info to the description of VML and VSL functions in the Intel MKL reference manual.
 - Eclipse IDE Infopop support for VML functions and VSL service functions. The infopop support means brief info on a function in a pop-up window appearing when the cursor is placed to the function/routine name in the Eclipse Editor panel. This Eclipse feature is implemented in the CDT 5.0 version.
- Support for new compilers including the new Intel® compilers 11.0 and PGI* compilers.
- The default OpenMP runtime library for Intel MKL has been changed from libguide to libiomp. See the User Guide in the doc directory for more information.
- The optimized code paths for the Intel® Pentium® III processor have been removed from Intel MKL along with the associated processor specific dynamic link libraries. We continue to support the use of Intel MKL on this processor, but the default code path will be used and as a result performance may be reduced.
- The interval linear solver functions have been removed from MKL.
- Support for Intel MPI 1.x has ended.

New in Intel® MKL 10.1 for Windows* OS

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- The sparse solver functionality can now be linked dynamically.
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- Improvements to the sparse BLAS:
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 - Routines for computing the sum and product of two sparse matrices stored, both stored in the compressed sparse row format have been added.
 - Routines for converting between different support sparse matrix formats have been added.
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 - 7-67% improvement for uniform random number generation.
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- The configuration file functionality has been removed. See the user guide for alternative means to configure the behavior of Intel MKL.
- Documentation updates:
 - The FFTW Wrappers for MKL Notes have been removed from the product package and their content was integrated into the Intel MKL Reference Manual (Appendix G).
 - The parallel BLAS (PBLAS) which support ScaLAPACK are now documented in the Intel MKL reference manual.
 - Added instructions for using example programs in Microsoft* Visual Studio to the User Guide.

- MKL Documentation is now accessible from the Microsoft* Visual Studio 'Help' menu with F1 Help and Dynamic Help features provided in the code editor. For more information, see Intel MKL User's Guide.
- Support for new compilers including the new Intel® compilers 11.0 and PGI* compilers.
- The default OpenMP runtime library for Intel MKL has been changed from libguide to libiomp. See the User Guide in the doc directory for more information.
- It is no longer possible to set environment variables during the installation process. Three script files, mklvars32.bat, mklvarsem64t.bat, and mklvars64.bat are available in the tools\environment directory to set the PATH, LIB, and INCLUDE environment variables at the command prompt.
- The optimized code paths for the Intel® Pentium® III processor have been removed from Intel MKL along with the associated processor specific dynamic link libraries. We continue to support the use of Intel MKL on this processor, but the default code path will be used and as a result performance may be reduced.
- The interval linear solver functions have been removed from MKL.

Intel® Trace Analyzer and Collector 7.2

New in Intel® Trace Analyzer and Collector 7.2

- Intel® Compiler 11.0 support
- Migration to the Trolltech* Qt* 4.x
- Correctness checking reports now available in the Intel® Trace Analyzer graphical user interface (GUI)
- Microsoft* Windows* HPC Server 2008 support

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Resolved Issues

Bug Number	Title of Bug Report
468	[INS] Warning: Unable to initialize "/var/log/itac_uninstall.log" log file
511	[DOC] minor problems with displaying ict FAQ on japanese windows
673	itcpin and the MKL Cluster DFT Applications on Microsoft Windows CCS
680	itcpin, Scalapack, and Cluster DFT Examples on Microsoft Windows
735	[INS] ict-update-path doesn't work correctly
742	[INS] wrong ICTCE version in Windows Start Menu entry
757	[FNC] No version info, no Intel copy right stamped on IMB-MPI1, mpitune driver
758	[FNC] No Intel copyright, timestamp at Trace Analyzer Help-> About GUI
766	[INS] Installer installs incorrectly if install path contains white space.

767	[INS] Invalid Intel logo at the GUI interface of startup.exe on Windows
777	[DOC] Request for proper architecture trademark mentioning
780	[INS] Unable to initialize "/var/log/itac_uninstall.log" log file
783	Use of the "-nocompchk" MPI Driver Option within the ScaLAPACK Test Suite
787	IMB HPC 2008 support
788	IMB MS VS project files
804	[DOC] IMB 3.2 contain no file make_ict_win
806	[INS] mkl rpm can't be extracted with --extract
807	[INS] can't install using license server
816	[INS] compilers are not uninstalled on IA-64
817	[INS] update mkl section name in SilentInstallConfigFile.ini
818	[DOC] doc_index links to compilers/debugger documentation are broken on Linux
819	[DOC] broken title in ictce getting started / linux
820	[DOC] IMB-ug_3.2.pdf contains old disclaimer section
821	[DOC] update MKL description in ICT release notes

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System Requirements

Processor System Requirements

Intel® Pentium® 4 processor, or
 Intel® Xeon® processor, or
 Intel® Itanium® 2 processor, or
 Intel® Core™2 Duo processor (example of Intel® 64 architecture)

Note that it is assumed that the processors listed above are configured into homogeneous clusters.

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Disk-Space Requirements

20 GBs of disk space (minimum)

Note that during the installation process the installer may need approximately 4 gigabytes of temporary disk storage to manage the intermediate installation files.

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Operating System Requirements

OS Distributions	IA-32 Architecture	Intel® 64 Architecture		IA-64 Architecture
		32-Bit Applications	64-Bit Applications	
SGI* Propack* 5 for Linux*		S	S	S
Red Hat Enterprise Linux* 4.0	S	S	S	S
Red Hat Enterprise Linux* 5.0	S	S	S	S
SUSE Linux Enterprise Server* 9	S	S	S	S
SUSE Linux Enterprise Server* 10	S	S	S	S
Microsoft* Windows* Compute Cluster Server (Microsoft Windows CCS*)	N/A	S	S	N/A
Microsoft* Windows* HPC Server 2008	N/A	S	S	N/A

S = Supported

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Memory Requirements

2 GB of RAM (minimum)

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Intel® Compilers

For all of the Intel processor architectures the version number on the Intel compilers should be 8.1 or greater.

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Installation Notes

Setting Up Secure Shell on Linux

Installation of the Intel Cluster Toolkit 3.2 assumes that the homogenous cluster has ssh connectivity.

1. Make sure `ssh` is installed on your computing cluster. To do this type the shell command:

```
which ssh
```

If it does not exist, you can acquire ssh from the URL:

<http://www.openssh.org>

2. Create an authentication key as follows:

```
ssh-keygen -t rsa
```

This will generate a private and public key pair. The private key should be saved in:

```
~/.ssh/identity
```

and the public key should be saved in:

```
~/.ssh/identity.pub
```

3. Authorize access by placing the contents of the public key into the `~/.ssh/authorized_keys` file. All keys listed in that file are allowed access. One way to do this is to issue the shell command:

```
cat ~/.ssh/identity.pub >> ~/.ssh/authorized keys
```

If the computing system that you are connecting to does not share a common file system, then `~/.ssh/identity.pub` should be concatenated to the `~/.ssh/authorized keys` file of the computing system you will be connecting to. Secure Shell will insist that the file `authorized keys` has its permissions set so that it is not group writable, so do the following:

```
chmod go-rwx ~/.ssh/authorized keys
```

This step avoids the need to enter your password each time you want to run a secure shell command.

4. In order to avoid typing in your pass phrase each time `ssh` is invoked, an `ssh-agent` needs to be created and your pass phrase added. This is done as follows:

```
ssh-agent $SHELL
```

```
ssh-add
```

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[Checklist in Case There Are Problems on Linux](#)

1. Make sure that the host names listed in the `machines.LINUX` file are also listed in the `/etc/ssh_known_hosts` file on your network or your `~/.ssh/known_hosts` file in your home directory.
2. It is important that `/tmp` has permissions set to `377`, with `root` as owner and group `0`.
3. `openssh` has a `-v` flag option which is very useful for tracking down handshaking problems.
4. If you encounter the following message:

```
"scp: FATAL: Executing ssh1 in compatibility mode failed
(Check that scp1 is in your PATH). Lost connection."
```

Then there is an incompatibility with the secure shell protocol between the master node and at least one of the other nodes listed in the `machines.LINUX` file. The solution is to install compatible versions of secure shell on all nodes of the cluster.

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Alternative Solution to Establishing Secure Shell Connectivity on Linux

Within the "tar" package of the Intel Cluster Toolkit, there is an `expect` shell script file called `sshconnectivity.exp`. "expect" is a tool for automating interactive applications. To run "`sshconnectivity.exp`", the `expect` runtime software needs to be installed on your Linux system. To make sure that the `expect` runtime software is properly installed, type:

```
which expect
```

If you encounter a "Command not found." error message, you can download the `expect` software package from the following URL:

<http://expect.nist.gov/>

The `expect` shell script file called "`sshconnectivity.exp`" can be used to help you establish secure shell connectivity on a cluster system. The syntax for the command is:

```
./sshconnectivity.exp machines.LINUX
```

This `expect` shell script will create or update a `~/.ssh` directory on each node of the cluster beginning with the master node which must be the first name listed in the `machines.LINUX` file. This script will prompt you for your password twice.

```
Enter your user password:
Re-enter your user password:
```

To provide security each time you enter your user password, asterisks will appear in lieu of the password text. Upon successful completion of the script, the following message fragment will appear:

```
Node count = 4
Secure shell connectivity was established on all nodes.
```

A log of the transactions for this script will be recorded in:

```
/tmp/sshconnectivity.<login-name>.log
```

where *<login-name>* is a meta-symbol for your actual login.

Note that the `expect` shell script `sshconnectivity.exp` will remove the write access capability on the group and other "permission categories" for the user's home directory folder. If this is not done, a password prompt will continue to be issued for any secure shell activity.

This process is demonstrated by the following complete graph¹ (Figure 1) illustration where a vertex in the graph represents a cluster computing node, and an edge between two vertices connotes that the two cluster computing nodes have exchanged public keys for secure shell connectivity. Secure shell connectivity is intended to provide secure, encrypted communication channels between two or more cluster nodes over an insecure network.

The script `sshconnectivity.exp` will call the appropriate secure shell utilities to generate a private key and a public key for each node of the cluster.

For the complete graph example in Figure 1, suppose there are nodes (vertices) 1 to n in the cluster. For a given node i , nodes 1 to $i - 1$ and nodes $i + 1$ to n are provided with the public key from node i . The user's public keys for a given node will be stored in the `~/ .ssh` folder associated with the user's home directory for that computing node. Since there are $n - 1$ edges to a given node, that node will have $n - 1$ public keys in the `~/ .ssh` folder that were provided by the other $n - 1$ nodes in the cluster. The example in Figure 1 represents a computing cluster that has at total of 5 nodes. The edges connecting a node indicate that that node has received 4 public keys from the remaining computing nodes. Also looking out from a given node indicates that the given node has provided its own public key to the remaining nodes that are reachable via the 4 edge paths.

¹ A mathematical definition of a complete graph in graph theory is a simple graph where an edge connects every pair of vertices. The complete graph on n vertices has n vertices and $n(n - 1)/2$ edges, and is denoted by K_n . Each vertex in the graph has degree $n - 1$. All complete graphs are their own cliques (a maximal complete graph). A graph of this type is maximally connected because the only vertex cut which disconnects the graph is the complete set of vertices.

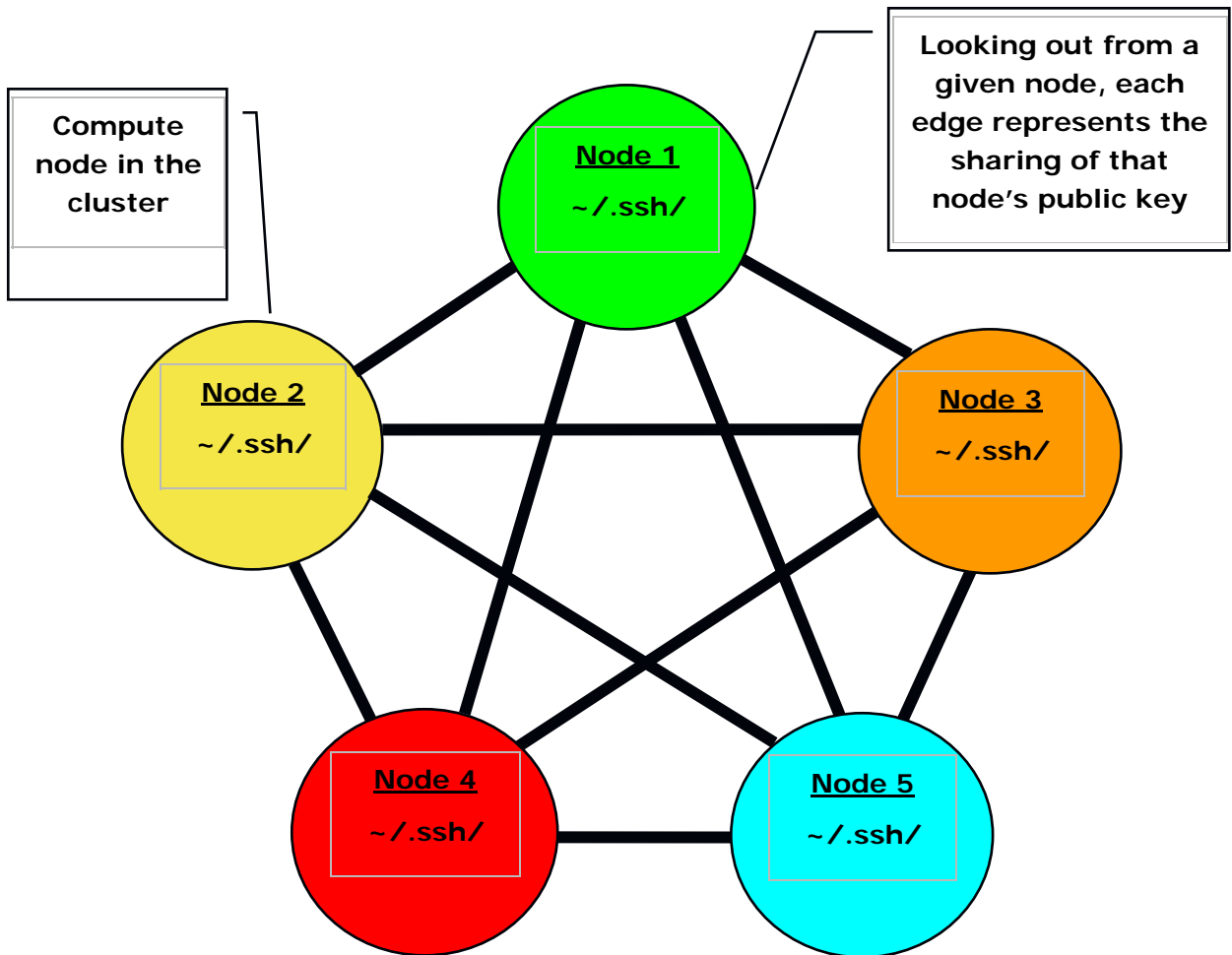


Figure 1 – Illustration of Secure Shell Connectivity for a Computing Cluster

Note that the expect shell script `sshconnectivity.exp` will remove the write access capability on the group and other "permission categories" for the user's home directory folder. If this is not done, a password prompt will continue to be issued for any secure shell activity.

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The Intel Cluster Toolkit installation process on Linux is comprised of eight basic steps. The installation process on Microsoft Windows CCS alternatively uses the Microsoft installer model. The Intel Cluster Toolkit 3.2 package for Linux and Microsoft Windows CCS consist of the following components:

Software Component	Default Installation Directory on Linux	Default Installation Directory on Windows
Intel Math Kernel Library 10.1	/opt/intel/ict/3.2.0.0xx/mkl where "xxx" is a sequence of three digits denoting the build number.	c:\program files (x86)\intel\ict\3.2.0.0xx\mkl where "xxx" is a sequence of three digits denoting the build number.
Intel MPI Library 3.2	/opt/intel/ict/3.2.0.0xx/impi where "xxx" is a sequence of three digits denoting the build number.	c:\program files (x86)\intel\ict\3.2.0.0xx\mpi where "xxx" is a sequence of three digits denoting the build number.
Intel MPI Benchmarks 3.2	/opt/intel/ict/3.2.0.0xx/imb where "xxx" is a sequence of three digits denoting the build number.	c:\program files (x86)\intel\ict\3.2.0.0xx\imb where "xxx" is a sequence of three digits denoting the build number.
Intel Trace Analyzer and Collector 7.2	/opt/intel/ict/3.2.0.0xx/itac where "xxx" is a sequence of three digits denoting the build number.	c:\program files (x86)\intel\ict\3.2.0.0xx\itac where "xxx" is a sequence of three digits denoting the build number.

Note that the Intel Cluster Toolkit installer will automatically make the appropriate selection of binaries, scripts, and text files from its installation archive based on the Intel processor architecture of the host system where the installation process is initiated. You do not have to worry about selecting the correct software component names for the given Intel® architecture. Also note that the values 035 in 3.2.0.035 and 037 in 3.2.0.037 are *example build number values* and may vary your actual installation.

Recall that you as a user of the Intel Cluster Toolkit on Linux, Microsoft Windows CCS, or both may need assistance from your system administrator in installing the associated software packages on your cluster system, if the installation directory requires system administrative write privileges (e.g. /opt/intel on Linux). This assumes that your login account does not have administrative capabilities.

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Linux Installation

Important Note: The 4.2.2 version of RPM on Red Hat Enterprise Linux 3.0 for Itanium 2 has a broken relocation feature. This will be a serious problem for users trying to install on clusters where there are shared devices. A recommended solution is for the user to upgrade to the latest release of RPM. A *possible* URL for retrieving a recent release of RPM that resolves this problem on the Itanium 2 architecture is:

<http://www.redhat.com>

1. A machines.LINUX file will either need to be created, or an existing machines.LINUX file can be used by the Intel Cluster Toolkit installer to deploy the appropriate software packages from the toolkit amongst the nodes of the cluster. This machines.LINUX file contains a list of the computing nodes (i.e. the hostnames) for the cluster. The format is one hostname per line:

hostname

The hostname should be the same as the result from the Linux* command "hostname". An example of the content for the file `machines.LINUX`, where a contrived cluster consists of eight nodes might be:

```
clusternode1
clusternode2
clusternode3
clusternode4
clusternode5
clusternode6
clusternode7
clusternode8
```

A line of text above is considered a comment line if column 1 contains the "#" symbol. It is always assumed that the first node in the list is the master node. The remaining nodes are the compute nodes. The text `clusternode1` and `clusternode2`, for example, represent the names of two of the nodes in a contrived computing cluster. The contents of the `machines.LINUX` file can also be used by users to construct an `mpd.hosts` file for the multi-purpose daemon (MPD) protocol. The MPD protocol is used for running MPI applications that utilize Intel MPI Library.

2. In preparation for doing the installation, the user may want to create a staging area. On the system where the Intel Cluster Toolkit software components are to be installed, it is recommended that a staging area be constructed in a directory such as `/tmp`. An example folder path staging area might be:

```
/tmp/ict_staging_area
```

where `ict_staging_area` is an acronym for Intel Cluster Toolkit staging area.

3. Upon registering for Intel Cluster Toolkit 3.2, you will receive a serial number (e.g., C111-12345678) for this product. Your serial number can be found within the email receipt of your product purchase. Go to the [Intel Registration Center](#) site and provide the product serial number information. Once admission has been granted into the registration center, a user will be able to access the Intel® Premier web pages for software support.
4. The license for the Intel Cluster Toolkit license file that is provided to the user should be placed in a location pointed to by the `INTEL_LICENSE_FILE` environment variable. Do not change the file name as the ".lic" extension is critical. Common locations for the attached license file are:

```
<installation path>/licenses
```

For example, on the cluster system where the Intel Cluster Toolkit software is to be installed, all licenses for Intel-based software products might be placed in:

```
/opt/intel/licenses
```

It is also imperative that the user and/or the system administrator set the environment variable `INTEL_LICENSE_FILE` to the directory path where the Intel

software licenses will reside *prior* to doing an installation of the Intel Cluster Toolkit. For Bourne* Shell or Korn* Shell the syntax for setting the INTEL_LICENSE_FILE environment variable might be:

```
export INTEL_LICENSE_FILE=/opt/intel/licenses
```

For C Shell, the syntax might be:

```
setenv INTEL_LICENSE_FILE /opt/intel/licenses
```

5. Patrons can place the Intel Cluster Toolkit software package into the staging area folder.
6. The installer package for the Intel Cluster Toolkit has the following general nomenclature:

```
l_ict_<major>.<minor>.<update>.<package_num>.tar.gz
```

where <major>.<minor>.<update>.<package_num> is a string such as:

```
b_3.2.0.xxx, where b is an acronym for beta
```

or

```
p_3.2.0.xxx, where p is an acronym for production
```

The <package_num> meta-symbol is a string such as 035. This string indicates the package number.

The command:

```
tar -xvzf l_ict_<major>.<minor>.<update>.<package_num>.tar.gz
```

will create a subdirectory called l_ict_<major>.<minor>.<update>.<package_num>. Change to that directory with the shell command:

```
cd l_ict_<major>.<minor>.<update>.<package_num>
```

For example, suppose the installation package is called l_ict_p_3.2.0.035.tar.gz. In the staging area that has been created, type the command:

```
tar -xvzf l_ict_p_3.2.0.035.tar.gz
```

This will create a subdirectory called l_ict_p_3.2.0.035. Change to that directory with the shell command:

```
cd l_ict_p_3.2.0.035
```

7. As mentioned in the release notes section titled, "[Alternative Solution to Establishing Secure Shell Connectivity](#)", the expect shell script file called "sshconnectivity.exp" can be used to help the user establish secure shell connectivity on a cluster system. "sshconnectivity.exp" is also located within

the `l_ict_<version>.<release>` directory staging area. The syntax for the “`sshconnectivity.exp`” command is:

```
./sshconnectivity.exp machines.LINUX
```

This `expect` shell script will create or update a `~/.ssh` directory on each node of the cluster beginning with the master node which must be the first name listed in the `machines.LINUX` file. This script will prompt the user for a cluster password twice.

```
Enter your cluster password:
Re-enter your cluster password:
```

Each time the user enters the cluster password, asterisks will appear in lieu of the password text so as to provide security. Upon successful completion of the script, the following message fragment will appear:

```
Node count = 4
Secure shell connectivity was established on all nodes.
```

A log of the transactions for this script will be recorded in:

```
/tmp/sshconnectivity.<login-name>.log
```

where `<login-name>` is a meta-symbol for the user's actual login.

8. Once secure shell connectivity is established, type a variation of the `install` command as demonstrated by the table below and follow the prompts issued by this install script.

9.

Installation command	Is root password required initially?	Installer prompts to be aware of	Default installation area
./install.sh	Yes		/opt/intel/ict/...
./install.sh --nonroot	No	<p>We recommend that you install the software using RPM (option 1). This will require root password. If you do not have root password, you can do a local installation in your home folder by choosing option 2 below.</p> <p>Which of the following would you like to do ?</p> <p>1. Install the software using RPM (root password required) - Recommended.</p> <p>2. Install the software without using RPM database (root password not required).</p> <p>x. Exit</p> <p>Please make a selection :</p>	./intel/ict/... in your home directory
./install.sh --nonrpm	Yes	If you do not have the root password, you can do a local installation in your home folder by choosing	./intel/ict/... in your home directory, if option 2 is selected

		<pre> option 2 below. Which of the following would you like to do? 1. Install the software using RPM (root password required) - Recommended. 2. Install the software without using RPM database (root password not required). x. Exit. Please make a selection: (1/2/x) [2] </pre>	
<code>./install.sh --nonroot --nonrpm</code>	No		<code>./intel/ict/...</code> in your home directory

Note that the Intel MPI Benchmarks are only installed on the master node.

By default, the global root directory for the installation of the Intel Cluster Toolkit is:

```
/opt/intel/ict/<major>.<minor>.<update>.<package_num>
```

where `<major>`, `<minor>`, `<update>`, and `<package_num>` are integers. An example would be `3.2.0.035`.

Within the folder path

`/opt/intel/ict/<major>.<minor>.<update>.<package_num>` you will find the text files:

```
ictvars.csh
```

```
ictvars.sh
```

and

```
ictsupport.txt
```

If you are using Bourne Shell or Korn Shell for the login session, you should type:

```
. ./ictvars.sh
```

and for a login session that uses C Shell, you should type:

```
source ./ictvars.csh
```

The file called:

```
ictsupport.txt
```

contains the Package ID and Package Contents information. Please use the information in `ictsupport.txt` when submitting customer support requests.

For the default installation path, an index file, an FAQ file, and the user's guide are located in the directory path:

```
/opt/intel/ict/<major>.<minor>.<update>.<package_num>/doc
```

where as mentioned above, `<major>`, `<minor>`, `<update>`, and `<package_num>` are integers. A complete default folder path to the documentation directory might be:

```
/opt/intel/ict/3.2.0.035/doc
```

The name of the index file is:

```
Doc_Index.htm
```

The index file can be used to navigate to the FAQ, the release notes, the user's guide, and an internet accessible Intel Cluster Toolkit Tutorial. The index file will also provide links to Intel Trace Analyzer and Collector documentation, Intel MPI Library documentation, Intel MKL documentation, and Intel MPI Benchmarks documentation.

The name of the FAQ file is:

```
HelpMe_FAQ.htm
```

The name of the user's guide file is:

```
Getting_Started.htm
```

By default, the local version of the release notes is located in the directory path:

```
/opt/intel/ict/<major>, <minor>, <update>, and  
<package_num>/release_notes
```

The name of the release notes file is:

```
Release Notes.htm
```

With the default installation settings, the Intel® Cluster Toolkit support file (`ictsupport.txt`) is installed at:

```
/opt/intel/ict/3.2.0.035/ictsupport.txt
```

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Windows Installation

The installer package for the Intel Cluster Toolkit has the following general nomenclature:

w_ict_<major>, <minor>, <update>, and <package_num>.exe

where <major>, <minor>, <update>, and <package_num> is a string such as:

b_3.2.0.xxx, where b is an acronym for beta

or

p_3.2.0.xxx, where p is an acronym for production

The <package_num> meta-symbol is a string such as 037. This string indicates the package number.

To install Intel® Cluster Toolkit simply go to the staging area where "w_ict_p_3.2.0.xxx.exe" is located, where "xxx" is a sequence of three digits (i.e., the <package_num>), and do the following:

1. Double click on the ".exe" file
2. Follow the instructions that are provided by the installation wizard. The installation wizard will install the components of the Intel® Cluster Toolkit on all nodes of the cluster.

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Documentation

Below is a list of documents related to the Intel® Cluster Toolkit.

Document Name	File Name	Type of Information in the Document	Comment
Intel® Cluster Toolkit Release Notes	Release_Notes.htm	Information about this release and how to use the library with various compilers. Includes: <ul style="list-style-type: none"> • Overview • System Requirements • Setting up Secure Shell on Linux • Installation • FAQ – Frequently Asked Questions • Technical Support and Feedback • Copyright and Legal Information 	For details about the Intel® Cluster Toolkit, please see the <i>Intel® Cluster Toolkit Getting Started Guide 3.2</i> .
Intel® Cluster Toolkit Getting Started Guide	Getting_Started.htm	Contains detailed information about: <ul style="list-style-type: none"> • Intel® MKL 10.1 • Intel® MPI Library 3.2 • Intel® MPI Benchmarks 3.2 • Intel® Trace Analyzer and Collector 7.2 	For implementation-specific information about the toolkit, please see the <i>Intel® Cluster Toolkit Release Notes</i> .

Intel® Cluster Toolkit FAQ	HelpMe_FAQ.htm	Contains a list of frequently asked questions (FAQ) regarding the Intel® Cluster Toolkit 3.2.	This file may contain helpful hints when using the Intel® Cluster Toolkit 3.2.
Intel® Cluster Toolkit Tutorial	Note that this link is not relevant to an Intel® Cluster Tools Beta program that is in preparation for a major release.	Contains detailed information about: <ul style="list-style-type: none"> • Intel® MKL 10.1 • Intel® MPI Library 3.2 • Intel® MPI Benchmarks 3.2 • Intel® Trace Analyzer and Collector 7.2 	This is a web-based version of the Intel® Cluster Toolkit Getting Started Guide. It may contain information that is more recent than that of the local version of the Intel® Cluster Toolkit Getting Started Guide that has been installed on the user's computing cluster. The tutorial and the user's guide will have a revision number located in the title page such as "(Revision 20081117)". The larger the number, the more current the document revision.

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Known Limitations

1. On Itanium 2-based systems, the following symptom may occur for RPM version 4.2.2 when doing an install with the `--nonroot` option:

```
install.sh --nonroot
```

the following symptom appears:

```
Installing Intel(R) MPI Library for Linux* version p_3.2.038...
```

```
Extracting
files... ##### [100%
]
```

Would you like to:

Install:

i. Intel(R) MPI Library, Development Kit for Linux* version 3.2-038

x. Exit

Your choice? (i/x) [i]: i

```
Cannot install Intel(R) MPI Library, Development Kit for Linux*
version 3.2-038 to "/home/tooluser/intel/impi/3.2":
RPM version 4.2.2 prevent installation into a non-default directory.
Installation failed.
```

```
WARNING: Intel(R) MPI Library for Linux* installer did not create
"/tmp/install.XX2svw1O/MPI.ini" file; the product cannot be
installed to all cluster nodes.
Press Enter to continue...
```

The solution is to use an updated version of RPM.

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2. There have been situations where during the installation process, /tmp has filled up. We recommend that you have at least one gigabyte of free space in /tmp when doing an install of the Intel® Cluster Toolkit. Also, the installer script install.sh has the command-line options:

```
--temp-path=PATH
```

or

```
--temppath=PATH
```

which can direct the use of intermediate storage to another disk partition.

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3. If during installation you see a diagnostic which looks something like:

```
...
```

```
Cannot install Intel(R) Trace Analyzer And Collector version 7.2p-
029 into directory "/usr/home/user01/intel/itac/7.2":
The prefix directory path "/usr/home/user01/intel/itac/7.2" is owned
by cookie intel-ta ipf version 7.2p-029.
Installation failed.
```

```
...
```

try the following corrective action when the installer completes:

- 1) Run an uninstall.sh command that should look something like the following:

```
/usr/home/user01/intel/ict/3.2.0.035/uninstall.sh
```

- 2) Reissue the install.sh command as done previously
- 3) If you see a prompt of the following type:

Would you like to:

Install:

1. Intel(R) Trace Collector version 7.2p-029
2. Intel(R) Trace Analyzer version 7.2p-029
- a. All of the above.

Uninstall:

3. intel-ta ipf version 7.2p-029
(non-rpm in "/usr/home/user01/intel/itac/7.2")
4. intel-tac ipf version 7.2p-029
(non-rpm in "/usr/home/user01/intel/itac/7.2")
- x. Exit

Please type a selection (1/2/a/3/4/x) [a]:

Enter the digit 3 under the "Uninstall" menu selection. This will probably result in a message that looks something like:

```
"/usr/home/user01/intel/ict/itac/7.2" does not exist. It looks
like installation was damaged. Force uninstallation.
Press Enter to continue...
```

- 4) For the above, repeat this process again for any item that appears in the "Uninstall" menu category prompt. You will eventually encounter messages that look something like:

```
Installing...
Installation successful.
To uninstall this package, run
  "/usr/home/user01/intel/itac/7.2/uninstall.sh".
```

- 5) Continue this process of doing the uninstall selection first, any time you encounter such subsequent prompts (e.g., Intel® MPI Library):

Would you like to:

Install:

i. Intel(R) MPI Library, Development Kit for Linux*
version 3.2p-038

Uninstall:

1. intel-mpi-ipf version 3.2p-038
(non-rpm in
"/usr/home/user01/intel/ict/3.2.0.035/impi/")
- x. Exit

Please type a selection (i/1/x) [i]:

...

- 6) Eventually you should see the following messages from the Intel® Cluster Toolkit installer:

...

```
Installation successful.  
To uninstall this package, run  
"/usr/home/user01/intel/ict/3.2.0.035/impi/uninstall".
```

```
Completed cluster installation successfully.
```

This "Installation failed" symptom occurs when a prior installation of the Intel® Cluster Toolkit into a directory such as /usr/home/user01/intel/ict/3.2.0.035 was removed without having issued the `uninstall.sh` command that for this example, resides in the directory /usr/home/user01/intel/ict/3.2.0.035.

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4. When installing Intel® Cluster Toolkit 3.2, you see a diagnostic message regarding Intel® Math Kernel Library 10.0 that looks something like the following:

```
Installing Intel(R) Math Kernel Library 10.1 for Linux* version  
p 10.1.0.020...
```

```
Detected operating system has not been tested:  
Red Hat Enterprise Linux AS release 4 (Nahant Update 3)  
Install and program functionality may be incorrect.  
Would you like to continue? ( Yes/No ) [ No ]:
```

You are doing nothing wrong. Just simply type in "Yes" to the query and continue with the installation. Red Hat Enterprise Linux AS release 4 (Nahant Update 3) works fine with Intel® Math Kernel Library 9.1. This message has also been generated when installing Intel® Math Kernel Library 10.0 on SUSE 9.0 and SUSE 9.1, where the message can also be ignored by typing "Yes".

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Technical Support

Your feedback is very important to us. To receive technical support for the tools provided in this product and technical information including FAQ's and product updates, you need to register for an Intel Premier Support account at the [Registration Center](#).

NOTE: Registering for support varies for release product or pre-release products (alpha, beta, etc) - only released products have support web pages on <http://support.intel.com/>.

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forgotten your password, please email a request to: quadsupport@mailbox.intel.com. Please do not email your technical issue to this email address.

The product support web site, <http://www3.intel.com/cd/software/products/asmona/eng/cluster/clustertoolkit/307698.htm>, provides top technical issues, [FAQs & Known Issues](#), [Documentation and Training](#), and product errata.

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Submitting Issues

To submit an issue via the Intel Premier Support website, please perform the following steps:

1. Ensure that Java* and JavaScript* are enabled in your browser.
2. Go to <https://premier.intel.com/>.
3. Type in your Login and Password. Both are case-sensitive.
4. Click the "Submit Issues" button in the left margin.
5. Read the Confidentiality Statement and click the "I Accept" button.
6. Click on the "Go" button next to the "Product" drop-down list.
7. Click on the "Submit Issue" link in the left navigation bar.
8. Choose "Development Environment (tools, SDV, EAP)" from the "Product Type" drop-down list.
9. If this is a software or license-related issue choose "Intel(R) Cluster Toolkit" from the "Product Name" drop-down list.
10. Enter your question and complete the fields in the web-page windows that follow to successfully submit the issue.

Please follow these guidelines when forming your problem report or product suggestion:

1. Describe your difficulty or suggestion. For problem reports, please be as specific as possible (e.g., including compiler and link command line options), so that we may reproduce the problem. Please include a small test case if possible.
2. Describe your system configuration information. Be sure to include specific information that may be applicable to your setup: operating system, name and version number of installed applications, and anything else that may be relevant to helping us address your concern.

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