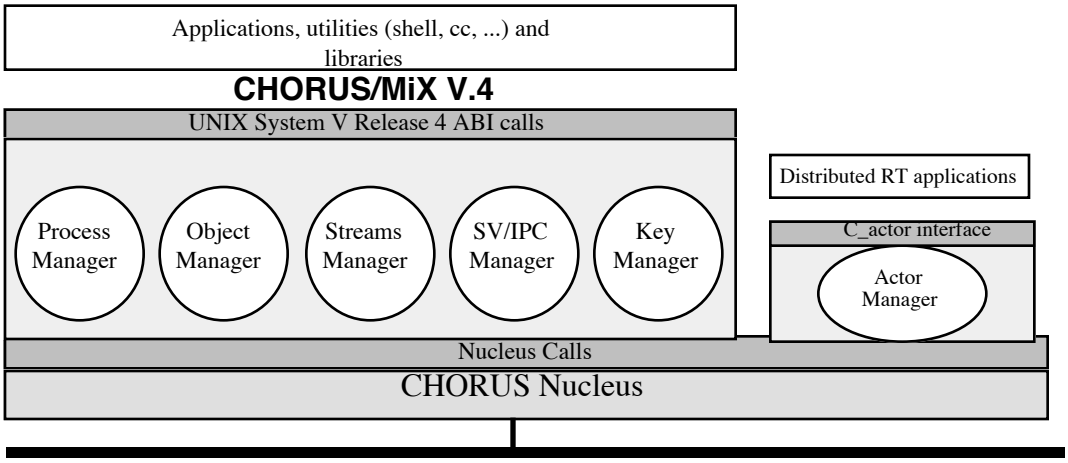
Product Datasheet: CHORUS/MiX™ V.4 r2

- ❖**UNIX® SVR4-based, ABI-conformant operating system**
- ❖**UNIX System Laboratories SVR4 Source-code Value-Added Reseller**
- ❖**Client-server operating system architecture on CHORUS® Nucleus microkernel**
- ❖**Real-time functionality and behavior**
- ❖**Fast, transparent location-independent message-passing system**
- ❖**Superior operating system development environment**
- ❖**Symmetric multi-processor support**
- ❖**Real-time applications development environment (C_actors)**

The CHORUS/MiX™ V.4 operating system is a microkernel-based implementation of UNIX® System V Release 4 (SVR4), built as a modular set of independent multi-threaded system servers supported by the real-time distributed CHORUS® Nucleus, while remaining fully binary compatible with the UNIX SVR4 ABI (Application Binary Interface).



The CHORUS/MiX system's high modularity provides substantially greater flexibility, simpler maintenance and easier adaptation to changing needs. Building on top of the real-time distributed microkernel CHORUS Nucleus low level services, CHORUS/MiX supplies the traditional UNIX services via a set of independent servers:

- the **Process Manager** handles incoming operating system requests from UNIX applications,
- the **Object Manager** manages files and virtual memory swapping,
- the **Streams Manager** processes System V I/O, and
- the **System V IPC Manager** and the **Key Manager** cooperate to provide System V messages, semaphores and shared memory.

The C_actor subsystem provides an ideal environment to develop Real-Time applications on top of the Nucleus. It allows users to dynamically load, control, debug and unload actors written in C language.

These servers are fully encapsulated and communicate using message-based semantics. Distributed applications (system and user) can use the fast and distribution-transparent CHORUS Inter-Process Communications (IPC). With this modular architecture and CHORUS IPC, system designers can easily develop and integrate their own distributed system servers with targeted functionality and can transparently distribute those servers. Thus system designers can support *parallel system* architectures, implement *fault tolerance*, and operate in *real time* environments more easily and more quickly than with alternative operating systems.

Main Benefits

CHORUS/MiX V.4 provides the system designer with a superior system development environment.

- The CHORUS architecture breaks up the operating system into smaller, fully encapsulated code- and data-independent servers. A server can be modified or replaced without impacting other system servers.
- Smaller operating system servers mean system modifications are easier to understand and more simple to work with.
- Designers can choose to run the servers in user space, providing virtual memory protection for the rest of the system, or in system space for greater performance. For example, new file systems or extensions can be made and tested at the user level. Then they can be installed in system space for higher performance, without a system shut down.

† C_actor Development Environment provides increased ease-of-use to develop applications on top of the Nucleus in C language

CHORUS/MiX V.4 has been designed as a solid basis for easily building multi-processor and "multi-computer" (distributed memory) systems that typify the newer generation of system designs.

- The CHORUS distributed microkernel architecture makes redundancy and dynamic reconfiguration implementation straightforward when high availability is the target.
- Designing high performance multi-computer systems is aided by all the necessary distribution enablers and modularity of the CHORUS/MiX V.4 operating system.
- The CHORUS IPC provides highly efficient local or remote communications between UNIX processes and/or CHORUS Nucleus actors or other UNIX processes.

CHORUS/MiX V.4 provides real-time functionality and behavior.

- UNIX kernel tasks as well as user processes are pre-emptable and scheduled by the CHORUS Nucleus to maintain real-time response even when UNIX is active.

CHORUS/MiX V.4 Functionality

- Access to key CHORUS Nucleus functionality from UNIX processes.
- Ability to easily create system servers than can be migrated and evolved simply, and reconfigured dynamically.
- Easier programming of distributed applications with automatic localization of clients and servers.
- Fast, efficient local and remote IPC.
- Increased continuity of service via enabling technologies for fault tolerant servers.
- Concurrent multiple communication protocols and physical transports.

MiX V.4 Process Manager

- Provides binary compatibility with SVR4.
- Directs the UNIX application system calls to the appropriate server.
- Real-time (priority based pre-emptive) scheduling by the CHORUS Nucleus of threads and processes.
- Dynamic stack growth management.
- Optimized exec and job control.

MiX V.4 Object Manager

- Handles all file processing.
- Uses the CHORUS Nucleus Virtual Memory Mapper interface for demand-paging across the network and swapping to disk.
- Optimized ufs and s5 file systems.

MiX V.4 Streams Manager

- Compatibility with System V Streams brings the benefit of implementing application and communications protocols independently.

MiX V.4 SVR4 IPC and Key Managers

- Implements UNIX System V IPC facilities.

C_actor Development Environment

† Consists of a small subsystem: 1 server, the Actor Manager (AM) running on top of the Nucleus allowing dynamic loading, controlling, debugging and unloading of c_actors (user or supervisor) with distributed capability.

† A threadsafe (reentrant) subset of the standard ANSI C library is available for use within (multi-threaded) c_actors. It offers the following services: standard I/O on UNIX regular files, memory allocation facilities, string operations.

Validation (Passed by Chorus and customers)

- SVVS - release 3. This test suite from UNIX System Laboratories (USL) is to make sure the UNIX port adheres to the SVID for UNIX SVR4.
- VSX - release 3.203. This test suite from XOPEN tests the UNIX port to see that it adheres to the system interfaces, headers and commands as defined in the XOPEN portability guide volumes 1 and 2.
- PCTS release 1.1 tests NIST 151-1 compatibility.
- Self-regeneration of the system.
- Nucleus: standard CHORUS Nucleus test suite.
- MiX V.4: standard CHORUS/MiX V.4 test suite.
- C_actors: standard CHORUS C_actors test suite.

CHORUS/MiX V.4: UNIX SVR4 System Calls

These UNIX SVR4 system calls are available to all CHORUS/MiX V.4 processes:

access	getcontext	msgctl	setcontext	stime
acct	getdents	msgget	setegid	stty
adjtime	getegid	msgrcv	seteuid	swapctl
alarm	geteuid	msgsnd	setgid	symlink
brk	getgid	munmap	setgroups	sync
chdir	getgroups	nfssys	setpgid	sysacct
chmod	getmsg	nice	setpgrp	sysconf
chown	getpgid	nuname	setrlimit	sysfs
chroot	getpgrp	open	setsid	sysi86
close	getpid	pathconf	setuid	sysinfo
creat	getpmsg	pause	shmat	termios
dup	getppid	pgrp	shmctl	time
execl	getrlimit	pipe	shmdt	times
execle	getsid	plock	shmget	uadmin
execlp	getuid	poll	sigaction	ulimit
execv	gtty	priocntl	sigaltstack	umask
execve	hrtsys	priocntlset	sighold	umount
execvp	ioctl	profil	sigignore	unlink
exit	kill	ptrace	signal	ustat
fchdir	lchown	putmsg	sigpause	utime
fchmod	link	putpmsg	sigpending	utsys
fchown	lseek	read	sigprocmask	vfork
fcntl	lstat	readlink	sigrelse	wait
fork	lxstat	readv	sigsend	waitid
fpathconf	memcntl	rename	sigsendset	waitpid
fstat	mkdir	rmdir	sigset	write
fstatfs	mknod	sbrk	sigsuspend	writev
fstatvfs	mmap	semctl	stat	xmknod
fsync	mount	semget	statfs	xstat
fxstat	mprotect	semop	statvfs	_exit

CHORUS/MiX V.4: CHORUS Nucleus System Calls

These CHORUS Nucleus system calls are available to CHORUS/MiX V.4 processes:

u_chorusSite	u_ipcReceive	u_ipcTarget	u_portMigrate
u_grpAllocate	u_ipcReply	u_portCreate	u_portUi
u_grpPortInsert	u_ipcRestore	u_portDelete	u_uiSite
u_grpPortRemove	u_ipcSave	u_portDisable	u_vmPageSize
u_ipcCall	u_ipcSend	u_portEnable	
u_ipcGetData	u_ipcSysInfo	u_portLi	

CHORUS/MiX V.4: C_actors thread-safe C library

The C_actor thread safe C library contains the functions listed below:

character handling	isalnum	isalpha	iscntrl
	isdigit	isgraph	lslower
	isprint	ispunct	isspace
	isupper	tolower	toupper
	isxdigit		
non-local jumps	setjmp	longjmp	
input/output	tmpfile	tmpnam	fclose
	fflush	fopen	freopen
	setbuf	setvbuf	printf
	fprintf	scanf	fscanf
	sscanf	vfprintf	vsprintf
	sprintf	fgetc	fgets
	fputc	putchar	puts
	ungetc	fread	fwrite
	fseek	ftell	rewind
	clearerr	feof	ferror
	perror		
general utilities	atof	strtod	atoi
	strtol	atol	calloc
	free	malloc	realloc
	exit	getenv	bsearch
	qsort		
string handling	memcpy	strcpy	strncpy
	strcat	memcmp	strcmp
	strncmp	strchr	strcspn
	strpbrk	strrchr	strspn
	strdup	strtod	strtol
	memset	strlen	

CHORUS/MiX V.4: C_actors specific system calls

In addition to the thread-safe C library and the CHORUS Nucleus library, the c_actors can use the functions listed below to control their run time environment.

UNIX Environment	setrootsite(3CACT)	getrootsite(3CACT)	chdir(3CACT)
Control and Execution	afexeclp(3CACT)	afexecvp(3CACT)	afexecl(3CACT)
	afexecle(3CACT)	afexecv(3CACT)	afexecve(3CACT)
	await(3CACT)	akill(3CACT)	
CHORUS Network	getSiteByName(3CACT)	getSiteByAddr(3CACT)	

CHORUS/MiX V.4 Deliverables

The license fees for the CHORUS/MiX V.4 reference port includes delivery of the following items:

Nucleus Deliverables

See separate Nucleus deliverables list.

MiX V.4 Deliverables

CHORUS/MiX V.4, including the following major components:

- SVR4 Process Manager (PM)
- SVR4 Object/File Manager (OM)
- SVR4 Streams Manager (StM)
- SVR4 System V IPC Manager (IPCM) and associated Key Manager (KM)
- SERVLIB DDI library
- C_actor subsystem (AM)
- C_actor utilities including libraries

System-dependent code:

- booting/initialization
- port to the Intel i386® and Intel i486® COMPAQ® Deskpro and Portables family, including device drivers for console/keyboard, EDI, ESDI hard disks and VGA display
- Network driver: Excelan/Federal Tech Exos 205T, Western Digital WD80x3

Include files and libraries for the above

Documentation Deliverables

Programmer's Reference Manual:

- Overview of CHORUS/MiX V.4
- Nucleus Programmer's Reference Manual (see Nucleus deliverables list)
- MiX V.4 Programmer's Reference Manual (including C_actor documentation)
- MiX V.4 User's Reference Manual (including C_actor documentation)
- Installation Guide for COMPAQ Deskpro
- Source Installation Guide

Implementation Guide :

- Nucleus Implementation Guide (see Nucleus deliverables list)
- MiX V.4 Inter-server Protocols
- MiX V.4 Process Manager Design
- MiX V.4 Object Manager Design
- MiX V.4 /proc File System
- MiX V.4 Streams Manager Design
- MiX V.4 SVR4 IPC Manager Design

Build Environment Deliverables

- makefiles
- test programs
- porting utilities
- validation tests (MiX and C_actor)
- Makedepend (determines file dependencies)
- Uu (encode/decode tools)
- standard SVR4 "C" development environment (make, "C", ...)

Restrictions

UNIX SVR4 functionality not provided:

- RFS
- Xenix compatibility
- `/dev/mem` and `/dev/kmem` accesses
- `/dev/cram` accesses

Prerequisites

- USL SVR4.0 v4 (or later) license for access to OM, StM and IPCM server code
- compilers: Glockenspiel C++ version 2.0A
- a machine capable of reading QIC streamer tapes
- Recommended:
  - COMPAQ reference machine (see separate configuration information)
  - USL SVR4 installed on the COMPAQ

Media

- 60 MB QIC-24 streamer cartridge tape

Reference Machine

- COMPAQ 386/486

Additional Ports

- Motorola 680x0
- Sun SPARC

Reference Standards

- X/Open Portability Guide Issue 3 (XP3)
- ANSI X3J 11
- IEEE POSIX 1003.1
- FIPS 151-1
- SVVS including DDI/DKI

Reference Microkernel

- CHORUS Nucleus r4.2

Reference Operating System

- USL System V Release 4.0 v4

† New in this release.

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