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This document is intended to give application programmers and system administrators an overview of the Cray XT3 systems 1.1 software releases.

1.1 Emphasis for the Cray XT3 Systems Software Releases

The key reasons for this release are support of:

- UNICOS/lc 1.1 operating system
- PGI 6.0 Fortran, C, and C++ compilers and tools
- Cray MPICH2 0.97 library of MPI-2 routines
- Cray SHMEM 1.0 library of distributed-memory access routines
- AMD Core Math Library (ACML) 2.5, a library of Basic Linear Algebra Subroutines (BLAS), Linear Algebra (LAPACK) routines, and Fast Fourier Transform (FFT) routines
- Cray XT3 LibSci 1.1 library of ScaLAPACK, Basic Linear Algebra Communication Subprograms (BLACS), and SuperLU routines
- Lustre 1.1 file system
- Performance API (PAPI) 3.0.8 interface for measuring an application’s use of processor functions
- Login load-leveling (Deferred implementation)
- Cray Reliability, Availability, Serviceability and Management System (CRMS) 1.1
- Portals 3.3 low-level message passing interface
- Up to 4 GB of memory per compute node
- Job accounting
## 1.2 Conventions

These conventions are used throughout Cray documentation:

<table>
<thead>
<tr>
<th>Convention</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>command</strong></td>
<td>This fixed-space font denotes literal items, such as file names, pathnames, man page names, command names, and programming language elements.</td>
</tr>
<tr>
<td><strong>variable</strong></td>
<td>Italic typeface indicates an element that you will replace with a specific value. For instance, you may replace <code>filename</code> with the name <code>datafile</code> in your program. It also denotes a word or concept being defined.</td>
</tr>
<tr>
<td><strong>user input</strong></td>
<td>This bold, fixed-space font denotes literal items that the user enters in interactive sessions. Output is shown in nonbold, fixed-space font.</td>
</tr>
<tr>
<td><code>[ ]</code></td>
<td>Brackets enclose optional portions of a syntax representation for a command, library routine, system call, and so on.</td>
</tr>
<tr>
<td><code>...</code></td>
<td>Ellipses indicate that a preceding element can be repeated.</td>
</tr>
<tr>
<td><code>name(N)</code></td>
<td>Denotes man pages that provide system and programming reference information. Each man page is referred to by its name followed by a section number in parentheses.</td>
</tr>
</tbody>
</table>

Enter:

```bash
% man man
```

to see the meaning of each section number for your particular system.
1.3 Reader Comments

Contact us with any comments that will help us to improve the accuracy and usability of this document. Be sure to include the title and number of the document with your comments. We value your comments and will respond to them promptly. Contact us in any of the following ways:

**E-mail:**
docs@cray.com

**Telephone (inside U.S., Canada):**
1-800-950-2729 (Cray Customer Support Center)

**Telephone (outside U.S., Canada):**
+1–715–726–4993 (Cray Customer Support Center)

**Mail:**
Software Publications
Cray Inc.
1340 Mendota Heights Road
Mendota Heights, MN 55120–1128
USA
This chapter describes the enhancements that have been made with this release.

For compatibility issues and differences that you should be aware of when installing this release or using these products, see Chapter 3, page 9. The *Cray XT3 Systems 1.1 Release Errata* describes temporary limitations and changes identified after the documentation for this release was packaged.

**Note:** The *Cray XT3 System Overview* gives a high-level description of Cray XT3 software and hardware components. For a list of all documentation provided with the Cray XT3 systems 1.1 release package, see Chapter 4, page 13.

### 2.1 Operating System

The UNICOS/lc operating system supports:

- The Catamount microkernel, which performs basic operating system functions for applications running on compute nodes. UNICOS/lc supports up to 4 GB of memory per compute node.
- The Cray Linux system, which runs on service nodes and provides user, application, and system administration support services.
- Login load leveling, a service that directs login attempts to the least heavily used login node (Deferred implementation).
- Lustre 1.1, a scalable, high-performance file system. Lustre optimizes I/O for a broad spectrum of application requirements, ranging from Lustre as a parallel file system to Lustre as a UNIX File System (UFS) like file system.
- Portals 3.3, a low-level message passing interface.
- Job accounting; UNICOS/lc can track resource usage on a project and task basis.
- Linux iptables firewalls. Administrators can use iptables to restrict the number of daemons listening on the network.
2.2 Programming Environment

The Cray XT3 Programming Environment supports:

- PGI 6.0 Fortran, C, and C++ compilers and tools. PGI 6.0 provides full support of Fortran 95. In addition, it provides numerous performance improvements, supports GNU-style template instantiation for C++ programs, and supports data objects larger than 2 GB. For additional information, see Section 4.5, page 15 and Chapter 3, page 9.
- Cray MPICH2 0.97
- Cray SHMEM 1.0
- ACML 2.5
- Cray XT3 LibSci 1.0
- PAPI 3.0.8

2.3 CRMS

CRMS 1.1 supports:

- Monitoring components at the system, cabinet, and chassis levels and alerting operators of critical or fatal conditions.
- Detecting and reporting loss-of-heartbeat failures of nodes, blades, cabinet control processors (L1 controllers), and blade control processors (L0 controllers).
- Booting diagnostics across sections, cabinets, chassis, and blades.
- Booting UNICOS/lc over the system interconnection network from a boot node.
- Detecting service failures on nodes using Resiliency Communication Agents (RCAs) and using an RCA daemon and failover manager to restart the service on a backup node.
2.4 Optional Products

The Cray XT3 system supports the following optional products:

- CrayPat 1.0 performance analysis tool (available from Cray)
- Cray Apprentice\(^2\) 2.3 performance data visualization tool (available from Cray)
- Etnus TotalView (available from Etnus, LLC)
- PBS Pro 5.3.1xt (available from Cray)
This chapter describes compatibility issues and functionality differences for this release. For a description of Cray XT3 1.1 release temporary limitations and known software problems, see *Cray XT3 Systems 1.1 Release Errata*.

### 3.1 Object and Module File Incompatibility

Object and module files created using PGI 6.0 compilers are incompatible with object files from previous Cray XT3 software that uses earlier versions of the PGI compilers.

### 3.2 Integer Variable Incompatibility

The `-i8` compiler option can make programs incompatible with Cray MPICH2 and ACML functions. Typically, the use of any `INTEGER*8` array size argument can cause failures with these libraries.

### 3.3 Restrictions on Large Data Objects

The PGI compilers support data objects larger than 2 GB. However, the Cray XT3 1.1 Programming Environment has restrictions in this area. To operate on large data sets, an application must:

- Be compiled for the small memory model (this is the default)
- Limit static data (.text + .bss) sections to less than 2 GB
- Allocate data objects that are larger than 2 GB dynamically
- Be compiled with the `-Mlarge_arrays` option
- Restrict library accesses to objects less than 2 GB (that is, MPI, SHMEM, and Cray XT3 LibSci library calls must be on data objects less than 2 GB in size)

The Cray XT3 1.1 user level libraries are compiled in the small memory model format. For more information about memory models, see the *PGI Server 6.0 and Workstation 6.0 Installation and Release Notes* and the *PGI User’s Guide*. 
3.4 Cray SHMEM Atomic Operations (Deferred implementation)

Cray SHMEM atomic operations are deferred (Deferred implementation).

3.5 Cray SHMEM Limitations on Stack and Heap Sizes

Cray SHMEM can be used only on programs requesting <= 2 GB stack, <= 2 GB private heap, and <= 2 GB symmetric heap.

Most applications are not expected to see the limitation. If an application runs into the limitation, the user can restart the application by using one or more of the yod -stack, -heap (private heap) and -shmem (symmetric heap for the SHMEM library) command line options to reduce the size of the memory region that was larger than 2 GB.

3.6 System Activity for Compute Nodes

The sar command collects, reports, or saves system activity information for service nodes. To get system activity information (such as accounting information) for compute nodes, use the xtgenacct command instead. For more information, see the xtgenacct(1) man page.

3.7 ACML Matrix Multiply Functions

The ACML library contains code that may not produce bit identical results for identical problems run with a different number of processors and varying grid decomposition.

A few digits of precision may be lost if you use the SGEMM, DGEMM, CGEMM, ZGEMM, SGEMV, DGEMV, CGEMV, or ZGEMV matrix multiply functions with the PGI 6.0 compiler. This loss of precision has been noted on a single processor. Since only one or two digits of precision are lost, many applications are not affected by this problem.

3.8 C Programs May Get Different Results Than Provided by Previous Cray XT3 Software Versions (Fixed SPR: 732204)

Sites upgrading from a previous Cray XT3 software version to the Cray XT3 1.1 release package could get different results for C programs that are compiled and built using the Cray XT3 1.1 release software.
Previous versions of the Cray XT3 software incorrectly added the compile options \(-g -O2\) to all C compiles. Now the optimization level and debugging symbol generation mode can be set by the user; the default is \(-O0\) with no debugging symbol generation.
This chapter describes the documentation that supports the Cray XT3 systems software releases.

4.1 CrayDoc Documentation Delivery System

The CrayDoc documentation delivery system, along with product documentation, is provided with each Cray software release. The CrayDoc software runs on any operating system based on UNIX systems or systems like UNIX including Mac OS X, Linux, BSD, and anywhere else that Perl and Apache can be compiled from source code with freely available (GNU) tools. The installation and administration of the CrayDoc server software and Cray documentation are described in the CrayDoc Installation and Administration Guide.

4.2 Accessing Product Documentation

With this release, Cray provides books, man pages, and third-party documentation. These documents are provided in the following ways:

- CrayDoc, the Cray documentation delivery system that allows you to quickly access and search Cray books, man pages, and in some cases, third-party documentation. Access this HTML and PDF documentation via CrayDoc at the following URLs:
  - The local network location defined by your system administrator
  - The CrayDoc public website: docs.cray.com

- Man pages—Access man pages by entering the `man` command followed by the name of the man page. For more information about man pages, see the `man(1)` man page by entering:
  
  ```
  % man man
  ```

- Third-party documentation not provided through CrayDoc. Access this documentation, if any, according to the information provided with that product.
4.3 Books Provided with This Release

The books provided with this release are listed in Table 1, which also notes whether each book was updated. Most books are provided in HTML and all are provided in PDF.

Note: The Cray XT3 Systems 1.1 Release Errata includes a description of temporary limitations and changes identified after the documentation for this release was packaged. Also, contact your Cray representative for other possible late problems published in Field Notices (FNs).

<table>
<thead>
<tr>
<th>Book Title</th>
<th>Number</th>
<th>Updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cray XT3 Systems Software Release Overview</td>
<td>S–2425–11</td>
<td>New</td>
</tr>
<tr>
<td>Cray XT3 Software Installation and Configuration Guide</td>
<td>S–2444–11</td>
<td>New</td>
</tr>
<tr>
<td>Cray XT3 System Overview</td>
<td>S–2423–11</td>
<td>Yes</td>
</tr>
<tr>
<td>Cray XT3 System Management</td>
<td>S–2393–11</td>
<td>Yes</td>
</tr>
<tr>
<td>Cray XT3 Programming Environment User’s Guide</td>
<td>S–2396–11</td>
<td>Yes</td>
</tr>
<tr>
<td>CrayDoc Installation and Administration Guide</td>
<td>S–2340–40</td>
<td>Yes</td>
</tr>
</tbody>
</table>

If your site has ordered the PBS Pro product for your Cray XT3 system, the following books are also provided. All PBS Pro books are provided in PDF. PBS Pro Release Overview, Installation Guide, and Administration Addendum for Cray XT3 Systems is also provided in HTML.

<table>
<thead>
<tr>
<th>Book Title</th>
<th>Number</th>
<th>Updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBS Pro Release Overview, Installation Guide, and Administration Addendum for Cray XT3 Systems</td>
<td>S–2438–14</td>
<td>Yes</td>
</tr>
<tr>
<td>PBS Pro 5.3 User Guide, PBS-3BU01</td>
<td>S–6500–53</td>
<td>No</td>
</tr>
<tr>
<td>PBS Pro 5.3 External Reference Specification, PBS-3BE01</td>
<td>S–6501–53</td>
<td>No</td>
</tr>
<tr>
<td>PBS Pro 5.3 Administrator Guide, PBS-3BA01</td>
<td>S–6502–53</td>
<td>No</td>
</tr>
<tr>
<td>PBS Pro 5.3 Quick Start Guide, PBS-3BQ01</td>
<td>S–6510–53</td>
<td>No</td>
</tr>
</tbody>
</table>
4.4 Man Pages Provided with This Release

- Compiler commands (cc(1), cc(1), ftn(1), f77(1))
- Application launch commands (yod(1), xtshowmesh(1))
- Cray-specific MPI man page (intro_mpi(1))
- Cray SHMEM man pages (start with intro_shmem(1))
- Single-system view (SSV) man pages (xthostname(1), xtkill(1), xtps(1), xtwho(1))
- UNICOS/lc man pages (start with intro_xt3(1))
- Cray Linux man pages

If your site ordered CrayPat, man pages are provided (start with craypat(1)).
If your site ordered Cray Apprentice\(^2\), the app2(1) man page is provided.
If your site ordered PBS Pro, man pages are provided (start with qsub(1)).

4.5 Third-party Books Provided with This Release

<table>
<thead>
<tr>
<th>Book Title</th>
<th>Number</th>
<th>Updated</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGI User’s Guide</td>
<td>S–6516–60</td>
<td>Yes</td>
</tr>
<tr>
<td>PGI Fortran Reference</td>
<td>S–6518–60</td>
<td>Yes</td>
</tr>
<tr>
<td>PGI Tools Guide</td>
<td>S–6517–60</td>
<td>Yes</td>
</tr>
<tr>
<td>PGI Server 6.0 and Workstation 6.0 Installation and Release Notes</td>
<td>S–6539–60</td>
<td>Yes</td>
</tr>
<tr>
<td>AMD Core Math Library (ACML)</td>
<td>S–6511–25</td>
<td>No</td>
</tr>
<tr>
<td>PAPI User’s Guide</td>
<td>S–6515–306 (^1)</td>
<td>Yes</td>
</tr>
<tr>
<td>PAPI Programmer’s Reference</td>
<td>S–6514–307 (^1)</td>
<td>Yes</td>
</tr>
<tr>
<td>PAPI Software Specification</td>
<td>S–6531–30 (^1)</td>
<td>Yes</td>
</tr>
<tr>
<td>PAPI User’s Guide</td>
<td>S–6515–23 (^2)</td>
<td>No</td>
</tr>
</tbody>
</table>

\(^1\) This manual documents PAPI 3. PAPI 3 is the default for this release.
\(^2\) This manual documents PAPI 2.
4.6 Third-party Man Pages Provided with This Release

Man pages are provided for the following third-party products:

- MPICH2
- LAPACK
- ScaLAPACK
- BLACS
- PAPI
- SUSE LINUX
- Lustre

4.7 Additional Documentation Resources

Table 4 lists the resources for obtaining documentation not included in this release or for documentation in addition to that included in the release.

<table>
<thead>
<tr>
<th>Product</th>
<th>Documentation Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPICH2</td>
<td>Additional documentation is available in HTML and PDF formats from the Argonne National Laboratory website at <a href="http://www-unix.mcs.anl.gov/mpi/mpich2">http://www-unix.mcs.anl.gov/mpi/mpich2</a>. Additional information about the MPI-2 standard is available at <a href="http://www.mpi-forum.org/docs/docs.html">http://www.mpi-forum.org/docs/docs.html</a></td>
</tr>
<tr>
<td>ScaLAPACK</td>
<td>The ScaLAPACK Users’ Guide and ScaLAPACK tutorial are available in HTML format at <a href="http://www.netlib.org/scalapack/slug">http://www.netlib.org/scalapack/slug</a></td>
</tr>
</tbody>
</table>
### 4.8 TotalView Documentation from Etnus, LLC

TotalView books and man pages for Cray XT3 systems are available from Etnus, LLC. For information about TotalView publications, see http://www.etnus.com/Documentation/index.html.

### 4.9 Cray Glossary

A Cray Glossary of terms specific to the Cray XT3 system is included with CrayDoc. The entire Cray Glossary is available on the CrayDoc public website: http://docs.cray.com
This chapter contains the following information about the Cray XT3 1.1 software releases:

- Hardware and software requirements (Section 5.1, page 19)
- Optional Cray products supported (Section 5.2, page 19)
- TotalView from Etnus, LLC (Section 5.3, page 20)
- Contents of the release package (Section 5.4, page 20)
- Licensing (Section 5.5, page 21)
- Ordering software (Section 5.6, page 22)

5.1 Hardware and Software Requirements

The following products run on Cray XT3 systems:

- UNICOS/lc 1.1
- Cray XT3 Programming Environment 1.1
- System Management Workstation 1.1
- CRMS 1.1

5.2 Optional Cray Products Supported

The Cray XT3 1.1 software releases support the following optional Cray products directly offered from Cray Inc.:

- PBS Pro 5.3.1xt
- CrayPat 1.0
- Cray Apprentice² 2.3
5.3 TotalView from Etnus, LLC

You can order a special implementation of the TotalView debugger for Cray XT3 systems from Etnus, LLC. You cannot order TotalView directly from Cray, Inc.

TotalView provides source-level debugging of MPI applications and is compatible with the PGI Fortran, C, and C++ compilers. For information about ordering, installing, and maintaining TotalView, see http://www.etnus.com/TotalView/index.html.

5.4 Contents of the Release Package

The Cray XT3 systems 1.1 release package includes:

- UNICOS/1c 1.1, which includes:
  - Linux kernel 2.4 and SUSE LINUX 8.2 beta
  - Catamount 1.1 microkernel

Also included with the UNICOS/1c release package are these related products:
- CRMS 1.1
- Lustre 1.1
- GNet 2.0.5 network library
- Modules 3.1.6 user environment management utility
- RPM Package Manager 4.1.1
- MySQL 4.0 database manager
- FLEXlm 9.5 license manager
- Dynamic Host Configuration Protocol (DHCP) 3.0

- Programming Environment 1.1, which includes:
  - PGI 6.0 Fortran, C, and C++ compilers and tools¹
  - Cray MPICH2 0.97 library of MPI-2 routines
  - Cray SHMEM 1.0 library of distributed-memory access routines

¹ PGI 6.0 requires FLEXlm license management, which controls the number of simultaneous users.
- ACML 2.5 library of BLAS, LAPACK, and FFT routines
- Cray XT3 LibSci 1.1 library of ScaLAPACK, BLACS, and SuperLU routines
- Performance API (PAPI) 3.0.8 and PAPI 2.3.4 ²
- GNU glibc 2.4.2

- CrayDoc software suite and the documentation, described in Chapter 4, page 13.
- A printed copy of this release overview
- A printed copy of the Cray XT3 Software Installation and Configuration Guide
- A printed copy of the Cray XT3 Systems 1.1 Release Errata
- CrayPat 1.1 (if ordered by your site)
- Cray Apprentice² 2.3 (if ordered by your site)
- PBS Pro batch subsystem 5.3.1xt release, which is based on PBS Pro version 5.3 from Altair Grid Technologies (if ordered by your site)

5.5 Licensing

Cray licenses the following as separate products for Cray XT3 systems under a Cray license agreement:
- Cray XT3 OS (which provides rights to UNICOS/lc and its components)
- Cray XT3 Programming Environment (licensed by number of simultaneous users)
- PBS Pro Batch Subsystem (optional product)
- CrayPat Performance Collector (optional product)
- Cray Apprentice² Performance Analyzer (optional product licensed by simultaneous users)

² PAPI 3.0.8 is the default. The Cray tools for Programming Environment 1.1 are built on top of PAPI 3. We are providing PAPI 2.3.4 as a courtesy for users who have software that uses PAPI 2. Cray recommends that customers port applications to PAPI 3. Programming Environment 1.2 will not support PAPI 2.3.
The `PAPILicnotices(7)` and `superlulicnotices(7)` man pages list the license notices for the software that Cray supplies for the Cray XT3 Programming Environment in conjunction with the software and documentation copyright distribution requirements. The `gnulicnotices(7)` man page lists the public license notice for the GNU Free Documentation used in the UNICOS/lc release.

For more information about licensing and pricing, contact your Cray sales representative or send e-mail to `crayinfo@cray.com`.

Customers outside the United States and Canada must sign a Letter of Assurance before software can be shipped to them. For questions about whether you have signed this agreement, or questions about which software requires this letter, send e-mail to `crayinfo@cray.com`.

5.6 Ordering Software

This release package is distributed by order only to customers who have signed a license agreement for the Cray software that includes this product. The most current revision of the release package is supplied. To receive any upgrades to a given Cray product, the customer must also have a signed support agreement for this Cray software.

You can order the release package from the Cray Software Distribution Center in any of the following ways:

**E-mail:**
oorderidsk@cray.com

**CRInform (for subscribers):**
crinform.cray.com

Click on the Order Cray Software link.

**Telephone (inside U.S., Canada):**
1–800–284–2729 (BUG CRAY), then 605–9100

**Telephone (outside U.S., Canada):**
+1–651–605–9100

**Fax:**
+1–651–605–9001

**Mail:**
Software Distribution Center
Cray Inc.
1340 Mendota Heights Road
Mendota Heights, MN 55120–1128
USA

Software will be shipped by ground service or 5-day international service.
This chapter describes the customer services that support this release.

6.1 Technical Assistance with Software Problems

If you experience problems with Cray software, contact your Cray service representative. Your service representative will work with you to resolve the problem. If you choose to have full- or part-time support on site, your on-site personnel are your primary contacts for service. If you have elected not to have on-site support, please call or send e-mail to the Cray Customer Support Center:

E-mail:
support@cray.com

Telephone (inside U.S., Canada):
1–800–950–2729 (CRAY)

Telephone (outside U.S., Canada):
+1–715–726–4993

Fax:
+1–651–605–9001
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