



# ChorusOS 4.0 UltraSPARC-III Target Family Guide

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# ChorusOS 4.0 UltraSPARC-III Target Family Guide

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This guide describes how to run the ChorusOS™ 4.0 product for the UltraSPARC™-III processor family.

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## Preface

### How This Guide is Organized

ChorusOS 4.0 UltraSPARC-III specific information is provided in the following major sections:

- “Development Environment” on page 8, includes supported hosts, host operating systems and development systems.
- “ChorusOS 4.0 Supported Features” on page 9, includes kernel components and POSIX components.
- “Libraries” on page 12.
- “Utilities” on page 13, includes host and target utilities.
- “Reference Hardware” on page 15, includes supported reference platforms, supported devices, and validated reference platforms.
- “How to Build and Boot a System Image on the Target” on page 19.
- Appendix A, details the list of Solaris packages in the product components, and the associated part numbers.

## Related Books

See the *ChorusOS 4.0 Installation Guide for Solaris Hosts* for a description of the installation process of the ChorusOS 4.0 product on a host workstation running the Solaris™ operating environment. This document also describes how to set up a boot server running the Solaris operating environment.

See the *ChorusOS 4.0 Introduction* for a complete description of the ChorusOS 4.0 features.

## Typographical Conventions

The following table describes the typographic changes used in this book.

TABLE 1-1 Typographical Conventions

Typeface or Symbol	Meaning	Example
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. <code>machine_name%</code> you have mail.
<b>AaBbCc123</b>	What you type, contrasted with on-screen computer output	<code>machine_name%</code> <b>su</b> Password:
<i>AaBbCc123</i>	Command-line placeholder: replace with a real name or value	To delete a file, type <b>rm</b> <i>filename</i> .
<i>AaBbCc123</i>	Book titles, new words or terms, or words to be emphasized.	Read Chapter 6 in <i>User's Guide</i> . These are called <i>class</i> options. You must be <i>root</i> to do this.

## Shell Prompts

The following table shows the default system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

TABLE 1-2 Shell Prompts

Shell	Prompt
C shell prompt	machine_name%
C shell superuser prompt	machine_name#
Bourne shell and Korn shell prompt	\$
Bourne shell and Korn shell superuser prompt	#

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# Development Environment

The ChorusOS 4.0 product provides a host-target development environment. Applications are developed on a workstation (the host), and then downloaded and executed on a specific board (the target).

A cross development system is needed to build the applications that execute on the target board (see Section “Utilities” on page 13).

## SPARC™/Solaris™ Reference Host Environments

Prerequisites for the Solaris host reference configuration are the following:

- Sun SPARCstation™
- Solaris 2.6, or Solaris 7
- JDK™ 1.1.3 to 1.1.8, for the installation tool
- JDK 1.2, for the graphical configuration tool

## Cross Compiler

This development environment component is bundled with the ChorusOS 4.0 for UltraSPARC-III product:

- Chorus Cross Development System 5.0, target PowerPC ELF

The Chorus Cross Development System is based on the Experimental GNU Compiler System egcs 1.1.2 and binutils 2.9.1 and additional patches.

## Graphical Debugger

This development environment component is bundled with the ChorusOS 4.0 for UltraSPARC-III product:

- XRAY Debugger from Mentor Graphics, target PowerPC ELF version 4.4crb and additional patches.



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# ChorusOS 4.0 Supported Features

The following table shows the ChorusOS kernel and operating system optional features that are available for the UltraSPARC-III processor family. The availability status of a feature, can be one of:

**Y** The feature is supported, and is configurable with the `configurator(1CC)` command, or with the `ews` GUI configuration tool.

Please refer to the note at the end of the table for information about specific conditions, or restrictions, for a given supported feature.

Some of the features (such as `MSDOSFS`, `FLASH`, `FS_MAPPER`, for example) require specific low-level drivers. These features operate only on platforms which provide these drivers.

**N** The feature is not supported.

Feature Description	Feature Name	Availability
Actor management		
Dynamic actor loading management	ACTOR_EXTENDED_MNGT	Y
User-mode extension support	USER_MODE	Y
Dynamic libraries	DYNAMIC_LIB	Y
Compressed file management	GZ_FILE	Y
Scheduling		
POSIX round-robin scheduling class	ROUND_ROBIN	Y
Memory management		
Virtual (user and supervisor) address space	VIRTUAL_ADDRESS_SPACE	Y
On-demand paging	ON_DEMAND_PAGING	N
Hot restart and persistent memory		
Hot restart	HOT_RESTART	Y
Inter-thread communication		

Feature Description	Feature Name	Availability
Semaphores	SEM	Y
Event flag sets	EVENT	Y
Mutual exclusion lock supporting thread priority inversion avoidance	RTMUTEX	Y
Time management		
Periodic timers	TIMER	Y
Thread and actor virtual timer	VTIMER	Y
Date and time of day	DATE	Y
Real-time clock	RTC	Y
Inter-process communication		
Location-transparent inter-process communication	IPC	Y
Remote (inter-site) IPC support	IPC_REMOTE	Y
Remote IPC communications medium	IPC_REMOTE_COMM	Y
Mailbox-based communications mechanism	MIPC	Y
POSIX 1003.1-compliant message queues	POSIX_MQ	Y
POSIX 1003.1-compliant shared memory objects	POSIX_SHM	Y
LAP		
Local name server for LAP binding	LAPBIND	Y
LAP validity-check option	LAPSAFE	Y
Tools support		
Message logging	LOG	Y
Profiling and benchmark support	PERF	Y
System Monitoring	MON	Y
System debugging	DEBUG_SYSTEM	Y <sup>1</sup>
C_INIT		
Basic command interpreter on target	LOCAL_CONSOLE	Y

Feature Description	Feature Name	Availability
Remote shell	RSH	Y
File system options		
Named pipes	FIFOFS	Y
MS-DOS file system	MSDOSFS	Y
NFS client	NFS_CLIENT	Y
NFS server	NFS_SERVER	Y
UFS file system	UFS	Y
I/O management		
Network packet filter	BPF	Y
Swap support	FS_MAPPER	N
Driver for IDE disk	IDE_DISK	N
/dev/mem, /dev/kmem, /dev/ null, /dev/zero	DEV_MEM	Y
Support for RAM disk	RAM_DISK	Y
Support for FLASH media	FLASH	Y
Virtual TTY	VTY	Y
Driver for SCSI disk	SCSI_DISK	N
Support for IPC	IOM_IPC	Y
Support for OSI	IOM_OSI	Y
Networking		
Serial link IP	SLIP	Y
POSIX 1003.1g-compliant sockets	POSIX_SOCKETS	Y
Point-to-point protocols	PPP	Y
Local sockets and pipes	AF_LOCAL	Y
Administration		
ChorusOS statistics	ADMIN_CHORUSSTAT	Y
ifconfig administration command	ADMIN_IFCONFIG	Y
mount administration command	ADMIN_MOUNT	Y
rarp administration command	ADMIN_RARP	Y
route administration command	ADMIN_ROUTE	Y

Feature Description	Feature Name	Availability
shutdown administration command	ADMIN_SHUTDOWN	Y
netstat administration command	ADMIN_NETSTAT	Y

1. A flashed system image configured with DEBUG\_SYSTEM enabled does not boot. The DEBUG\_SYSTEM feature must be disabled.

---

## Libraries

The ChorusOS operating system provides the elementary libraries indicated in the following list:

ChorusOS embedded library <sup>1</sup>	libebd.a
ChorusOS extended library <sup>1</sup>	libcx.a
C++ library	libC.a
X11 related client libraries (not thread safe)	libX11.a, libXaw.a, libXext.a, libXmu.a, libXt.a
Specific BSD APIs (not thread safe)	libbsd.a
The SunRPC library	librpc.a
The mathematical library	libm.a
The “embedded” C library <sup>2</sup>	stdc.a
The microkernel “visu” library <sup>3</sup>	visu.a

1. The libebd.a, libcx.a, libm.a and libC.a libraries have been made thread-safe in order to support multithreaded actors.
2. Included in libebd.a
3. This library is provided for the sake of backwards compatibility only. It is not documented. Its use is strongly discouraged.

---

# Utilities

## Target Utilities

The following utilities may be run on the target ChorusOS operating system:

*chorusStat(1CC)*

*cp(1CC)*

*cs(1CC)*

*date(1CC)*

*dd(1CC)*

*df(1CC)*

*domainname(1CC)*

*ftp(1CC)*

*hostname(1CC)*

*ls(1CC)*

*mkdir(1CC)*

*mkfifo(1CC)*

*mv(1CC)*

*netstat(1CC)*

*nfsstat(1CC)*

*pax(1CC)*

*PROF(1CC)*

*profctl(1CC)*

*rdbc(1CC)*

*rm(1CC)*

*rmdir(1CC)*

*touch(1CC)*

*uname(1CC)*

*ypcat(1CC)*

*ypmatch(1CC)*

*ypwhich(1CC)*

*arp*(1M)  
*chat*(1M)  
*chorusNS*(1M)  
*chorusNSinet*(1M)  
*chorusNSsite*(1M)  
*dhclient*(1M)  
*disklabel*(1M)  
*flashdefrag*(1M)  
*format*(1M)  
*fscck*(1M)  
*fscck\_dos*(1M)  
*ftpd*(1M)  
*inetNS*(1M)  
*inetNSdns*(1M)  
*inetNShost*(1M)  
*inetNSien116*(1M)  
*inetNSnis*(1M)  
*mkfd*(1M)  
*mkfs*(1M)  
*mount*(1M)  
*mount\_msdos*(1M)  
*mount\_nfs*(1M)  
*mountd*(1M)  
*newfs*(1M)  
*newfs\_dos*(1M)  
*nfsd*(1M)  
*portmap*(1M)  
*shutdown*(1M)  
*slattach*(1M)  
*syncd*(1M)  
*sysctl*(1M)

*telnetd*(1M)  
*umount*(1M)  
*ybind*(1M)

## Host Utilities

The following utilities may be run on the host machine:

*chadmin*(1CC)  
*chconsole*(1CC)  
*chlog*(1CC)  
*chls*(1CC)  
*ChorusOSMkMf*(1CC)  
*chserver*(1CC)  
*configurator*(1CC)  
*configure*(1CC)  
*ews*(1CC)  
*mkmerge*(1CC)  
*rdbs*(1CC)  
*profrpg*(1CC)

---

## Reference Hardware

ChorusOS 4.0 targets are described in this section from three different points of view:

### **Reference Processors and BSPs:**

This subsection describes the processors on which the ChorusOS 4.0 product can run as well as the details of the BSPs included in the delivery

### **Reference Target Platforms:**

This section describes all the target platforms which can be used as references in the context of Sun support contracts

### **Validated Reference Targets:**

This section describes the precise platforms used to run the Sun QA tests; this may be useful, in case of bugs, as a hint or guide to help in identifying issues which are closely hardware related.

## **Reference Processors and BSPs**

The ChorusOS 4.0 system for UltraSPARC-III supports the following processor:

- UltraSPARC-III

The ChorusOS 4.0 system for UltraSPARC-III supports the following reference BSP:

- cp1500 Reference BSP

## **cp1500 Reference BSP**

### **Systems**

The cp1500 reference BSP supports the following board:

- CP1500 — Sun Microelectronics

### **Devices**

The cp1500 reference BSP supports the following on board devices:



<b>Device Id</b>	<b>ChorusOS Driver</b>
/cpu (time base and decremter)	sun:powerpc-(tb,dec)-timer
/cpu	sun:usparc-tick-timer
/ric	sun:usparc-ric-ric
/sabre	sun:usparc-sabre-pci
/sabre/simba	sun:(pci,ric)-simba-pci
/sabre/simba/cheerio-ethernet	sun:pci-cheerio-ether
/sabre/simba/ebus (ebus bridge)	sun:pci-ebus-(bus,isa)
/sabre/simba/ebus/ns16550-1 (UART)	sun:bus-ns16550-uart
/sabre/simba/ebus/ns16550-2 (UART)	sun:bus-ns16550-uart
/sabre/simba-2	sun:(pci,ric)-simba-pci
/sabre/simba-2/dec21150 (cPCI bridge)	not supported
/sabre/simba/ebus/28f008 (system flash)	not supported
/sabre/simba/ebus/28f016 (user flash)	not supported
/sabre/simba/ebus/led (ready LED)	not supported
/sabre/simba/ebus/7seg (7-seg LED)	not supported
/sabre/simba/ebus/wdtimer (watchdog)	not supported
/sabre/simba/ebus/tempsensor	not supported
/sabre/simba/ebus/kbd (keyboard)	not supported
/sabre/simba/ebus/mouse	not supported
/sabre/simba/ebus/lpt (parallel)	not supported
/sabre/simba/ebus/fdd (floppy)	not supported
/sabre/simba/ebus/ide	not supported
/sabre/simba/ebus/tod (time of day)	not supported

<b>Device Id</b>	<b>ChorusOS Driver</b>
/sabre/simba/ebus/nvram	not supported
/sabre/simba/sym53c875 (SCSI)	not supported

## Reference Target Platforms

Reference target platforms are configurations to be used by customers covered by a Sun support contract.

### SPARCengine Ultra CP1500 (Sun Microelectronics)

<b>Type:</b>	CompactPCI Board
<b>Processors:</b>	UltraSPARC-IIi (270-333 Mhz)
<b>Main memory:</b>	64-512 MB
<b>L2 cache:</b>	256-1024 MB
<b>Bus bridges:</b>	Asynchronous serial ports (38.4 Kbaud), 10/100BaseT Ethernet, Real-time clock, Timers
<b>Devices:</b>	Asynchronous serial ports (38.4 Kbaud), 10BaseT Ethernet, Timers
<b>Firmware:</b>	OpenBoot 3.10.x

## Validated Reference Targets

This section describes the precise platform used to run the Sun QA tests

- SPARCengine Ultra CP1500: 5093-01 REV-51 / 333 Mhz / 128 MB

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# How to Build and Boot a System Image on the Target

**Note** - UltraSPARC-III target systems do not boot archives directly, but instead require the inetboot application to boot.

As a result, the boot procedure that follows differs from the procedure described in the *ChorusOS 4.0 Installation Guide for Solaris Hosts*, and requires that you use a boot server that reads local files instead of the NIS™ database.

---

## ▼ Building a ChorusOS 4.0 System Image

The following procedure assumes that the ChorusOS 4.0 product has already been correctly installed on the host workstation. See the *ChorusOS 4.0 Installation Guide for Solaris Hosts*.

1. **Create and change to a build directory where you will build system images:**

```
$ mkdir build_dir
$ cd build_dir
```

2. **Set an environment variable to use with the `configure(1CC)` command as a shortcut to the base directory.**

For example:

---

Set the environment variable...	To the family-specific product directory. The default value is...
DIR	/opt/SUNWconn/SEW/4.0/chorus-usparc

---

3. **Make sure your `PATH` has been set correctly to include the directory `install_dir/4.0/chorus-usparc/tools/host/bin`, where the default**

`install_dir` is `/opt/SUNWconn/SEW`. Also make sure that your `PATH` includes `/usr/openwin/bin`, which contains the `imake` utility.

#### 4. Configure the build directory, using the `configure(1CC)` command:

If you are building from a binary distribution:

```
$ configure -b $DIR/kernel \  
$DIR/os \  
$DIR/tools \  
-s $DIR/src/nucleus/bsp/drv \  
$DIR/src/nucleus/bsp/usparc \  
$DIR/src/nucleus/bsp/usparc/cp1500 \  
$DIR/src/iom
```

---

**Note** - The above command configures the build directory to include components installed during a “Default Install”. It does not include optional components, such as the X library or code examples, that you may choose to install separately on Solaris host workstations. For example, in order to include everything in your build environment:

```
$ configure -b $DIR/kernel \  
$DIR/os \  
$DIR/opt/X11 \  
$DIR/opt/jvm \  
$DIR/tools \  
-s $DIR/src/nucleus/bsp/drv \  
$DIR/src/nucleus/bsp/usparc \  
$DIR/src/nucleus/bsp/usparc/cp1500 \  
$DIR/src/iom \  
$DIR/src/opt/examples
```

---

If you are building from the source distribution, see the *ChorusOS 4.0 Production Guide*.

As a result of configuration, `build_dir` now contains a `Makefile`, which is used to generate the build environment, and a `Paths` file, which specifies paths to files required by and created in the build environment.

#### 5. Generate the build environment:

```
$ make
```

## 6. Build a system image:

```
$ make chorus
```

The resulting system image file is located in the build directory, *build\_dir* and is called *chorus.obp*.

---

**Note** - You can also make a smaller system image that includes only the operating system kernel:

```
$ make kernonly
```

## ▼ Configuring the Boot Server

---

**Note** - The target system and boot server must be on the same subnet.

See the *ChorusOS 4.0 Installation Guide for Solaris Hosts* for instructions on how to enable TFTP and RARP services on the boot server.

---

### 1. Become root on the boot server:

```
$ su
Password: root_password
#
```

2. Copy the `inetboot.sun4u` file, `install_dir/4.0/chorus-usparc/opt/unsupported/inetboot.sun4u` where `install_dir` is `/opt/SUNWconn/SEW` by default, to the `/tftpboot` directory.
3. Create a soft link from the `inetboot.sun4u` file to a file called `/tftpboot/target_IP_address_in_hex.ChorusOS.4.0`. For example, the file for the target system with IP address `129.157.197.88` is called `819DC558.ChorusOS.4.0`, and is constructed as follows:
  - 129 in decimal translates to 81 in hexadecimal
  - 157 in decimal translates to 9D in hexadecimal
  - 197 in decimal translates to C5 in hexadecimal

- 88 in decimal translates to 58 in hexadecimal
- (optional) `.ChorusOS.4.0` identifies the release, and is appended to the concatenation of the IP address expressed in hexadecimal.

---

**Note** - The system first attempts to find the configuration file with the `.ChorusOS.4.0` extension. If it fails to find one, however, it attempts to find a configuration file without the `.ChorusOS.4.0` extension.

---

To create the soft link for the above example:

```
# ln -s /tftpboot/inetboot.sun4u 819DC558.ChorusOS.4.0
```

4. **Create a `/tftpboot/export/root/target/platform/sun4u` directory on the boot server.**
5. **Copy the system image, `chorus.obp`, to the directory you just created.**
6. **Edit `/etc/bootparams` to include the following, creating the file if it does not exist yet:**

```
target root=boot_server:/tftpboot/export/root/target
```

Where *target* is the target system hostname and *boot\_server* is the boot server hostname.

7. **Edit `/etc/hosts` to include the following:**

```
target_IP_address      target
```

Where *target\_IP\_address* is the target IP address, such as `129.157.197.88`, and *target* is the target system hostname.

8. **Edit `/etc/ethers` to include the following:**

```
target_Ethernet_address  target
```

Where *target\_Ethernet\_address* is the target IP address such as `8:0:20:a7:d6:f3` and *target* is the target system hostname.

9. **Add the following line to `/etc/dfs/dfstab`:**

```
share -F nfs -o rw -d "ChorusOS boot" /export/home
```

**10. Edit /etc/nsswitch.conf so that the hosts, ethers, and bootparams entries read files rather than NIS databases. For example:**

```
#
# /etc/nsswitch.nis:
#
# An example file that could be copied over to /etc/nsswitch.conf; it
# uses NIS (YP) in conjunction with files.
#
# "hosts:" and "services:" in this file are used only if the
# /etc/netconfig file has a "-" for nametoaddr_libs of "inet" transports.

# the following two lines obviate the "+" entry in /etc/passwd and /etc/group.
passwd:      files nis
group:       files nis

# consult /etc "files" only if nis is down.
hosts:       files [NOTFOUND=return] nis
networks:    nis [NOTFOUND=return] files
protocols:   nis [NOTFOUND=return] files
rpc:         nis [NOTFOUND=return] files
ethers:      files [NOTFOUND=return] nis
netmasks:    nis [NOTFOUND=return] files
bootparams:  files [NOTFOUND=return] nis
publickey:   nis [NOTFOUND=return] files

netgroup:    nis

automount:   files nis
aliases:     files nis

# for efficient getservbyname() avoid nis
services:    files nis
sendmailvars: files
```

**11. Reboot the boot server.**

## ▼ Booting the Target System

- ◆ **Boot the target by entering the following in the target system console:**

```
# ok boot net /platform/sun4u/chorus.obp
```





## ChorusOS 4.0 for UltraSPARC-IIi Product Packages and Part Numbers

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The tables below list the Solaris packages available in this release and indicate the part number for each distinct product component

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### Binary Product — for Solaris Host

<b>Part Number</b>	<b>CLX400-SSU0</b>
<b>Package Name</b>	<b>Description</b>
SUNWewbu	Sun Embedded Workshop for UltraSPARC Iii BSP source
SUNWewcd	Sun Embedded Workshop PDF Format Common Documentation
SUNWewch	Sun Embedded Workshop HTML Format Common Documentation
SUNWewcp	Sun Embedded Workshop PostScript Format Common Documentation
SUNWewdu	Sun Embedded Workshop for UltraSPARC Iii XRAY Debugger
SUNWewgu	Sun Embedded Workshop for UltraSPARC Iii GUI Tools
SUNWewiu	Sun Embedded Workshop for UltraSPARC Iii IOM source
SUNWewju	Sun Embedded Workshop for UltraSPARC Iii JVM

<b>Part Number</b>	<b>CLX400-SSU0</b>
<b>Package Name</b>	<b>Description</b>
SUNWewku	Sun Embedded Workshop for UltraSPARC Ili Kernel
SUNWewm	Sun Embedded Workshop On-Line Manual Pages
SUNWewou	Sun Embedded Workshop for UltraSPARC Ili OS
SUNWewpu	Sun Embedded Workshop for UltraSPARC Ili Examples
SUNWewsd	Sun Embedded Workshop PDF Format Specific Documentation
SUNWewsh	Sun Embedded Workshop HTML Format Specific Documentation
SUNWewsp	Sun Embedded Workshop PostScript Format Specific Documentation
SUNWewtu	Sun Embedded Workshop for UltraSPARC Ili Build Tools
SUNWewuu	Sun Embedded Workshop for UltraSPARC Ili Debugger and Profiling Support
SUNWewxu	Sun Embedded Workshop for UltraSPARC Ili X11 Library
SUNWewzu	Sun Embedded Workshop for UltraSPARC Ili egcs Toolchain

## Flite Add-on for Solaris Host

<b>Part Number</b>	<b>FLT400-SSU0</b>
<b>Package Name</b>	<b>Description</b>
SUNWewfu	Sun Embedded Workshop for UltraSPARC Ili Flite

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## Source Add-on for Solaris Host

<b>Part Number</b>	<b>CLX400-SSU0-S</b>
<b>Package Name</b>	<b>Description</b>
SUNWewhu	Sun Embedded Workshop for UltraSPARC Ili OS source
SUNWewlu	Sun Embedded Workshop for UltraSPARC Ili Kernel source

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## Documentation for Solaris Host

<b>Part Number</b>	<b>CLX400-SAA0-D1N</b>
<b>Package Name</b>	<b>Description</b>
SUNWewcd	Sun Embedded Workshop PDF Format Common Documentation
SUNWewch	Sun Embedded Workshop HTML Format Common Documentation
SUNWewcp	Sun Embedded Workshop PostScript Format Common Documentation
SUNWewm	Sun Embedded Workshop On-Line Manual Pages
SUNWewsd	Sun Embedded Workshop PDF Format Specific Documentation
SUNWewsh	Sun Embedded Workshop HTML Format Specific Documentation
SUNWewsp	Sun Embedded Workshop PostScript Format Specific Documentation