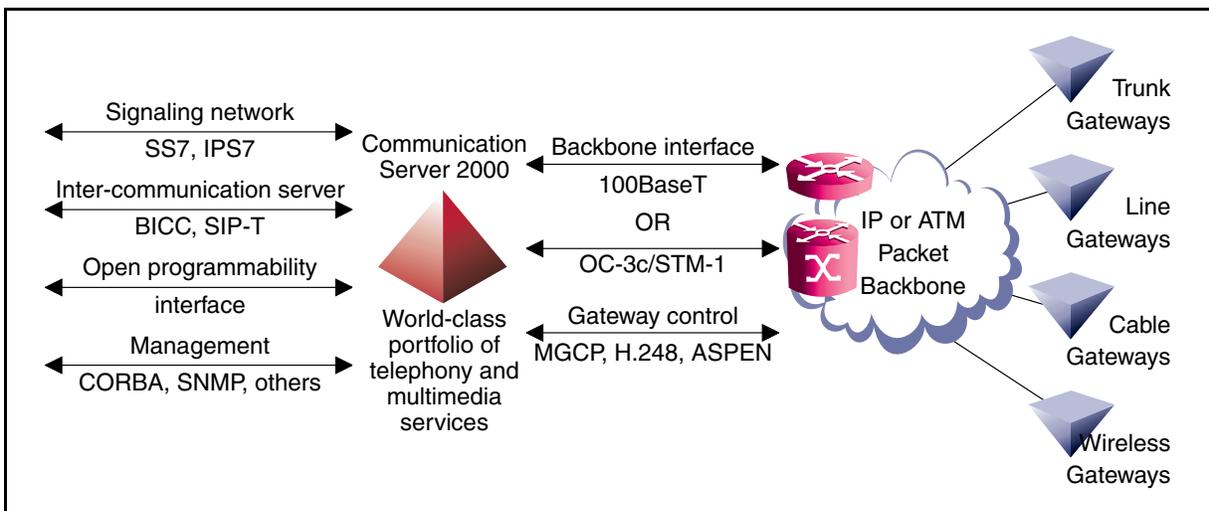# Communication Server 2000 Basics

The Communication Server 2000 (CS 2000) product is a member of the Succession portfolio of network elements. Within this portfolio, CS 2000 acts as a media gateway controller and signaling gateway to support next generation networks (NGN). CS 2000 operates in a multi-vendor network architecture that decouples services from connectivity. This architecture is feature-rich, transport-efficient, and scalable.

Functional Description

CS 2000 enables service providers to offer their residential and business customers a comprehensive set of telephony services that use packet networks. These services include a call processing engine and feature set that provide complete equivalence with Class 3 through Class 5 central office digital switches. CS 2000 supports the migration from circuit switched to packet networks (referred to as evergreen) as well as the deployment of new packet telephony networks (referred to as greenfield).

Communication Server 2000 network role

Service providers can deploy CS 2000 with other Succession portfolio servers, depending on the service offerings. These other Succession portfolio servers include the Communication Server 2000 - Compact (CS 2000 Compact), Communication Server 3000 (CS 3000), media servers, interactive media servers, and signaling servers.

Product Description

The Succession portfolio CS 2000 is a composite product that includes principal and auxiliary components. The principal components provide the media gateway controller and signaling gateway functionality that characterize a communication server. Auxiliary components provide support functions like power distribution and cooling.

Media Gateway Controller Functionality

The CS 2000 computing module (CM), which is based on the extended architecture core (XA-Core) together with the Gateway Controller (GWC) provide the media gateway controller (MGC) functionality.

MGC functionality provides the translations and routing control for the entire Succession network This functionality also directs the setup and teardown of switched virtual circuits (SVC) over the IP backbone.

Signaling Gateway Functionality

The CS 2000 works with the Universal Signaling Point (USP) to provide signaling gateway functionality in Succession solutions.

Alternatively, the CS 2000 works with TDM-Core components to provide signaling gateway functionality. The TDM-Core components include the CCS7 link interface unit (LIU7), the fiberized link peripheral processor (FLPP) and the message switch (MS). The LIU7 connects the CCS7 signaling network to the XA-Core through the message switch using DS-512 connections.

>   *Note:* Succession solutions cannot use both the USP and LIU7 with a single CS 2000 at the same time.

Communication Server Complex

The CS 2000, selected TDM-Core components, Communication Server 2000 Core Manager, Communication Server 2000 Management Tools, and an IP router such as the Passport 8600 together form the CS 2000 complex.

Network Role

The following figure shows the components that make up the Wireline Universal Packet Access Solution (UA-IP) from Nortel Networks.

Wireline Universal Packet Access Solution - IP
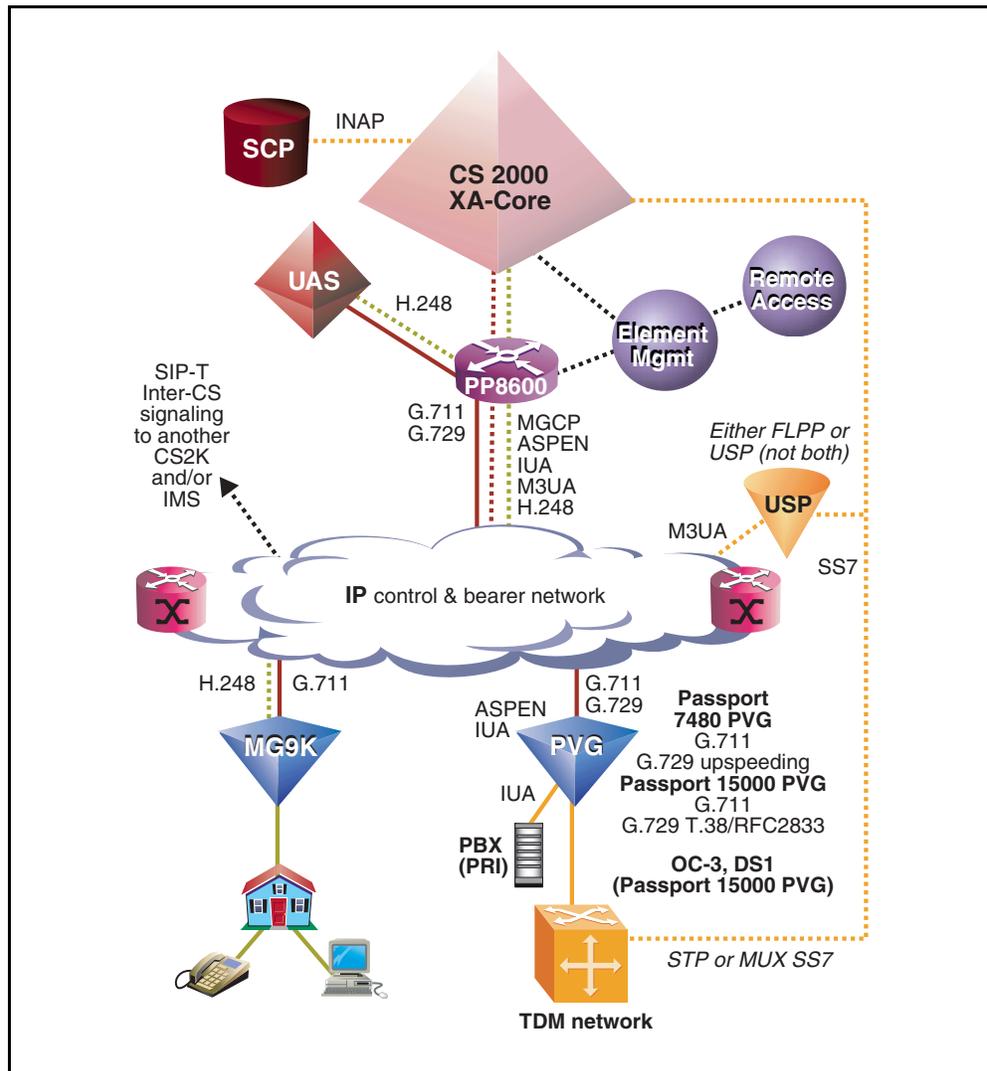
Benefits

CS 2000 provides the following benefits to Service Providers:

- **Transparent delivery of revenue-generating services**. CS 2000 reaches into a variety of multi-vendor service platforms to deliver profitable services over the packet infrastructure. Such services include custom local area signaling services (CLASS), integrated services digital networks (ISDN) primary rate interface (PRI), ISDN user part (ISUP), virtual private networks (VPN), and intelligent network services such as toll-free 800/900 numbers.

- **Open architecture**. Succession Solutions use open standards that are compatible with any vendor's non-proprietary standards for end

office and local exchange switches, legacy SS7 signaling networks, and carrier-grade ATM and IP platforms.

- **Robust, scalable solution**. The CS 2000 XA-Core is a scalable, multi-processor engine that distributes call processing and system overhead functions across multiple, independent processing elements. This modular core allows service providers to add capacity by adding circuit packs for truly seamless growth.

- **Protects investments in TDM platforms**. Nortel Networks DMS technology, with a minimum core processor configuration of XA-Core Release 1, can be upgraded to a CS 2000. The parallel processors in the XA-Core provide plug-in capacity up to six times greater than the SN70EM.

- **Reduced cost of ownership**. Succession solutions provide a flatter architecture based on point-to-point delivery of voice/data traffic using switched virtual circuits (SVC). This architecture supports higher capacity and better economics through packet switching. When fully deployed, the Succession solution eliminates the Class 4 (tandem/transit switching) layer, with all call processing and signaling distributed across the network on one or more CS 2000s.

  The resulting reduced equipment counts and advanced technology considerably reduces heating, ventilation, and air conditioning (HVAC) and real estate costs.

Hardware

The Succession portfolio CS 2000 is a composite product that includes principal and auxiliary components. The principal components provide the media gateway controller and signaling gateway functionality that characterize a communication server. Auxiliary components provide support functions like power distribution and cooling.

Principal components

The following table lists the principal components that make up the CS 2000 product.

Principal CS 2000 components

Description	PEC
Extended Architecture Core (XA-Core) including: • processor element (PE) circuit cards • shared memory (SM) circuit cards • input/output processor (IOP) circuit cards	NTLX01AA
Services Application Module (SAM21) with Gateway Controller (GWC)	NTRX51
Message Switch (MS)	NT9X63
Fiberized Link Peripheral Processor (FLPP)	NT9X70

Extended Architecture Core

The extended architecture core (XA-Core) is the call processing component of the CS 2000 that controls signaling gateway and media gateway functionality.

The XA-Core uses an OC-3c ATM network connection to provide two permanent virtual circuits to each MG 4000 in the network. These OC-3c connections pass signaling data between the XA-Core and MG 4000s.

The Ethernet network between the XA-Core and CS LAN provides 10/100BaseT Ethernet connections with the operations, administration, maintenance, and provisioning (OAM&P) network, and the GWCs.

DS-512 connections with the message switch allow the XA-Core to connect with the signaling gateway, input output module (IOM), TDM-Core enhanced network (ENET), and the CS 2000 Core Manager (CS2E).

Architecture   The XA-Core design is a symmetric, tightly coupled multiprocessor system based on identical processor elements each running the same software load and accessing a single shared memory system. The circuit packs that make up the XA-Core fit into a single shelf on a standard SuperNode cabinet.

The processor elements (PE) provide the XA-Core with spared, fault-detecting, computing engines that operate in a multiprocessing environment.

Shared memory (SM) circuit packs provide scalable shared memory capacity for global program and data storage. Each card supports 384 MBytes of memory using 64 MBit SDRAM technology. SM cards contain all XA-Core shared data that PEs and IOPs use. These circuit packs also control data access by PEs and IOPs.

Block diagram of the XA-Core
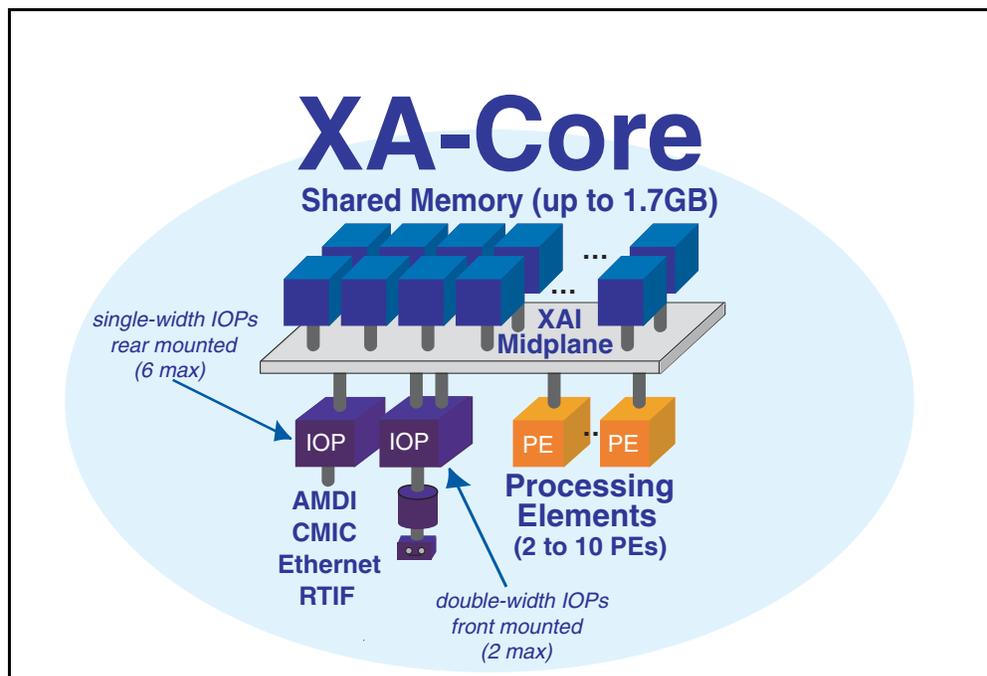
The IOPs provide generic support for all input /output and mass storage requirements of the XA-Core. Each IOP uses a generic input/output (I/O) processor to control one or two daughter boards (called packlets) that provide specific I/O services. IOPs provide the following functionality:

- double-slot, front-mounted IOP circuit packs that provide mass storage using the following packlet types:

  — transportable digital audio tape (DAT)

— fixed hard disk drive

- single-slot, rear-mounted IOP circuit packs that provide computing module interface cards, cabled interfaces, RS232/422 serial interfaces, and OC-3 interfaces use the following packlet types:

  — Ethernet

  — ATM Multimode Data Interface (AMDI)

  — Computing Module Interface Card (CMIC)

  — Remote Terminal Interface (RTIF)

Shelf design   The XA-Core shelf has a mid-plane design, with front and rear slots to mount circuit packs.

XA-Core shelf
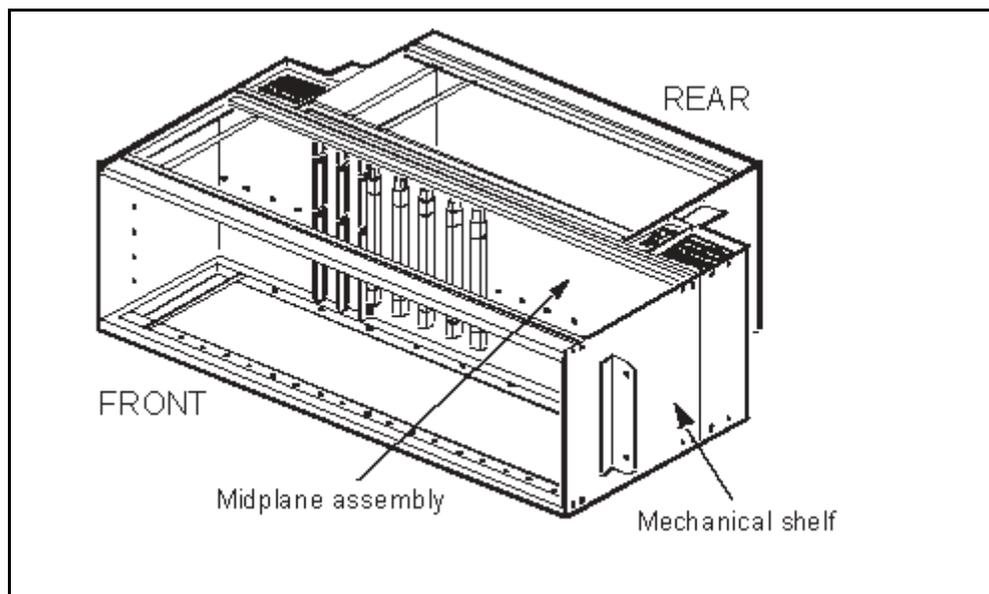
There are two provisionable areas for these slots:

- 10 slots that support shared memory (SM)
- 16 universal slots and 2 sets of paired slots that support the following types of circuit packs:

  — single-slot, front or rear mounted processor elements (PE)

  — single-slot, rear mounted input/output processors (IOP)

  — double-slot, front mounted input/output processors

In addition to these 30 provisionable slots, designated by slot identifiers 01 to 30, the XA-Core shelf has two slots for shelf interface modules

(SIM). SIM slots have slot numbers, namely 03R(ear) and 16R(ear), but do not have slot identifiers.

XA-Core slot configuration

XA-Core shelf in the 3 + 1 configuration
(All PEs operate in a load sharing mode)

Slot Number - ID (right)

Slot Number - ID (left)

Slot Number - ID (Rear)	Rear content	Front content	Slot Number - ID (Front)
		IOP (NTLX03BB) (Disk/Tape)	18F - 18
			17F - 17
16R	SIM	Filler	16F - 16
15R - 30	IOP and packlet(s) (see Note)	Filler (slot unassignable)	15F - 15
14R - 29	IOP and packlet(s) (see Note)	Filler	14F - 14
13R - 28	IOP and packlet(s) (see Note)	PE	13F - 13
12R - 27	Filler	PE	12F - 12
11R - 07	SM	SM	11F - 26
10R - 09	Filler	SM	10F - 24
09R - 11	Filler	SM	09F - 22
08R - 23	Filler	SM	08F - 10
07R - 25	SM	SM	07F - 08
06R - 21	IOP and packlet(s) (see Note)	PE	06F - 06
05R - 20	IOP and packlet(s) (see Note)	PE	05F - 05
04R - 19	IOP and packlet(s) (see Note)	Filler	04F - 04
03R	SIM	IOP (NTLX03BB) (Disk/Tape)	03F - 03
			02F - 02
		Filler (slot unassignable)	01F - 01

◄ Rear   Front ►

Note: Rear slots 4R, 5R, 6R, 13R,14R, and 15R contain NTLX03AB (IOP) circuit packs populated with NTLX05AB (CMIC), NTLX08AB (RTIF), NTLX05BA (AMDI), and/or NTLX09AA (Ethernet) packlets as required.

Note: Slots numbered 07F(ront) to 11F and 07R(ear) to 11R are opposite each other on the midplane assembly and are reserved for shared memory circuit packs. Universal slots numbered 01F, 04F to 06F, 12F to16F, 03R to 06R, and 12R to 15R are reserved for single-slotted IOPs or processor elements. Universal slots numbered 02F/03F and 16F/17F are reserved for double-slotted IOPs. Each of these slots has a unique slot identifier for provisioning purposes.

Processor Element circuit packs   The XA-Core uses a variable number of Processor Element circuit packs (PE) in an N+1 configuration. Each PE operates completely independently of the others. Two processors run in sync on each PE and match all bus transactions.

This design provides the PE fault detection capability. The design also provides a symmetric multiprocessing architecture that does not assign a permanent "master" PE pack. Each and every PE can and does run all code. All XA-Core functions operate normally so long as at least one PE pack is fault free.

Shared Memory circuit packs   The XA-Core uses a single, scalable, shared memory system to support multiple PEs and IOPs. This memory system consists of up to ten SMs that contain all data store and program store for the XA-Core. A point-to-point midplane serial bus, the Extended Architecture Interconnect (XAI), provides inter-card connectivity for this architecture.

SMs provide shared memory capability for both global data store and master copy program store. A copy of program store is also cached locally on each PE. SM main memory supplies 384 MBytes of logical memory capacity. Main memory is configured as six 128 MByte memory modules. Each memory module consists of eighteen 64 Mbit synchronous dynamic random access memory (SDRAM) devices.

Input Output Processor circuit packs   The IOPs provide generic support for all input/output and mass storage requirements of the XA-Core. IOPs provide the following functionality:

- cabled interfaces, computing module interface cards, RS232/422 serial interfaces, and OC-3 interfaces in single-slot, rear-mounted IOP circuit cards

- mass storage, disk, and tape in double-slot, front-mounted IOP modules

Both the single- and double-slot IOPs provide a physical interface to the XA-Core PEs and SMs using the XAI midplane serial bus.

Extended Architecture Interconnect   The eXtended Architecture Interconnect (XAI) is a printed circuit board (PCB) midplane assembly that acts as a serial bus to provide connectivity between XA-Core circuit packs. The XAI separates the XA-Core shelf into front and rear sets of slots for circuit packs and packlets installation. Each PE, IOP, and SM connects to the XA-Core midplane serial bus through a vertical slot connector.

The XAI serial bus is a non-contact midplane that uses electromagnetic field couplers and connector pins to connect circuit packs to the midplane assembly. These couplers connect using the effect of an electromagnetic field between one pair of circuit tracks and another pair. A voltage on a transmit pair of circuit tracks induces a small voltage pulse on the receive side of another track pair. Each coupler has a small

transmitter and antenna embedded in the midplane circuit tracks. The non-contact midplane allows circuit pack insertion and removal in a live state of electrical power (see the figure below).

The eXtended Architecture Interconnect midplane

IOP circuit packs SM circuit packs PE circuit packs

○ non-contact coupling
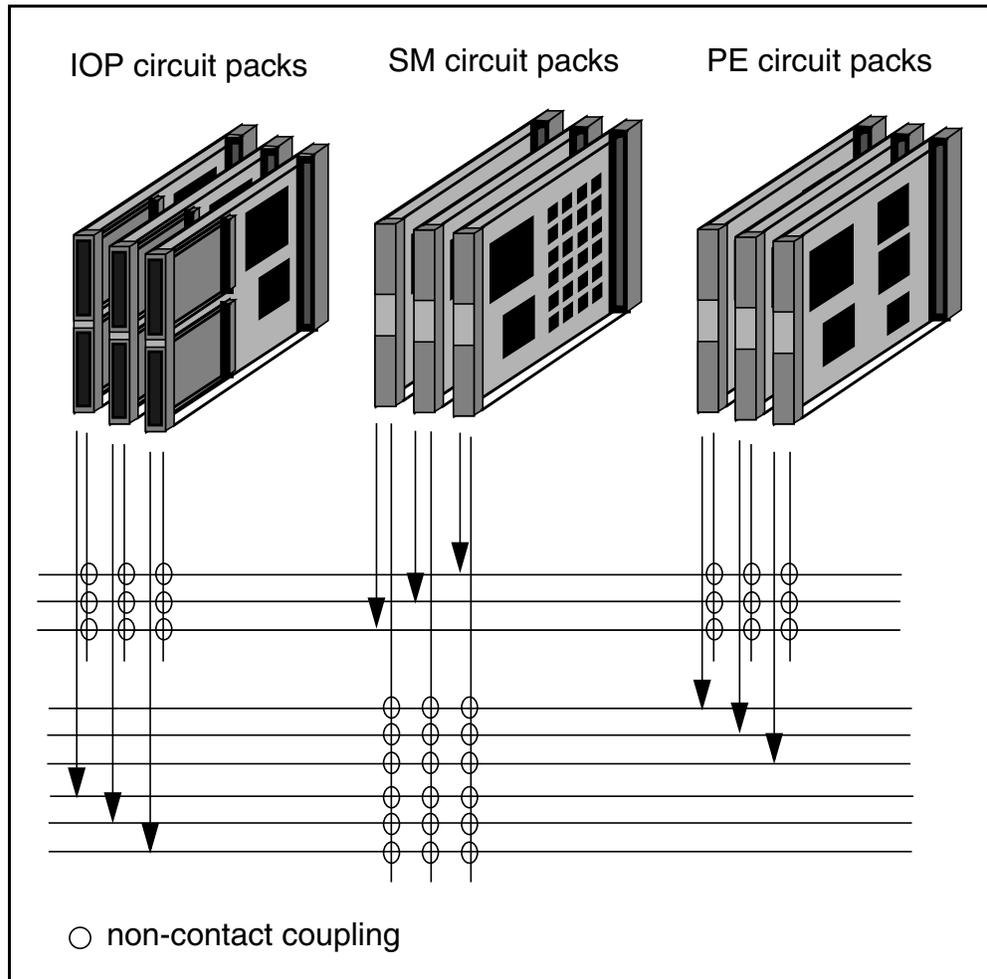
Five pulse receiver chips (PRCs) and one pulse transmitter chip (PTC) make up the electromagnetic field couplers on the bus interface. Each PRC provides a dedicated data link for two of the up to ten installed shared memory (SM) circuit packs. The chip receives four 1 GByte/sec links through the midplane from two SMs, each of which is demulti-plexed into eight 500 MByte/sec links for use by the circuit pack.

The PTC provides a dedicated data link to all installed SMs. The chip receives four 500 MBytes/sec links, which are multiplexed into two 1GByte/sec links and transmitted through the midplane to all SMs. SMs monitor all transmit links out of all installed PEs. Similarly, all transmit links out of all SM packs are monitored by all PE packs.

SMs support all communication between PEs, PEs and SMs, as well as communication between PEs, HIOPs and IOPs. An address field in each communication determines the destination for every transaction.

Operation   The XA-Core uses a scheduler to divide up the work load based on processes. When a PE becomes free, it runs the scheduler to get the next process waiting execution and then executes it until swapped out by the scheduler.

All transmit links out of a PE or IOP are monitored by all SM circuit packs, and all return links (transmit out of the SM) are monitored by all PE and IOP circuit packs. An address field in every transaction allows each pack to determine whether or not it is the destination for the transaction. All links are bit-serial, gigabit links with non-contact connections at the receive ports. This allows circuit packs to be live-inserted, and also prevents a failed receive port from potentially disabling a link that is still being shared by other circuit packs. The figure depicting the eXtended Architecture Interconnect midplane (page 10) shows how the XAI provides individual, point-to-point connections between PEs and IOPs by way of the SMs.

In the outgoing (transmit) direction, PRCs receive the XAI signals output by a pair of SMs over the midplane are received. The PRC demultiplexes the signals and outputs a PECL signal to a processor interface to gigabit interconnect (PIGI), application specific integrated circuit (ASIC). The PIGI outputs the signal received from the pulse receiver chip through the PPC bus to both PowerPC 604 processors.

In the incoming (receive) direction, the signal output by the master PowerPC 604 processor through the PPC bus is received by the PIGI. The PIGI applies XAI protocol to the received signal, checks parity and then applies the signal to a pulse transmitter chip. The pulse transmitter chip multiplexes the signal and then transmits the multiplexed XAI signal over the midplane to all shared memory circuit packs.

SMs use the principal of data ownership and mutual exclusion to allow multiple processors to execute simultaneously. Once a PE accesses a piece of data, it owns that data until it is done with it. If a second processor attempts to access that data before it has been released by the first, the SM sends a collision notification to the second processor. This notification causes the second PE to terminate the data access, abort its execution, and notify shared memory to rollback all the data to its original values. The processor returns the aborted task to the scheduler for rescheduling and re-runs the scheduler to pick up an alternate task.

Most data transfers between PEs and IOPS takes place via queues in shared memory. Because IOPs do not have matched processors as do PEs, they do not have the fault detection required to be allowed to access shared memory unchecked. To provide the necessary protection, IOPs can only write to special staging areas in shared memory. These staging areas provide a write access region IOPs. IOP write access attempts outside this region generates a fault alert. This restriction does not apply to read accesses. IOPs have global read access to any data they may need.

Circuit packs   The following table lists the baseline circuit packs that populate the XA-Core shelf.

XA-Core shelf components (Sheet 1 of 2)

PEC	Component	Comments
NTLX02CA	Processor Element	256 MByte PPC604 modules
Note: Alternatively use NTLX02DA (ATLAS PE). Do not mix PEs.		
NTLX03AB	I/O Processor 1-Slot Module	Single Width IOP (replaced by NTLX17AA)
NTLX03BB	I/O Processor 2-Slot Module	2 installed (each module supports either a Disk or DAT Drive)
NTLX04CA	High Performance I/O Processor	*Note:* 1 HIOP replaces 2 IOPs with Ethernet packlets (PEC NTLX09AA).
NTLX05AB	CMIC Packlets (OC3)	packlet (daughter board) (NTLX03AB only, replaced by NTLX17AA)
NTLX05BA	AMDI Packlets (OC3)	packlet (daughter board) (NTLX03AB only, can be replaced by NTLX04CA)
NTLX06AB	Disk Drive	8.4 GByte hard drive packlet (NTLX03BB only)
Note: Alternatively, use NTLX06AC (34.2 GBytes).		
NTLX07BA	DAT	tape drive packlet (NTLX03BB only)

XA-Core shelf components (Sheet 2 of 2)

PEC	Component	Comments
NTLX08AB	RTIF	packlet (daughter board) (NTLX03AB only, replaced by NTLX17AA)
NTLX09AA	Ethernet Packlet	packlet (daughter board) (NTLX03AB only, can be replaced by NTLX04CA)
NTLX12AA	Shelf Interface Module used in slots 03R and 16R	
NTLX14CA	Shared Memory	384 MByte modules
NTLX17AA	HCMIC Pack	Replaces NTLX03AB, NLX05AB, and NTLX08AB.
NTLX20AB	Filler-Terminator	used in otherwise empty slots to maintain cool air flow and terminate midplane bus
NTLX20BA	Filler	used in otherwise empty slots to maintain cool air flow
NT9X63AB	MS Paddleboard	E3MLIC

Refer to the *XA-Core Reference Manual*, 297-8991-810 for a detailed description of the XA-Core.

Gateway Controller
The Gateway Controller (GWC) acts as a protocol converter to create a bridge between media gateways and the call processing function provided by the CS 2000 XA-Core. To perform this function the GWC converts between proprietary Peripheral Processing Virtual Machine (PPVM) messages that the XA-Core uses and the open standard protocols that media gateways use. This conversion makes media gateways appear to the XA-Core like standard TDM call processing, messaging, and control peripherals.

   Note: GWCs allow service providers to select the most appropriate media gateways for their specific business applications.

In addition to providing an XA-Core to media gateway interface, GWCs support communication between peer communication servers. This

capability handles inter-MGC, networked calls using packet network protocols.

Protocols   The GWC supports the following protocols:

- MEGACO/H.248

- Session Initiation Protocol for Telephony (SIP-T)

- Network Control System (NCS)

- ASPEN (proprietary media gateway control protocol)

Hardware platform   The GWC is based on the Motorola MCPN750 single board computer (SBC). Two SBCs make up each GWC node. These SBCs run in hot standby mode with call information exchange to provide carrier grade reliability. The SBC cards plug into the Services Application Module (SAM) CPX8221 compact personal computer interface (cPCI) chassis. This 21-slot chassis is referred to as the SAM21.

The GWC circuit cards host the gateway controller software that, together with the XA-Core, provide the CS 2000 with its media gateway controller (MGC) functionality. Processing capacity is scalable by adding GWC circuit card pairs.

Refer to the *Gateway Controller* and *Services Application Module* menu items for more information about the hardware that supports the GWC.

Message Switch
The message switch (MS) is a communications bus that provides peer to peer messaging between the distributed CS 2000 components. The MS is made up of two identical load sharing planes (MS 0 and MS 1). Each MS plane provides a system clock and supports the full internal CS 2000 messaging load.

Refer to *Hardware Description Manual*, 297-8991-805 for more information about the message switch.

Fiberized Link Peripheral Processor
The CS 2000 fiberized link peripheral processor (FLPP) includes the following components:

- up to three link interface shelves (LIS) that each support up to 12 slot-mounted CCS7 link interface units (LIU7)

- a link interface module (LIM) that includes two load-sharing local message switches (LMS).

- F-buses that support direct high-speed communication between CCS7 link interface units

The CCS7 link interface units (LIU7) within the FLPP use SR 128 sub-rate fiber links to connect the CS 2000 to the SS7 network. These links provide a V.35 interface to an CCS7 signaling multiplexer. Each interface can support three 64 kbps SS7 links.

FLPPs also support TCP/IP over Ethernet links that comply with IEEE 802.3.

Refer to *Hardware Description Manual*, 297-8991-805 for more information about the fiberized link peripheral processor.

Auxiliary Components
The following table lists the auxiliary hardware that supports the principal CS 2000 components.

Auxiliary hardware components

| Description	PEC
XA-Core SuperNode Cabinet	NTLX01AA
Cabinetized Power Distribution Center	NTRX31
Cabinetized Miscellaneous Equipment Cabinet	NTRX34
Cabinetized Miscellaneous Spares Storage	NTRX49

XA-Core SuperNode Cabinet
The XA-Core SuperNode cabinet provides the housing for the frame supervisory panel (FSP), two message switch (MS) shelves, one filler shelf, a standard XA-Core shelf, and a high capacity cooling unit (CU). The following table lists the components contained in the XA-Core

SuperNode cabinet. The block diagram following this table depicts the XA-Core SuperNode cabinet and its components.

XA-Core SuperNode cabinet components

Qty	PEC	Description	Provisioning Rule
1	NT9X03AA	Frame supervisory panel	48V office
1	NT9X03BA	Frame supervisory panel	60V office
2	NT9X0440	Message switch	Always provided
1	NT0X24BD	Filler shelf assembly	Always provided
1	NTLX0101	XA-Core shelf assembly	Always provided
1	NTLX10AA	High capacity cooling unit	Always provided

XA-Core and Message Switch in a SuperNode cabinet
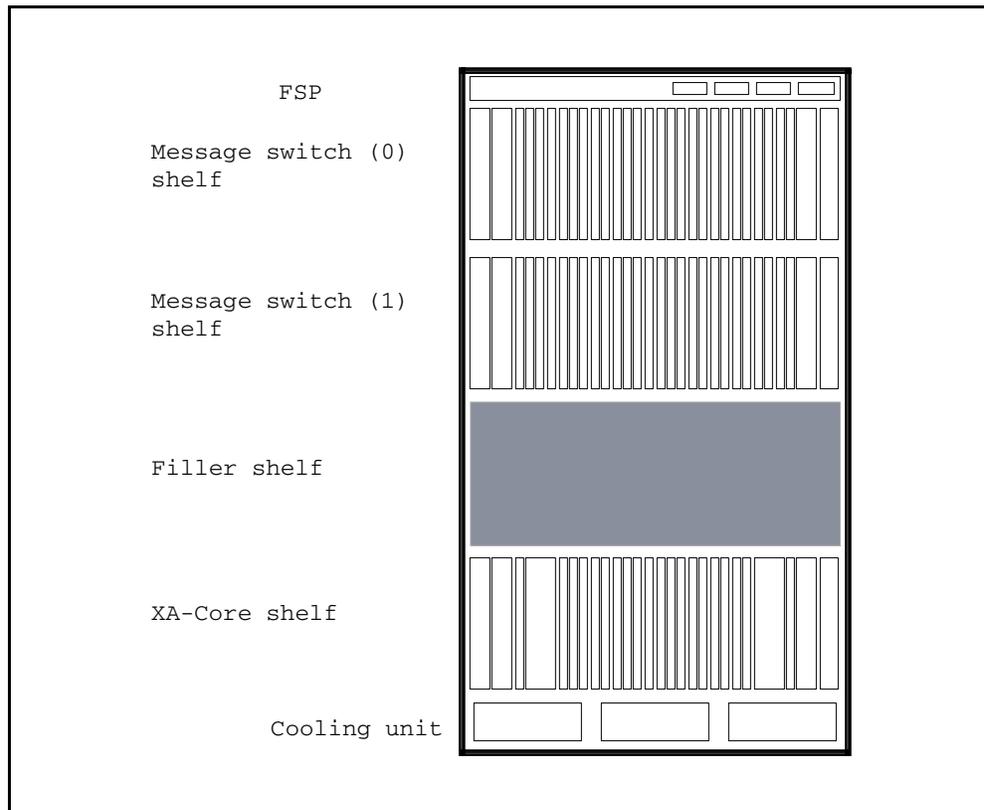
Cabinetized Power Distribution Center

The cabinetized power distribution center (CPDC) is a single cabinet that distributes power to the cabinets in a lineup. The CPDC provides D.C. power distribution and protection and optional inverted ac power for endguard outlets. The CPDC is the first cabinet in a lineup of a maximum of 11 cabinets.

The CPDC acts as the interface between equipment lineups and the OAU. The office alarm unit (OAU) provides alarm control. The OAU is in the first cabinetized trunk module equipment (CTME).

Cabinetized Miscellaneous Equipment Cabinet

The cabinetized miscellaneous equipment cabinet (CMIS) performs the same functions as the miscellaneous equipment frame.

The CMIS is provisionable. A customer can select from a list of equipment types. The Frame supervisory panel (FSP) and cooling unit are required at the top and bottom of the CMIS. The FSP and cooling unit are not required when the CMIS functions as an intermediate distribution frame.

Cabinetized Miscellaneous Spares Storage

The cabinetized miscellaneous spares storage (CMSS) can be provisioned with shelves and shelf inserts. The shelves and shelf inserts provide storage for circuit packs and a utility tray for technician tools. The CMSS provides framework, hardware, and ground braid assembly.

Refer to the *Hardware Description Manual*, 297-8991-805 for more information about these auxiliary hardware components.

Core Components from the Time Division Multiplex Suite

The principal CS 2000 components interwork with selected time division multiplex core (TDM-Core) components in Succession solutions. The following table lists the TDM-Core components that interwork with CS 2000 in Succession solutions that support AAL1 based packet networks.

Time division multiplex core components

Description	PEC
Enhanced Network	NT9X05
Cabinetized Integrated Services Module	NTFX40
Interworking Spectrum Peripheral Module	NTLX51

Time division multiplex core components

Description	PEC
spectrum peripheral module (SPM)	TBD
digital trunk controller (DTC)	TBD

Enhanced Network

The enhanced network (ENET) is a fully duplicated constant bit rate network that performs TDM call switching. CS 2000 interworks with an ENET that has two pairs of shelves that are divided between plane 0 and plane. The ENET supports direct message flow between TDM components by concentrating and distributing messages.

Refer to the *Hardware Description Manual*, 297-8991-805 for more information about the ENET.

Cabinetized Integrated Services Module

The CISM supports up to four enhanced integrated service module (ISME) shelves and a cooling unit shelf. The modular supervisory panel (MSP) provides power and control for this hardware.

Refer to the *Hardware Description Manual*, 297-8991-805 for more information about the CISM.

Interworking Spectrum Peripheral Module

The interworking spectrum peripheral module (IW-SPM) acts as a bridge between the TDM-Core ENET (using a DS512 connection) and the ATM network (using an OC-3c connection). This bridge functionality provides end-to-end connectivity between DTC or SPM TDM interoffice trunks and MG 4000 trunks. Bridging also provides MG 4000 trunks with the ability to connect to ENET-based integrated service modules (ISM) for tones and DRAM-based announcements.

The IW-SPM performs the following primary functions:

- collects and grooms TDM trunk traffic onto the ATM backbone
- extends TDM trunk services supported by DMS type telephony switches to TDM trunks that terminate at the CS 2000
- provides backbone level announcements to end users

Refer to the *IW SPM VToA Local Tandem Customer Information Guide*, 297-1771-903, or the *IW SPM VToA Long Distance Customer Information Guide*, 297-1771-904, for more information.

Hardware Baseline

The following table lists the CS 2000 hardware baseline by individual PECs:

Hardware baselines

Description	PEC	Baseline
XA-Core PE	NTLX02	CA
SAM Frame	NTRX51	HA
SAM21 (for GWC)	NTRX51	FE
MS	NT9X63	AB
FLPP Model	NTNT02	AA
ENET	NT9X05	AD
CPDC	NTRX31	CA
CISM	NTFX40	AA
CMIS	NTRX56	AA
CMSS	NTRX49	BA

Software

Communication Server 2000 (CS 2000) software is a layered product. Each layer has defined ownership, clear functionality, and specified inter-layer dependencies. This structure allows software development to proceed independently for different parts of the system.

The overall CS 2000 software load consists of Development Release Units (DRUs) and software libraries. A DRU can be a complete software layer or part of a set of integrated software within a layer. Software libraries are collections of self-contained software components that products use on an as required basis.

Note: A single DRU cannot cross over different software layers.

The CS 2000 software load lineup consists of the following loads:

- Computing module software

- Signaling peripheral software

- Miscellaneous component software

- Operations, administration, maintenance and provisioning software
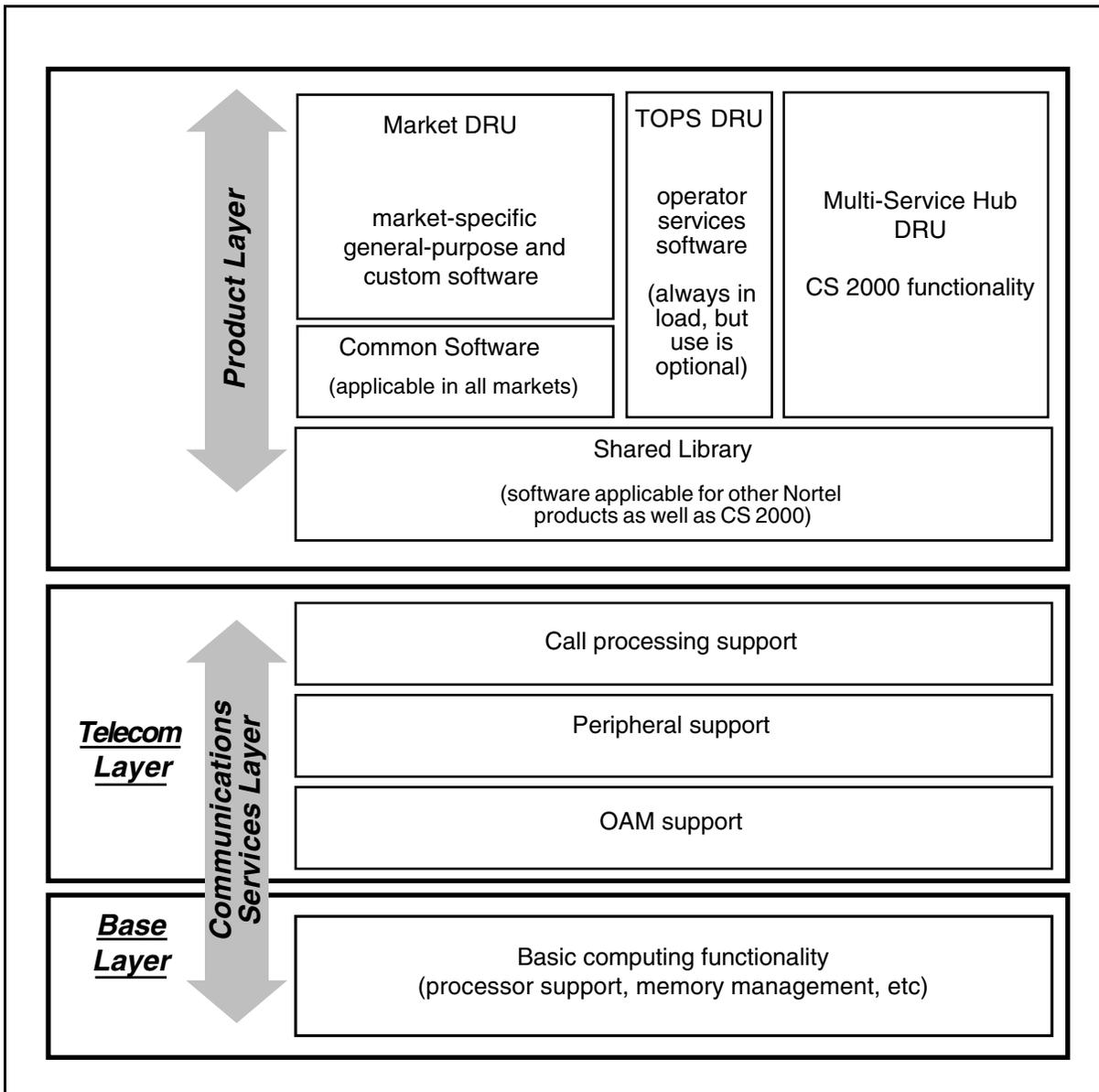
Computing Module Software

The following layers make up the main XA-Core software load:

- Base - provides basic computing functions such as processing, memory management and hardware diagnostics.

- Telecom - supports the peripheral types used by CS 2000 and provides call processing support functions such as translations and routing.

- Product - supports call processing applications and services by means of reusable software objects and generic agents. The Product Layer also includes any market-specific software required to customize CS 2000 for use in a particular market.

Together, the Base and Telecom layer (Base/TL) software provide the Communications Services Platform (CSP) layer.

The following figure shows the structure of the delivery requirement units (DRU) that form the communication services platform and product layers of the XA-Core software.

Computing module (XA-Core) software layers

<table>
<tr>
<td rowspan="2">Product Layer ↕</td>
<td colspan="3">

Market DRU

market-specific general-purpose and custom software

Common Software

(applicable in all markets)
</td>
</tr>
</table>

	Market DRU market-specific general-purpose and custom software Common Software (applicable in all markets)	TOPS DRU operator services software (always in load, but use is optional)	Multi-Service Hub DRU CS 2000 functionality

Shared Library

(software applicable for other Nortel products as well as CS 2000)

Telecom Layer / *Communications Services Layer*

Call processing support

Peripheral support

OAM support

Base Layer

Basic computing functionality
(processor support, memory management, etc)

Signaling Peripheral Software

The CS 2000 uses a fiberized link peripheral processor (FLPP) to interface with the CCS7 signaling network. The FLPP software load includes software for the link interface modules (LIM) and the CCS7 link interface units (LIU7).

The following table lists the peripheral software loads.

Signaling peripheral software loads

Component	Software load	Ordering code
LPP (LIM)	LPC20CQ	LPC20CQ.TL20
LIU7 (32 MByte)	LTS20CU	LTS20CU.CNA20

Miscellaneous Component Software

Miscellaneous component software supports the following CS 2000 communication facilities:

- the XA-Core IOP connection to the Ethernet LAN

- the message switch connection to TDM-Core components

- Input Output Module (IOM) connection to operational support systems (OSS)

The table below shows the software loads that support this communication.
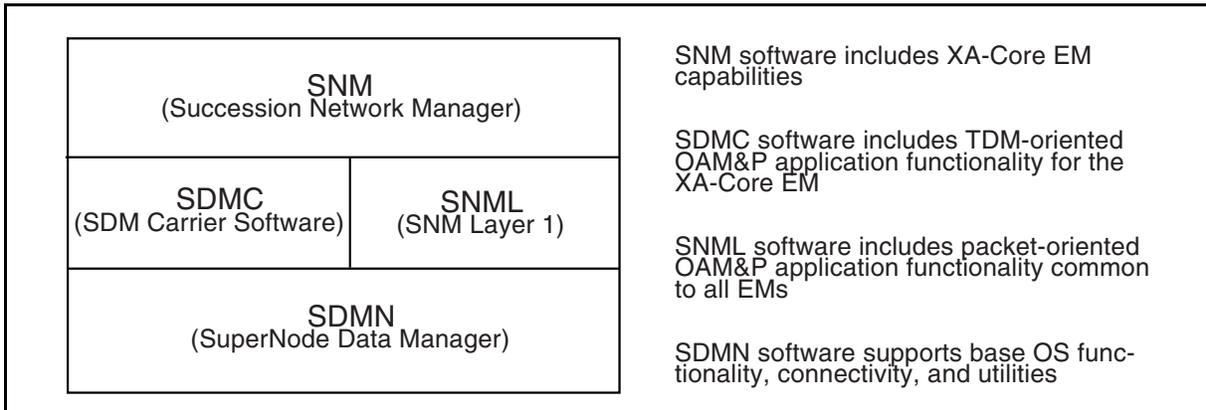
Miscellaneous component software loads

Component	Software load	Ordering code
6X17BA Ethernet packlet for IOP	EP14DO03	NA
DMS-Bus (Port Card)	MPF20CQ	MPF20CQ.TL20

Operations, Administration, Maintenance, and Provisioning Software

Preside Management for Succession Solutions (Preside MSS) provides CS 2000 with its operations, administration, maintenance and provisioning (OAM&P) capabilities. Preside MSS is a collection of applications that run on a variety of hardware platforms to deliver both element management (EM) and domain management capabilities.

The XA-Core element manager runs on the CS 2000 Core Manager platform. The following figure shows the layered and partitioned network management software load that is installed on the CS 2000 Core Manager hardware platform to support the XA-Core EM.

Structure of the CS 2000 Core Manager software load

SNM (Succession Network Manager)	SNM software includes XA-Core EM capabilities
SDMC (SDM Carrier Software) / **SNML** (SNM Layer 1)	SDMC software includes TDM-oriented OAM&P application functionality for the XA-Core EM
	SNML software includes packet-oriented OAM&P application functionality common to all EMs
SDMN (SuperNode Data Manager)	SDMN software supports base OS functionality, connectivity, and utilities

Refer to the *CS 2000 Core Manager Product Overview* for more information about the functionality included its software load.

Software Load Lineup

The following table lists the CS 2000 software load lineup for the Wireline Universal Packet Access Solution for IP networks. Contact Global Customer Services at Nortel Networks to verify that this list contains the current versions of the software.

CS 2000 software load lineup (Sheet 1 of 2)

Load	Version	Ordering code
PCL (Core Load)	PSNNC07	SN000007
PCL MMP/GMP/ISN (Core Load)	PSNGCSC07	SG000007
PCLMMP/ISN (Core Load)	PSNWC07	SW000007
PPL (Peripheral Lineup - Int'l)	PLLT20	PSNW0007
PPL (Peripheral Lineup - NA)	PLLT20	PLLT0020
IOP Firmware	XAIO01AK	XAIO01AK
Ethernet Packlet Firmware	EP14DO03	EP14DO03
HIOP Firmware (ROM) NTLX04AA and NTLX04BA NTLX04CA	XHIO02AA XHIO02AH	XHIO02AA_224_upgr.TL18 XHIO02AH_484_upgr.TL19
HIOP Firmware (RAM)	XHIO03AC	XHIO03AC_143_idll.TL20

CS 2000 software load lineup (Sheet 2 of 2)

Load	Version	Ordering code
HCMIC (NTLX17AA)	XREC01DE	XREC01DE_203_pkg.TL20
PE Firmware	XAPE01AG	XAPE01AG
Atlas PE Firmware (ROM)	XAPE02AB	XAPE02AB-396.TL17
NRL (Commissioning Tools)	INST0020	INST0020
Int'l NRL	NSW00007	NSW00007
MUL (MS Load)	MUC20	MUC00020
SAM21 Platform	SCU10	SAM20070 - NA SAM2M0070 - Intl
GC070 (GN070 Load)[a]	GC070	GWC00070
GC070 (GCI070 Load)[b]	GC070	GWCW0070
GC070 Firmware (NA)[c]	SCU10	SAM20070
GC070 Firmware (Intl)[d]	SCU10	SAM2M0070

a.Previously GWC and PGC loads.
b.Previosly International PGT load.
c.Delivered on the SAM21 load.
d.Delivered on the SAM21 load.

Software Inventory Manager

The software inventory manager (SWIM) provides a user friendly interface to simplify the installation and upgrade of CS 2000 software. This interface allows users to do the following:

- view information about the current version and state of CS 2000 filesets
- set installation preferences
- install new filesets
- install bundles

> *Note:* Bundles are groups of related or interdependent filesets.

- patch installed filesets
- remove patches and restore previous fileset version

- remove filesets
- free up hard disk space by removing archives

    Note: An archived fileset cannot be restored after removal.

- execute configuration scripts that require user input to complete software installation
- access SWIM commands from a remote terminal
- obtain context sensitive help for SWIM commands
- view software maintenance history information

Management Files
The following files interact with SWIM:

- history files
- log files
- application configuration scripts

History files   Each time a user attempts to apply, remove, or commit a SWIM function, the software inventory manager creates a history entry in these files. The history file contains a maximum of 200 entries. The `/var/adm/swm` directory contains the history files.

Log files   When a SWIM **installp** occurs the software inventory manager creates a log that records the results of the function. The `/var/adm/swm` directory contains the log files.

Application configuration scripts   The application developer installs the configuration program that SWIM accesses. This program executes automatically after an install, or manually to support platform reconfiguration.

Modes of operation
The software inventory manager runs in read-only and full-functions modes.

Read-only mode   The read-only mode allows the user to view the current CS 2000 fileset versions and states. Users can also use this mode to view history information for filesets. When CS 2000 is running in split mode only the SYSOLD side has access to read-only functionality.

Full-function mode   Full-function mode is restricted to a root user. This mode gives the user access to all SWIM functions. When CS 2000

is running in split mode only the SYSNEW side has access to full functionality.

Software Ordering

Customer orders for software route from the Software Load Information Database through the Schedule Transaction Absorption Rebroadcasting (STAR) system. This process uses the Galaxy tool to determine whether or not software delivery can use the Customer Access Network.

Galaxy makes automated, intelligent routing decisions based on the size of the load for delivery and the capacity of the network link to the customer. Galaxy can also select alternate routes for delivery when the primary link is not functioning.

Software Optionality Control

Software optionality control (SOC) of "Right To Use" controls access to subsets of the software feature set.

Software Delivery

Software packaging, ordering, and delivery for CS 2000 comply with the standards, processes, and procedures that Nortel Networks currently uses for the DMS, CS 2000 Core Manager, and SPM product groups. Digital Audio Tapes (DAT) provide the software required for initial commissioning. The Customer Access Network delivers software for upgrades, patches, and maintenance loads. Customers require a contact email address so that they receive timely alerts about new software loads.

Electronic Connectivity Between Nortel Networks and Customers

The Nortel Networks Global Solutions (NGS) team manages electronic connectivity to customer access facilities. NGS operates worldwide extranets known as the Customer Access Network (CAN) that external partners access using dialup or leased facilities. The CAN has analog and ISDN dialup service and shared Frame Relay (V.35), X25, or T1 service. The delivery of CS 2000 software requires a minimum throughput of a T1 or better service.

External drop boxes can either exist on the CAN or on a wide area network maintained by the customer. This drop box requires a minimum of 5 GBytes of disk space and the server must comply with Nortel Networks and customer network security requirements.

Release Notes and other documentation are delivered with software in portable documentation file (PDF) format as required. The customer is

responsible for making hard copies or otherwise ensuring that the users of the document receive a copy in the format they require.

Electronic Connectivity Between Succession Portfolio Elements

CS 2000 supports connectivity between all Succession portfolio components for end-to-end software delivery using XA-Core Ethernet connections and the message switch. Product computing module load (PCL) and non-computing module load (NCL) files reside on the XA-Core hard disk ready for installation or distribution as required.

Tracking of Software Ordering and Delivery

The software delivery process uses the Software Load Information Database (SOLID) application for ordering and tracking software loads. SOLID also manages feature dependencies and maintains records of software delivered to the customer network.

Customer Regulatory, Tax, and Contractual Considerations

Customers are responsible for all regulatory, tax, and contractual obligations associated with the electronic distribution of software. In some locations electronically delivered software is exempt from sales tax. Customers ordering in tax exempt jurisdictions must be prepared to accept an invoice from Nortel Networks where certain line items have no sales tax applied. Customers assume the responsibility of remitting non-collected taxes if such line items become taxable after delivery. This situation can occur if a portfolio element is moved to a non-tax exempt location.

Software Maintainability

Succession portfolio network elements comply with the same standard processes used by the DMS family of switches and their peripherals for the application of patches.

Operations, Administration, Maintenance, and Provisioning

CS 2000 uses a dedicated operations, administration, maintenance, and provisioning (OAM&P) network for fault, configuration, accounting, performance, and security (FCAPS) management. This OAM&P system implements the following design principles:

- a clear functional separation between:
  - interface specific adaptation and interface independent management
  - element and network management

- element specific development that uses uniform, standardized interfaces between element managers and:
  - network elements
  - element manager clients

- optimized scalability by:
  - delegating management functionality from the network manager to the appropriate element manager or network element wherever possible
  - designing for distribution of functionality across multiple computing platforms

- optimized reliability by replicating functionality across multiple computing platforms

- optimized time-to-market, sustainability, flexibility, feature richness, and product cost by using third party software as appropriate

These design principles make full use of industry standard technology enablers including advanced applications for the automatic detection, provisioning, configuration, and self-healing of network resources.

System Architecture

The following block diagram shows the OAM&P system architecture.

OAM&P architecture
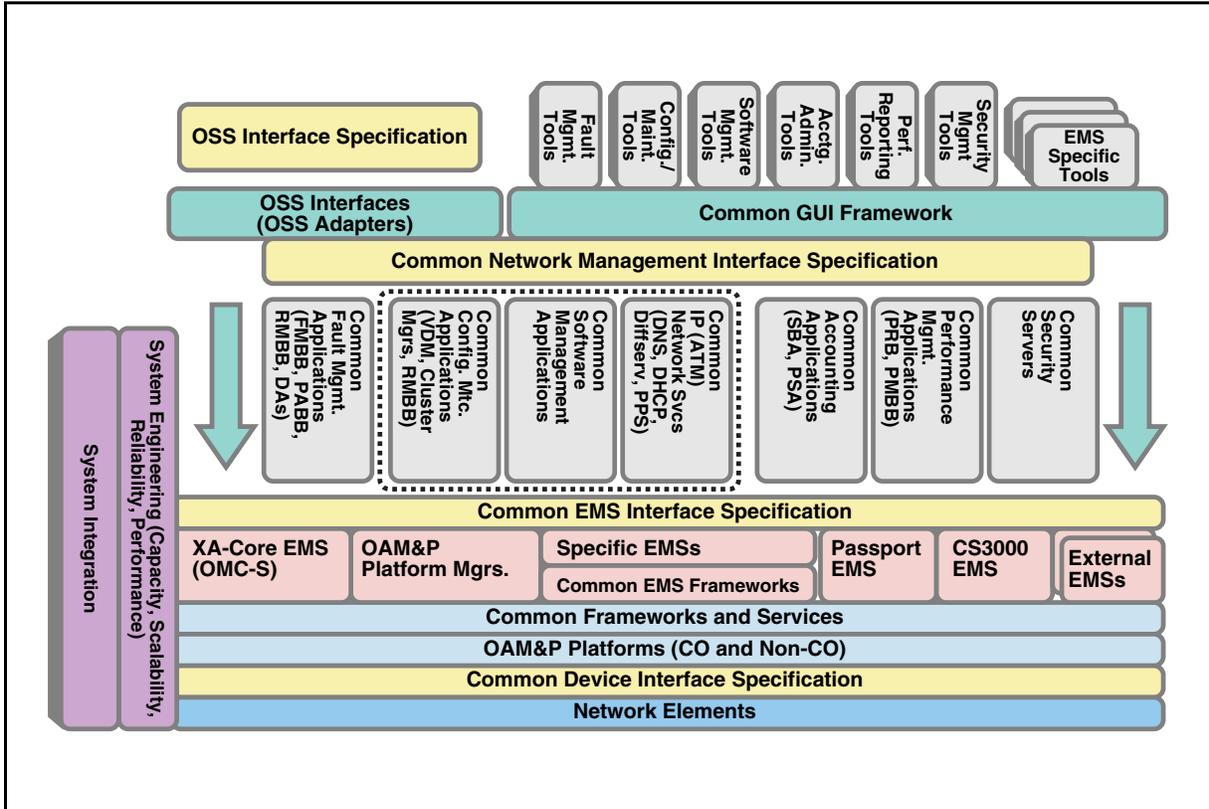
OAM&P architecture supports the International Telecommunications Union (ITU) M.3400 specification for the Telecommunications Management Network (TMN) model. The TMN model categorizes all management data exchanges between network elements into one of the following five functional areas:

- fault management and prevention (F)
- configuration and provisioning (C)

    Note: Succession solutions treat upgrades as a sub-category of configuration and provisioning.

- accounting management (A)
- performance and traffic management (P)
- security and administration management (S)

    Note: The acronym FCAPS represents these five TMN model categories.

The following interfaces and protocols support this FCAPS categorization:

- the Nortel Networks proprietary operations support systems data interface (OSSDI) protocol
- the Nortel Networks proprietary frame transport system (FTS)
- the IETF BOOTP protocol
- the IETF trivial file transfer protocol (TFTP)
- the IETF file transfer protocol (FTP)
- the IETF Telnet standard

Operations Support System Data Interface Protocol
The OSSDI is a Nortel Networks proprietary protocol that supports the following:

- retrieving and setting configuration and provisioning parameter requests from CS 2000 Core Manager applications to the DMS data management (DDMS) system
- responses from the DDMS to the CS 2000 Core Manager
- notification from the DDMS when the CS 2000 Core Manager detects the addition or deletion of a network element

Frame Transport System
The FTS is a Nortel Networks proprietary standard that transfers OAM&P data over the OAM&P network using UDP/IP.

BOOTP
BOOTP is the Internet Engineering Task Force (IETF) standard that Succession solutions use to broadcast the media access control (MAC) address for media gateways connected to a CS 2000. The CS 2000 associates this MAC address with an IP address and uses TFTP to transmit this information to the media gateway along with its Initial Build Load (IBL).

Trivial File Transfer Protocol
TFTP is the IETF standard that CS 2000 uses to transfer the IBLs to common equipment modules (CEM) following the discovery of media gateways.

File Transfer Protocol
FTP is the IETF standard that CS 2000 Core Manager uses to transfer software from an OSS.

Telnet
Telnet is the IETF standard that provides remote access to the CS 2000 Core Manager.

Management Tasks
The CS 2000 Core Manager performs all OAM&P FCAPS tasks for the CS 2000. Normally, CS 2000 Core Manager software applications access and manage OAM&P data from the MAP terminal.

Fault Management and Prevention
Preside MSS MDM collects fault and alarm data from the network routers and switches and forwards it to the CS 2000. CS 2000 collates XA-Core fault management and alarm data with the Preside MSS MDM data and network element data received over the OAM&P network and sends it to the CS 2000 Core Manager. The CS 2000 Core Manager routes this data to the OSS.

The MAP terminal provides command line user access to this collated data.

Configuration and Provisioning
The MAP command interface and table editor access the DDMS to support CS 2000, CS 2000 Core Manager, and media gateway configuration and provisioning.

Accounting Management
CS 2000 software includes the capability to gather billing and accounting information. The CS 2000 Core Manager SuperNode Billing Application (SBA) collects this billing and accounting data and transfers it to the OSS as Automatic Message Accounting (AMA) or Call Detail Reporting (CDR) billing records.

Performance and Traffic Management
The CS 2000 receives operation measurements (OM) from network elements over the OAM&P network. CS 2000 transfers these OMs to the CS 2000 Core Manager according to instructions configured in the operational measurement data delivery (OMDD) application. The MDM forwards network performance management (PM) data to the CS 2000 Core Manager.

The OMDD application formats OM and PM data in comma separate value (CSV) format and provides a scheduler for the transfer of CSV data files to OSSs. The CS 2000 Core Manager can also transfer XA-Core data in TR470 format using the Engineering and Administrative Data Acquisition System (EADAS) interface upon request.

The CS 2000 Core Manager Event Browser also provides access to OM data.

Security and Administrative Management
Distributed computing environment (DCE) security services support CS 2000 Core Manager applications. PC clients can also use Enhanced Terminal Access (ETA) or Secure File Transfer (SFT).

The Network User Administration (NUA) database, including client changes to it, uses DCE. DCE security services also support Event Record Manager (ERM) integration of OMs, OSS test tools, and command line user interfaces.

CS 2000 manages software loads for itself, the CS 2000 Core Manager, and Succession network elements using the OAM&P network. CS 2000 manages software loads for the TDM-Core using the ENET.

Interfaces

CS 2000 uses two broad categories of interfaces: signaling interfaces that support the exchange of information across networks; and, user interfaces that support user interaction with network elements.

Signaling Interfaces

CS 2000 supports signaling interfaces to:

- internet packet networks

- public switched telephone network (PSTN) constant bit rate networks

- common channel signaling system seven (CCS7) networks

- intelligent network services including:

    — Advanced Intelligent Networks (AIN)

    — Carrier Advanced Intelligent Networks (CAIN)

- management networks that use Preside Management for Succession Solutions (Preside MSS)

Signaling types

CS 2000 uses the following types of signaling to support network interfaces.

- access signaling including:

    — media control signaling that allows the CS 2000 to control the characteristics of the packet network bearer path

    — call control signaling that allows CS 2000 to setup and teardown connections across interfaces outside North America that do not use the CCS7 network, for example ISUP PRI calls.

- audio control signaling

    — provides CS 2000 with a communication path to the Universal Audio Server (UAS)

- network signaling

    — supports communication between peer media gateway controllers (MGC) across packet networks.

- management signaling

    — session description signaling that specifies bearer path capabilities for access, audio control, and network signaling
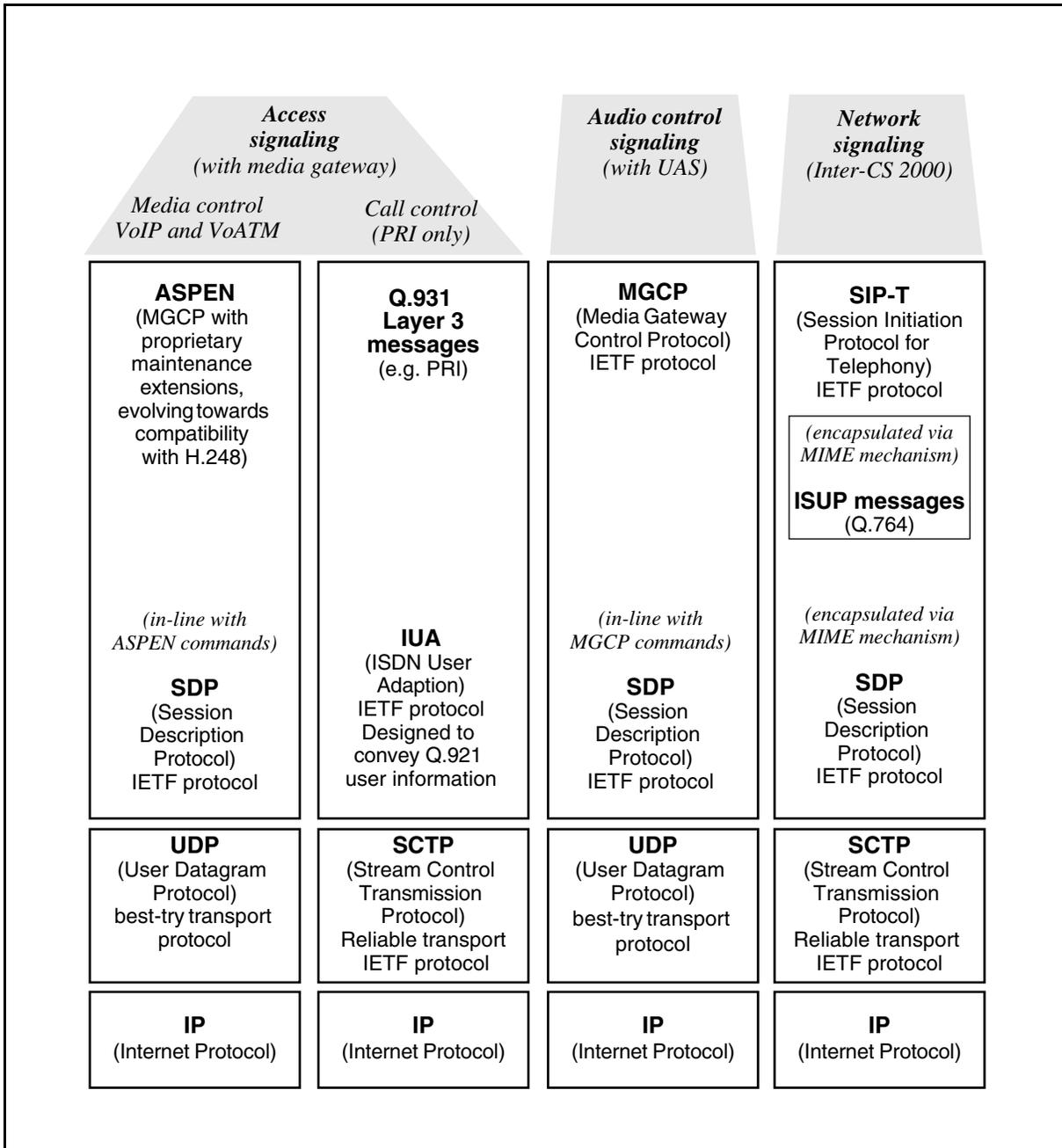
        Example
        Session Description Protocol (SDP) and ISDN User Adaptation (IUA).

— transport signaling reliably transfers access, audio control, and network signaling across the packet network
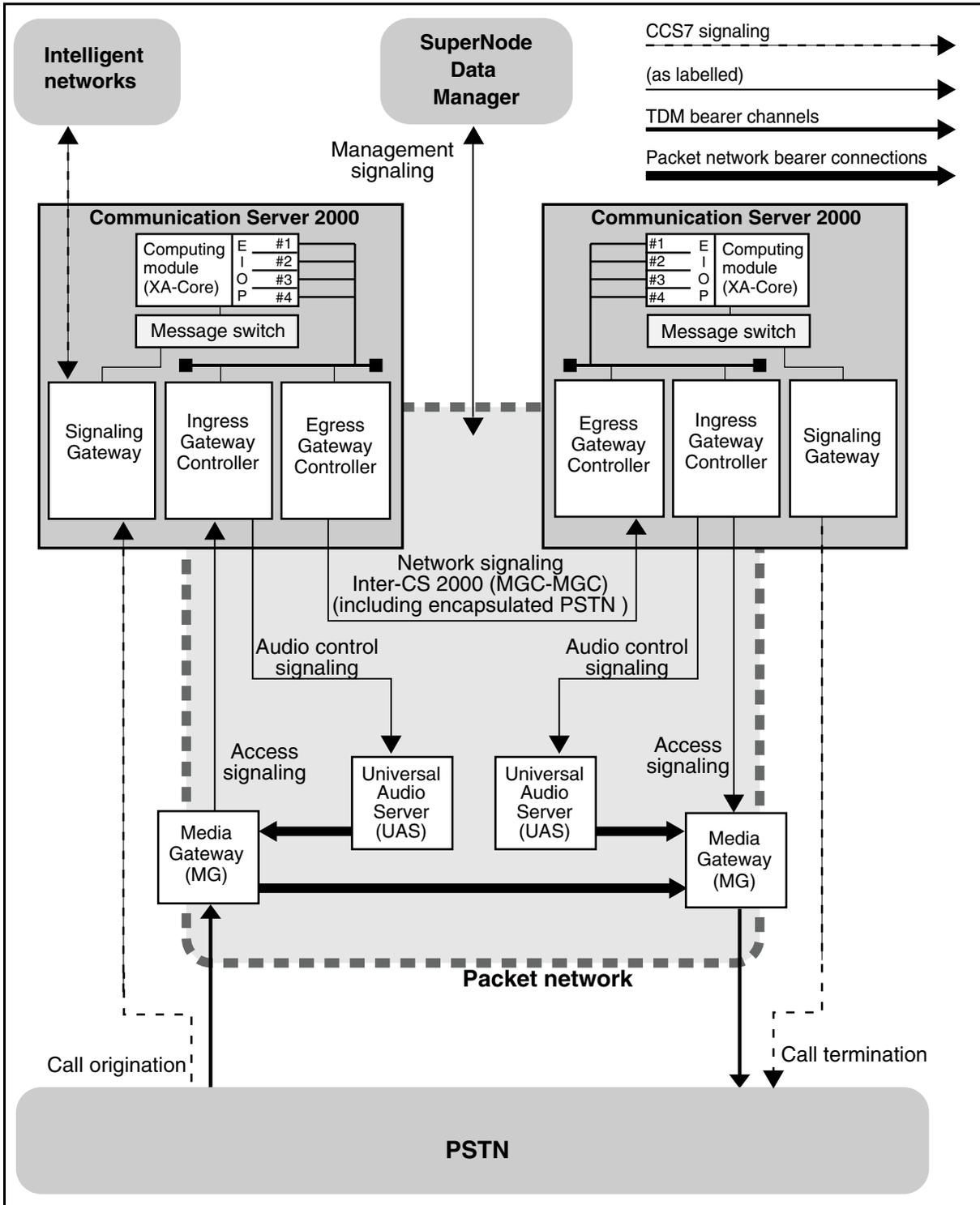
Example
User Datagram Protocol (UDP) and Stream Control Transmission Protocol (SCTP)

Protocol stacks for packet network signaling

Access signaling (with media gateway)		Audio control signaling (with UAS)	Network signaling (Inter-CS 2000)
Media control VoIP and VoATM	Call control (PRI only)		
ASPEN (MGCP with proprietary maintenance extensions, evolving towards compatibility with H.248)	**Q.931 Layer 3 messages** (e.g. PRI)	**MGCP** (Media Gateway Control Protocol) IETF protocol	**SIP-T** (Session Initiation Protocol for Telephony) IETF protocol
			(encapsulated via MIME mechanism) **ISUP messages** (Q.764)
(in-line with ASPEN commands) **SDP** (Session Description Protocol) IETF protocol	**IUA** (ISDN User Adaption) IETF protocol Designed to convey Q.921 user information	*(in-line with MGCP commands)* **SDP** (Session Description Protocol) IETF protocol	*(encapsulated via MIME mechanism)* **SDP** (Session Description Protocol) IETF protocol
UDP (User Datagram Protocol) best-try transport protocol	**SCTP** (Stream Control Transmission Protocol) Reliable transport IETF protocol	**UDP** (User Datagram Protocol) best-try transport protocol	**SCTP** (Stream Control Transmission Protocol) Reliable transport IETF protocol
IP (Internet Protocol)	**IP** (Internet Protocol)	**IP** (Internet Protocol)	**IP** (Internet Protocol)

CS 2000 signaling

Note: Arrows indicate flow from originating to terminating agent.

Access Signaling

The communication protocol for access signaling and information exchange between the CS 2000 and the media gateways supports the following requirement set:

- call processing including:
  - — resource reservation
  - — connection requirements
  - — media transformations
  - — signal (event) processing and scripting
  - — quality of service (QoS)
  - — class of service (CoS)
  - — test support
  - — accounting
  - — signaling control
- resource control including:
  - — resource status management
  - — resource alignment
- operational and management requirements including:
  - — assurance of control and connectivity
  - — error control
  - — management information base (MIB)
  - — association requirements between the media gateway and media gateway controller
  - — performance requirements
- transport requirements including underlying network assumptions
- security
- media specific requirements including addressing
- application specific requirements including:
  - — access gateway requirements
  - — lines gateway requirements
  - — trunking gateway requirements
  - — multimedia gateway requirements
  - — restricted access gateway requirements
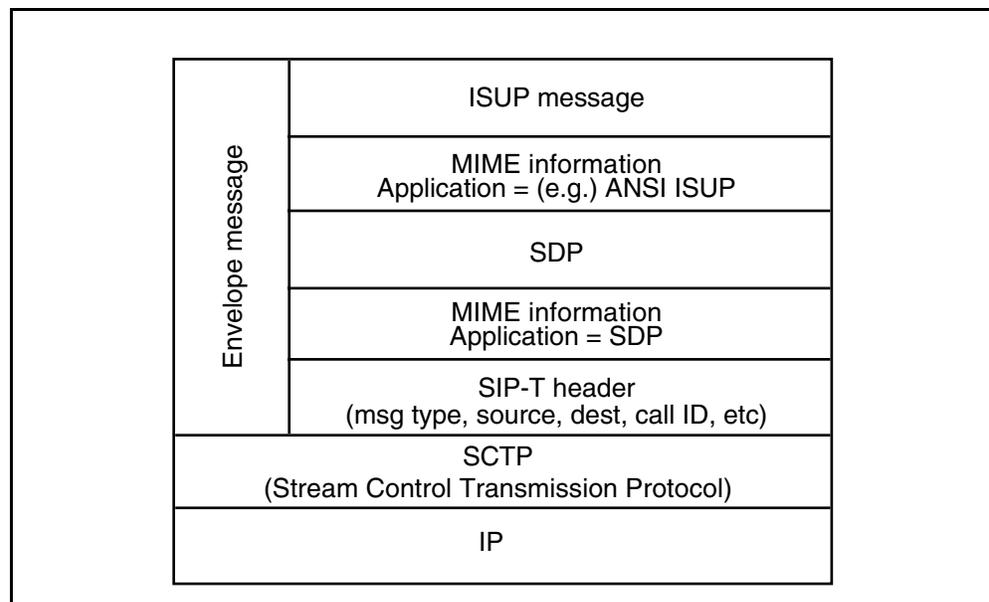
Network Signaling

SIP-T supports communication between peer communication servers by encapsulating and transparently conveying SS7 signaling and complementary session description protocol (SDP) session descriptions using Multipurpose Internet Mail Extension (MIME) mechanism. CS 2000 uses SIP-T to negotiate connections between media gateways and communicate the following information between media gateway controllers:

- SIP header that contains the transport address of the endpoints; for example, the IP address and UDP port

- complete PSTN user part message encapsulated in SIP-T message body for signaling information

- session description protocol (SDP) messages conveying connectivity and media stream information

SIP establishes and maintains session level information that includes the identification of call participants and media types. Because this protocol does not depend on the session it creates, modifies, or terminates, SIP can establish single- or multi-media sessions between two or more participants. SIP for telephony (SIP-T) allows SIP to support PSTN transparency of SS7 signaling across Succession networks.

The following figure shows how the CS 2000 SIP-T message structure transports SS7 messages as payload between communication servers.

CS 2000 SIP-T message structure

Envelope message	ISUP message
	MIME information Application = (e.g.) ANSI ISUP
	SDP
	MIME information Application = SDP
	SIP-T header (msg type, source, dest, call ID, etc)
SCTP (Stream Control Transmission Protocol)	
IP	

Protocol Overview   SIP for telephony (SIP-T) contains the enhancements to SIP found in a number of internet draft documents under development by the IETF. The Nortel Networks implementation of SIP-T modifies or extends the following areas of the SIP-T draft specification to support carrier grade requirements:

- Reliability

- Proxy Servers

- Transport of SS7 protocols

- Message format restrictions

- Addressing scheme

- Trunk Group characteristics

- Bearer Path manipulation

- SIP-T protocol versioning

Reliability   The CS 2000 implementation of SIP-T uses Stream Control Transmission Protocol (SCTP) to provide reliable ordered transport for SIP-T messaging. As a result, CS 2000 does not use the reliability mechanisms that the IETF request for comment (RFC), numbered 2543 RFC 2543), defines for SIP.

Proxy Servers   Succession solutions do not require SIP proxy servers to carry PSTN information transparently over packet networks. CS 2000 does not use proxy servers with the SIP-T protocol nor any of the IETF SIP messages or headers related to proxies.

Transport of SS7 protocols   CS 2000 uses SIP-T to transport SS7 messages between communication servers. CS 2000 does not support calls to or from user agent clients or servers that do not transport SS7 messages using SIP-T.

Message format restrictions   Nortel Networks sets format and length restrictions for the SIP message and parameter definitions that RFC2543 describes. These restrictions support the capacity and performance requirements of large scale media gateway controllers. See Message formats for more information about these restrictions.

Addressing scheme   The SS7 payload of the SIP-T message contains the details of the originating and terminating call agents. No benefit arises from mapping the calling or called party number to the TO or FROM headers of the Uniform Resource Indicator (URI) for the SIP Request. The hostnames for the media gateway controllers within the Succession network provide the only information required by the SIP-T addressing scheme.

Trunk Group characteristics   SS7 based telephony networks provide network nodes with a large amount of information about each trunk. These networks provide this information statically, through provisioning and matching the connection identification code (CIC) of the trunk. Alternatively, they can provide this information within the ISUP message itself using protocol message parameters that are specific to the ISUP protocol.

Examples of trunk information include customer group and protocol. Customer group information allows the use of private numbering plans and the specification of available features. Protocol information specifies the version of ISUP in use.

Typically SS7 messages do not internally identify trunk group characteristics. CS 2000 uses a text string header in the SIP INVITE message to represent the trunk group characteristics that the SS7 based networks provide. When this header does not appear in the SIP INVITE message, the CS 2000 at the originating end of the call defines a default trunk group characteristic set based on the SS7 protocol.

Bearer Path manipulation   CS 2000 does not support the use of a subsequent INVITE message to modify the path of an existing call. However, any SIP request or response sent during the normal move of a call can include an SDP payload. CS 2000 uses SDP payloads that contain connection modification commands to modify the bearer paths by sending the updated bearer path information to the appropriate media gateways.

SIP-T protocol versioning   CS 2000 uses **com.nortelnetowrks.sip-t-v1** in the Require header of the INVITE message to cover all SIP-T extensions that CS 2000 uses.

Message formats   CS 2000 implements format and length restrictions for SIP messages and parameters that support the capacity and performance required for a large scale media gateway controller. CS 2000 also implements extensions to the basic SIP-T message and header set.

General message rules   CS 2000 conventions establish the following general rules for SIP-T messages.

- Use the two ASCII characters CR (decimal value 13) and LF (decimal value 10), in that order, for line breaks within a SIP-T message.

- Ignore unrecognized headers, whether defined in the RFC2543 or not, when parsing a message.

    Note: This rule applies only if the unrecognized header complies with the general header field format,

- Do not exceed 143 characters (excluding the terminating CRLF) in the value length of individual headers.

- Do not use more than 20 headers in a single SIP-T message.

    Note: Notwithstanding this maximum, the SIP-T header block cannot exceed 2048 characters.

- Do not repeat headers within a SIP-T message.

    Note: In the case of a repeated header, CS 2000 only uses the first instance of the header.

- Do not use more than three message payloads in an individual SIP-T message.

    Note: A message payload cannot exceed 300 bytes.

Uniform Resource Identifiers   The SIP URI can support user, password, host, and port fields using the following format:
"sip:"[user[":"password]"@"]host[":"port]

The user, password, and host fields are character arrays of a maximum of 32 bytes each. The port field uses an unsigned integer. Escaped characters (escape + character) are not supported.

The CS 2000 implementation of the SIP URI only uses the host field. This reduces the format to the following main body:
"sip:"host

CS 2000 message parsing discards any parameters following the main body of the URI including semi-colon delimiters.

Start line requirements   Support for the start line requirements is different between request messages and response messages. The requirements for the start line of a request message depend on the

methods supported and restrictions set by the SIP URI. The length of the **<progress-indication>** string determines the limitations for the start line of a response message (see also INVITE responses).

Header requirements   CS 2000 SIP-T messages use the following header types:

- To
- From
- Call-ID
- CSeq
- Content-Length
- Content-Type
- Require
- Supported
- Unsupported
- X-Nortel-Profile

TO header   This mandatory header contains the identity of the destination MGC in SIP URL format. CS 2000 discards any additional parameters when parsing the To header.

FROM header   This mandatory header contains the identity of the source MGC in SIP URL format. CS 2000 discards any additional parameters when parsing the From header.

Call-ID header   This mandatory header provides a unique identification for a call leg. The header value is a character array whose length cannot exceed 64 bytes.

The header value consists of three segments:

- An ASCII character string that acts as a unique identifier for the hardware unit that generated the call. This string cannot exceed 16

characters and can use any printable US ASCII character except for the dash.

> ***Note:*** The dash character is a reserved character that separates the first segment from the second.

- A timestamp consisting of five two-digit fields each separated by a colon. The fields represent the day, hour, minute, second, and centisecond respectively.
- A character string that gives the local host name. The character string cannot exceed 32 characters.

> ***Note:*** An **@** must precede this string.

Example
0057.4002-17:11:59:59.99@dcs.nortelnetworks.com

Call Sequence header   This mandatory header contains the request method and a single decimal sequence number that is unique within a call leg. CS 2000 supports call sequence (CSeq) headers that do not contain method information

Content-Length header   This mandatory header indicates the size, in octets, of the message body sent to the recipient. The single decimal value is an unsigned integer.

Content-Type header   This header is mandatory when the SIP-T message contains a MIME body. In this case, the Content-Type header describes the MIME body content. CS 2000 supports the following media types and sub-types:

- application/sdp
- application/isup
- application/tup

> ***Note:*** Nortel Networks developed the tup media sub-type extension to transport BTUP and FTUP payloads.

- multipart/mixed

> ***Note:*** CS 2000 implements the multipart/mixed payloads in accordance with IETF RFC2046.

The CS 2000 Content-Type header also supports the following parameters:

- For session description payloads, the "charset" parameter specifies the character set in use.

    Example
    text/html;charset=ISO-8859-4

- For user part payloads (ISUP, BTUP and FTUP) the following two parameters specify particular variants.
    — base parameter
    — version parameter

- For multipart message bodies, a string unique to the message body content separates the different payloads. The "boundary" parameter specifies this string.

    Note: In every case, the parameter value is a character array that cannot exceed 20 bytes.

Require header   This general header describes the options that the client expects the user agent server to support in order to process the request properly. The header value is a character array that cannot exceed 32 bytes.

Supported header   This general header lists user agent capabilities. The header value is a character array that cannot exceed 32 bytes.

Unsupported header   This response header lists capabilities not supported by the server. The header value is a character array that cannot exceed 32 bytes.

X-Nortel-Profile header   This Nortel-specific extension header describes the telephony trunk group information within the SIP INVITE message. The header value is a character array that cannot exceed 16 bytes.

Message types   The Nortel Networks implementation of SIP-T uses the following message types:

- INVITE message
- INVITE responses
- ACK message
- BYE message
- INFO message

INVITE message   The originating CS 2000 sends an INVITE message to the terminating CS 2000 to request its participation in a SIP-T session. The INVITE message is always the first message sent in a session. The message body contains a description of the session the calling party wishes to establish. Specifically, it indicates which media types the calling user can handle and the IP or ATM address to which these should be sent. The response to the INVITE message indicates which media types the called user can handle and the IP address to which these should be sent.

INVITE responses   A series of messages that provide the responses to an INVITE message. These responses indicate the progress of call setup and can also provide SDP address and media stream information. The format for the start line is:
<SIP version> <response-code> <progress-indication>.

The **<response-code>** is a three-digit numeric identifier beginning with 1 or 2. 1xx codes provide information. 2xx codes indicate successful completion of a request. These codes support automated processing.

The **<progress indication>** string is a character array that contains a maximum of 40 bytes that reports on the progress of call setup. These codes provide information for maintenance personnel.

The most common responses are:

• 100 TRYING. This response indicates the far-end terminating port selection SDP definition of its IP address and port number.

• 183 SESSION PROGRESS. This response follows receipt of a backward ACM by the terminating Communication Server and indicates the called party's line is ringing.

• 200 OK. This response follows receipt of a backward ANM by the terminating Communication Server and indicates that the called party has answered.

Any of these responses can include an SDP session description

ACK message   The originating CS 2000 sends an ACK message to confirm receipt of the final response to an INVITE message. Normally, the ACK is a 200 OK message. The body of the ACK message contains the modified session description when the call setup negotiation changes the description provided in the original INVITE message.

BYE message   The BYE message sent by a participant in a call indicates that the party wants to release the call. When CS 2000

receives a BYE message, it terminates the transmission of all media streams connected to the party supplying the BYE request.

INFO message The INFO message allows call participants to exchange call progress and session description information during an active call. This message is a general-purpose mechanism for conveying PSTN and SDP protocol information.

INFO messages carry mid-call PSTN signaling from the originating PSTN network through the SIP network to the destination PSTN network. These include ISUP messages like INR, INF and PAM.

INFO messages can also contain encapsulated session description messages when overlap signaling is in use. An INFO message used for this purpose contains the same CallID as the initial INVITE message, but its CSeq number is incremented by 1 from the most recent setup message for the call.

Dynamic Packet Trunk mechanism CS 2000 uses the dynamic packet trunk (DPT) mechanism to implement SIP-T. This mechanism requires the following two types of gateway controller:

- virtual router distribution node (VRDN) GWCs
- SIP-T GWCs

VRDN GWCs provide externally visible IP addresses as points of contact for CS 2000s. All outgoing and incoming SIP-T messages to/from a given remote CS 2000 route through the same VRDN.

SIP-T GWCs originate or terminate SIP-T signaling. They originate SIP-T messages by encapsulating CCS7 messages and SDP session descriptions in outgoing SIP-T messages. They terminate SIP-T messages by extracting CCS7 messages and SDP session descriptions from incoming SIP-T messages.

> *Note:* SIP-T GWCs have unique IP addresses. CS 2000s use these unique IP addresses for intra-CS 2000 communication only.

The following figure shows how SIP-T GWCs interact with VRDN GWCs and the ingress/egress GWCs that control media gateways to support call processing for the multiple call server model.

SIP-T network role
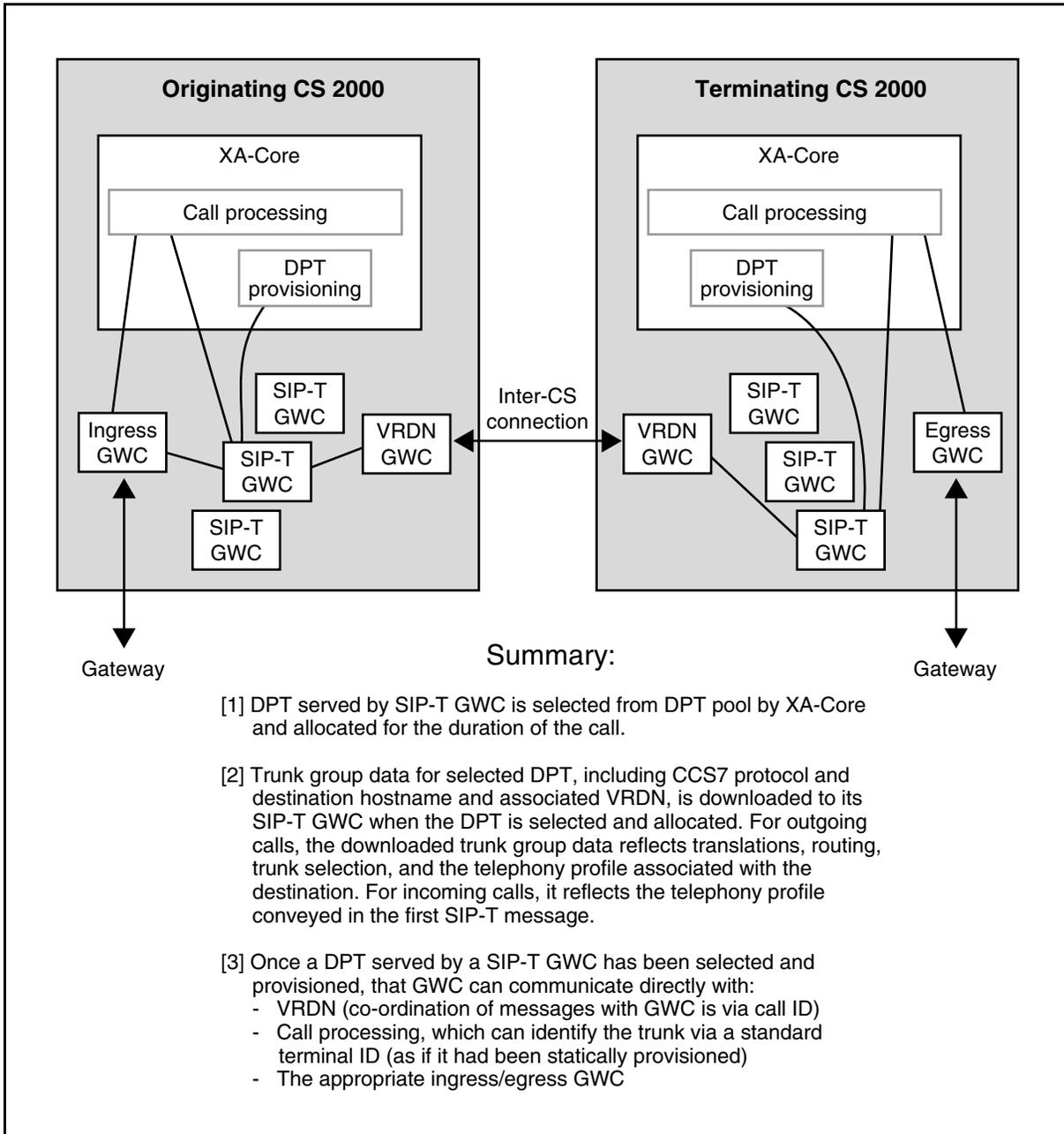
SIP-T GWCs provide CS 2000 with a pool of DPTs that create dynamic connections to any peer CS 2000 through an associated VRDN GWC. These dynamic connections exist only for the duration of the call. CS 2000 determines the associated trunk group data, including CCS7 protocol and destination host name, when selecting and allocating the DPT.

This DPT mechanism promotes network efficiency by:

- maintaining a single VRDN IP address in place of a number of SIP-T GWC IP addresses

- eliminating the potential for congestion or excess capacity that can result from statically provisioning trunks

Management Signaling
The management data network uses a Ethernet-based local area network (LAN). FCAPS data is routed to the appropriate operations support system (OSS) connected to this LAN. All other FCAPS tasks are managed by Preside Management for Succession Solutions (Preside MSS).

Preside Management for Succession Solutions
Preside MSS is responsible for all FCAPS tasks related to the CS 2000 and other Succession network elements. These FCAPS tasks are supported through the following manager applications:

- Engineering and Administrative Data Acquisition System (EADAS) provides a transmission control protocol/internet protocol (TCP/IP) connection from the CS 2000 and performance operations support system (OSS) with optional distributed computing environment (DCE) authentication between the Succession NM TCP/IP server and the performance OSS.

- SuperNode Billing Application (SBA) supports the formatting, storage, and transfer of AMADNS billing records using the file transfer protocol (FTP) to the billing OSS.

- Log delivery

- Secure File Transfer (SFT) provides secure remote access to the Succession NM from a TCP/IP-based LAN. SFT is used to transfer data (such as software loads, billing, patches, and translations) between the CS 2000, Succession NM, and a remote workstation connected to a TCP/IP-based LAN. User login validation is controlled by DCE servers.

- Enhanced Terminal Access (ETA) provides secure remote access to the Succession NM from a TCP/IP-based LAN.

- ASCII Terminal Access (ATA) provides secure remote access to the Succession NM from a TCP/IP-based LAN.

- DMS Data Management System (DDMS) provides access to TDM-core provisioning data.

- GUIDE system provides an interface to TDM-core data through a web browser and system and user administration using Operation Support System Data Interface (OSSDI) commands.

- Software inventory manager (SWIM) supports the installation, update, configuration, and removal of network element software.

- CS 2000 Core Manager Operational Measurement Data Delivery (OMDD) delivers customer selected operational measurement (OM) data to the Performance OSS. The OM data can be viewed through a data browser, such as the Event Record Manager, or any spreadsheet application.

- Event Record Manager (ERM) is a a web-based application for collecting, managing, and analyzing network event records.

- Succession Network Subnet Viewer provides an integrated view of fault, configuration, and performance data.

These applications provide interfaces to the various OSS and other network management systems. The network management entities interface directly with the Succession NM.

Management Interfaces and Protocols
A Succession network uses the following management network interfaces and protocols:

- Bootup Protocol

- Operation Support System data interface protocol

- Simple network management protocol

- Trivial file transfer protocol

- File transfer protocol

- Telnet

- Internet inter-operability protocol

Bootup Protocol   The IETF bootup protocol (BOOTP) broadcasts the MAC address of a peripheral when it is initially powered up. The element manager auto-discovery process uses the MAC address to associate the detected MAC address with a unique profile stored on the Succession NM.

Operation Support System data interface protocol   The Operation Support System Data Interface (OSSDI) protocol is a proprietary Nortel Networks standard that supports:

- retrieving and setting provisioning parameter requests from Preside MSS applications to the DDMS application

- responses from the DDMS to Preside MSS applications

- notifications from the DDMS when a peripheral is added to or deleted from Preside MSS applications

Simple network management protocol   The Internet Engineering Task Force (IETF) simple network management protocol (SNMP) transfers data to peripherals. SNMP receives traps that contain faults and state changes.

Trivial file transfer protocol   The IETF trivial file transfer protocol (TFTP) transfers the initial build load (IBL) to common equipment modules (CEM) following discovery.

File transfer protocol   The IETF file transfer protocol (FTP) transfers software to peripheral modules after the IBL.

Telnet   The IETF Telnet standard allows access to the peripheral user interface in an emergency situation when system-level functions are not available through the SNMP interface.

Internet inter-operability protocol   The Internet inter-operability protocol (IIOP) is the Object Management Group standard that supports the user interface for Preside MSS.

User Interfaces

The following CS 2000 user interfaces support initial software configuration and ongoing software maintenance and upgrading:

- [Maintenance and Administration Position](#)
- [CS 2000 Core Manager](#)
- [Universal Audio Server](#)

Maintenance and Administration Position

Use the maintenance and administration (MAP) terminal to provision data schema tables that require datafill entries for the CS 2000 configuration. From the MAP command interface (CI) level, use the table editor, which gives you direct access to tables.

CS 2000 Core Manager

The CS 2000 Core Manager application provides an integrated view for the fault, configuration, and performance management.

Universal Audio Server

The Universal Audio Server (UAS) uses a conventional computer server architecture based on Windows NT. This architecture includes a provisioning server and uses the element management system (EMS) resident on the CS 2000 Core Manager.

A web based provisioning interface makes controlled access to the audio available with the use of a web browser. The GUI driven interface

provides the ability to add new audio segments and to do password controlled searches for audio segments by any of the fields in the database. Audio can also be entered over the network.

For more information about UAS user interfaces, use the following Worldwide Web address to access *Universal Audio Server Basics*, NN10010-111:

WWW URL: Helmsman Express

Note: Expand the Succession Networks Solutions (N America & Int'l) item and select the desired solution.

Customer Support

Nortel Networks provides product support using standard Customer Service Center (CSC) and Global Product Support (GPS) policies and procedures. This support includes:

- [Product and Customer Support](#)

- [Professional Services](#)

- [Training](#)

Product and Customer Support

When Service Provider staff find a problem that they cannot resolve, Nortel Networks regional Customer Service Center provides the next line of support. The Nortel Networks regional Customer Service Center representative opens a Customer Service Report (CSR) to track progress through to problem resolution.

The regional representative, together with the appropriate subject matter specialists from the Customer Service Center, attempt to resolve the problem. If they are unsuccessful, the Global Prime, or corrective action screener, refers the CSR to the appropriate Nortel Networks Global Product Support group. The Global Product Support group either provides an answer to the problem or develops the appropriate corrective action.

Corrective action can include the following:

- an amendment in a future software release

- an incremental software update (patch)

- a documentation change

- a request for feature development to address new or changed functionality

The Service Provider receives notification after the problem is resolved and follows-up on this notification by authorizing the closure of the CSR.

Special arrangements may include no charge support for initial trials, fee-based technical assistance support (TAS), and other support plans.

Professional Services

An extensive set of professional services accompanies the Succession network product to complement and simplify the activities Service Providers normally perform. The basic product definition describes the customer responsibilities.

Professional services supplement the engineering, installation, and commissioning services that are part of the base product. The needs of the customer define and determine what these services can include. Services can range from turnkey solutions to programs that assist the customer in performing specific tasks and acquiring the skills they need to operate their Succession network product.

The initial set of services offered as part of the Succession network product include:

- business and market planning services
- network planning and design to cover the IP network, ATM network, TDM network, operations networks, and access networks
- operations planning and realization
- business contingency and disaster recovery planning
- program and project management
- CS 2000 translations support
- ATM configuration
- CO LAN design and setup, and element manager setup
- Preside MSS and DCE planning, implementation, and integration
- network test and verification
- line and feature migration services
- line and facility cut-over services
- surveillance, maintenance, provisioning, customer care services
- enhanced TAS support services
- removal of old equipment

Additional services are available on a custom ordered basis.

Training

Each release of a Succession solution generates a training needs analysis. This needs analysis yields the following data:

- product information that describes the impact of the release to such functional areas as maintenance, translations, and capital requirements to support the product
- audience analysis that identifies the incremental prerequisite skills, knowledge and experience that the release requires
- market data that includes a market forecast, lead customer identification, and cross-market impact

The needs analysis determines the training requirements associated with the introduction of each release and can result in limited training, such as a seminar or workshop, or a full complement of standard training that includes a variety of courseware.

Training courses for baseline product (Sheet 1 of 5)

Baseline products	Offerings	Description	Available? Y/N
Network Planning and Design	#5010 - *Carrier Networks, Services, and Applications Overview*	This course is designed to provide you with a broad knowledge of circuit-switched telecommunications networks and services, including broadband access and transport networks and services, and their evolution.	Y
Network Planning and Design	#5011 - *Wireless Networks, Services and Application Overview*	This course is designed to provide you with a broad knowledge of wireless telecommunications networks and services, and their evolution.	Y
Network Planning and Design	#5012 - *Carrier Packet & Enterprise Data Networks, Services and Applications Overview*	This course is designed to provide you with a broad understanding of carrier and enterprise packet-centric telecommunications networks and services, and their evolution.	Y
Network Planning and Design	#5013 - *IP Networks, Services and Applications Overview*	This course is designed to provide you with a broad understanding of carrier and enterprise IP networks and services, and their evolution.	Y

Training courses for baseline product (Sheet 2 of 5)

Baseline products	Offerings	Description	Available? Y/N
Network Planning and Design	#5020 - *Business Case Analysis for Systems and Networks Planning & Deployment*	This course provides instruction on the understanding and use of structured business case analysis methodologies for making sound business decisions based on economic and financial impacts criteria. The methodologies are based on engineering economics approach for economic and financial impacts assessments, and are applicable to making decisions related to the development of products, systems, and network solutions.	Y
Network Planning and Design	#5021 - *Marketing Practices and Considerations Products Planning and Development*	This course is a seminar and workshop designed to provide you with a clear understanding of the marketing function, its interaction with other functions; intelligence gathering, competitive analysis, conducting SWOT analysis (Strength, Weakness, Opportunity, and Threat), and developing winning strategic and managerial/operational product plan.	Y
Network Planning and Design	#5030 - *Carrier Networks Planning & Design: Circuit Switched and Broadband Access & Transport Networks*	This course has a circuit switched orientation. It provides instruction on developing network planning and design capabilities within a diverse team.	Y
Network Planning and Design	#5031 - *Carrier Networks Planning and Design: Packet Networks*	This course has a packet networks orientation; provides instruction on developing network planning and design capabilities within a diverse team.	N

Training courses for baseline product (Sheet 3 of 5)

Baseline products	Offerings	Description	Available? Y/N
XA-Core	#8201 - *An Introduction to XA-Core*	This four-hour, instructor-led seminar will introduce you to the major components of XA-Core functions, fault tolerance, and P-side/C-side relationship.	Y
XA-Core	#0487 - *DMS SuperNode XA-Core Maintenance*	This three-day, hands-on course includes an open lab. Upon completion of this course, you will be able to complete routine and corrective maintenance tasks on the XA-Core. This course includes the content from the 9201 seminar.	Y
XA-Core	#4331 - *DMS SuperNode XA-Core Installation, Cutover, & Testing*	This course teaches the installation, commissioning, and cut-over processes for XA-Core.	Y
Link Peripheral Processor (LPP)	#1291 - *Link Peripheral processor (LPP) Hardware Maintenance*	This course provides instruction on the maintenance of LPP equipment.	Y
DMS SuperNode	#4004 - *DMS SuperNode Hardware Architecture*	This four-day, instructor-led course provides an introduction to the DMS SuperNode System.	Y
DMS SuperNode	#1143 - *DMS SuperNode System Maintenance: Basic Platform Training*	This 120-hour, computer-based course teaches you to perform basic maintenance on the DMS SuperNode System.	Y
DMS SuperNode	#1134 - *Introduction to the ISME*	This one-hour, computer-based course instructs you on how to operate the Integrated Service Module Equipment (ISME). (Also available as part of course 1143.)	Y

Training courses for baseline product (Sheet 4 of 5)

Baseline products	Offerings	Description	Available? Y/N
DMS SuperNode	#1140 - *DMS SuperNode Advanced Technical Overview*	This 40-hour, computer-based course teaches you the DMS SuperNode system's hardware, functions, user interfaces, tools, translations, and storage devices. (Also part of the course 1143.)	Y
SuperNode Data Manager (SDM)	#3000 - *SDM Overview*	This half-day, CD-ROM based course introduces you to the key characteristics, terms, and functions of the SDM in a DMS SuperNode network.	Y
SuperNode Data Manager (SDM)	#3001 - *SDM OA&M*	This two-day, instructor-led course describes the operations, administration, and maintenance of the SuperNode Data Manager (SDM).	Y
SuperNode Data Manager (SDM)	#3002 - *SDM SBA*	This two-day, instructor-led course introduces you to the SuperNode Billing Applications for the SDM with hands-on exercises.	Y
SuperNode Data Manager (SDM)	#3003 - *SDM System Administration and DCE Administration*	This course teaches installation, configuration, and administration of the Distributed Computing Environment (DCE).	N
SuperNode Data Manager (SDM)	#8316 - *DMS Data Management System (DDMS) Seminar*	This one-day, instructor-led seminar teaches you the DMS Data Management System, GUI, Tools, Administration, and Troubleshooting.	Y
Translations	#3710 - *DMS-250 Translations (Sprint) (applies to the DMS-250 Sprint customers only)*	This course provides instruction in translations, data table interactions, and datafill processes fundamentals for the Sprint DMS-250 tandem switching system	Y

Training courses for baseline product (Sheet 5 of 5)

Baseline products	Offerings	Description	Available? Y/N
Translations	#3712 - *DMS-250 Translations Universal Carrier Systems/Interexchange Carrier (UCS/IXC) (DMS-250 UCS customers only)*	This course provides instruction and hands-on practice in translations, data table interactions, and datafill process for the DMS-250 tandem switching system.	Y
Translations	#8136 - *DMS-500 Translations (DMS-500 customers only)*	This course provides instruction and hands-on practice in translations for the DMS-500 switching system.	Y

Training courses for Succession Networks

Succession Networks	Offerings	Description	Available? Y/N
General Training	#1700 - *Succession Network Architecture Overview*	This course provides an architectural overview of the Succession Network and its nodes.	Y

Nortel Networks Knowledge Services is developing a number of training labs to support multiple geographic markets. The first two labs are located in North America: one in Raleigh, North Carolina; and the other in Brampton, Ontario. Both labs are part of the existing Nortel Networks training facilities in these locations. Under consideration for future development are a European site in the United Kingdom and an Asia Pacific site in Australia.