DMS SuperNode SYSTEM OVERVIEW

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ABSTRACT

The DMS SuperNode system provides the flexibility to integrate network resources and functions that previously were engineered and built separately, and, as such, it offers significant benefits for both the providers and consumers of communications services.

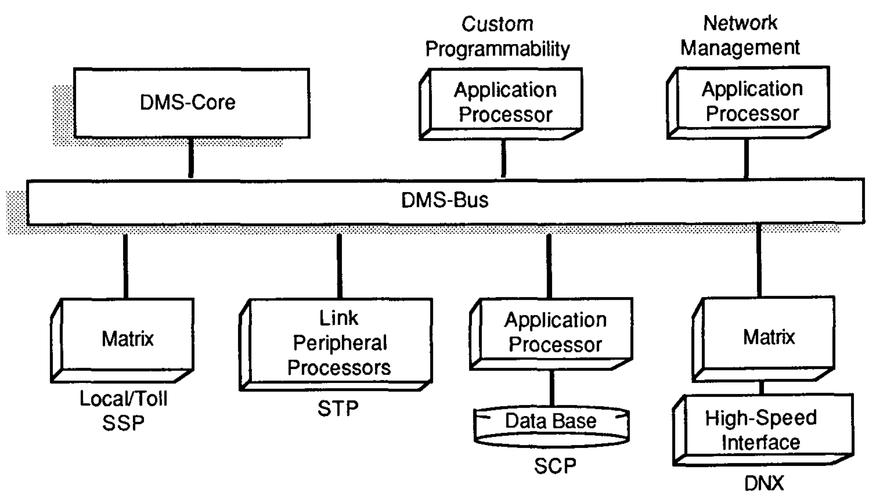
To meet telephone operating company plans for the Intelligent Network, the DMS SuperNode system enhances Northern Telecom's delivery of Advanced Network Services, such as Meridian Digital Centrex, Integrated Services Digital Network (ISDN), and new Information Based Services.

The DMS SuperNode system is based on a new, powerful architecture and is designed to ensure compatibility with previously installed DMS-100 Family switches. These switches can be upgraded to the status of DMS SuperNode systems, thus protecting the original investment of the telephone operating company.

DMS SuperNode SYSTEM OVERVIEW

1.0 GENERAL DESCRIPTION

The fundamental components of the DMS SuperNode system—DMS-Core, DMS-Bus, and DMS-Link—provide the enabling architecture for a series of DMS SuperNode applications and Advanced Network Services (see Figure 1). DMS-Core is the computing and memory resource for the new architecture. DMS-Bus is a high-speed transaction switch that is the hub joining all the system peripherals and processors connected to its ports (i.e., DMS-Core, DMS-STP, DMS-SCP, custom-programmable processors, DMS-100 peripheral processors) so that they may communicate freely with one another. DMS-Link provides the software infrastructure that enables the networking of DMS SuperNode systems and the interfaces for Custom Programming applications.



SSP Service Switching Point
STP Signaling Transfer Point
SCP Service Control Point
DNX Digital Network Cross Connect

Figure 1. DMS SuperNode Multifunctional Architecture

A DMS SuperNode system can be configured as a high-capacity local or tandem switch with the Common Channeling Signaling No. 7 (CCS7) Service Switching Point (SSP) function, a Signaling Transfer Point (STP), a Service Control Point (SCP), a network service node with Custom Programming applications and in the near future a Digital Cross Connect (DNX) system. Advanced messaging technology allows the integration of multiple applications on the same DMS SuperNode system, leading to the integration of these functions.

1.1 DMS-Core

DMS-Core performs system management in DMS SuperNode applications (see Figure 2). DMS-Core consists of two synchronized computing module planes.

The Master Processor of the computing module is the Motorola 32-bit MC68020 microprocessor. The supporting components consist of 240 megabytes of memory (ten 24-megabyte circuit packs), a fiber optic interface to DMS-Bus, and a System Load Module (SLM). The SLM consists of a 140-megabyte Winchester disk drive and 75-megabyte streaming tape drive with a removable cartridge. SLM provides for loading DMS-Core with software and dumping images of system operating data.

In addition to the use of the more powerful microprocessor MC68020, the implementation of a data cache, use of a Static Random Access Memory (SRAM) as intermediary memory for high runner code, and custom gate array circuits for memory access control provide significant call processing efficiencies.

Development now in progress increases the throughput capacity of the DMS-Core through the use of the new MC68030 microprocessor. Also, prototypes have been developed using the recently announced Motorola MC88000 that implement the BNR Inc. version of Reduced Instruction Set Computing (BRISC) techniques. This technology, when used in the local/tandem application, achieves a capacity reaching 1,500,000 call attempts per hour by 1990.

1.2 DMS-Bus

DMS-Bus is the key architectural element of the DMS SuperNode system. DMS-Bus provides an internal communications network which allows messaging autonomy between DMS-SuperNode subsystems and further enables processing distribution.

DMS-Bus consists of two redundant message switch planes (i.e., a duplex architecture) for greater reliability. Each plane can support the entire system load, although in normal operating mode the total load is shared by the two planes.

One plane of DMS-Bus consists of the following (see Figure 3): Processor Bus, Transaction Bus, Control Processor with supporting memory, Mapper, Processor Transaction Bus (T-Bus) Interface, System Clock, Port Interface Units.

The Processor Bus originates on the Motorola MC68020 Control Processor (the same microprocessor as in the DMS-Core). This bus is used by the Control Processor to manage and maintain the other components of DMS-Bus.

The Transaction Bus carries messages between DMS SuperNode components. The 32-bit Transaction Bus has a capacity of 128 Mbps and can support a typical message mix of 100,000 messages per second, with a transaction delay of less than 100 microseconds. Access from the Transaction Bus to the DMS-Bus Control Processor is managed by the Processor Transaction Bus Interface.

Port Interface Units manage the individual interfaces of Peripheral Processors, Application Processors, and DMS-Core to the DMS-Bus Transaction Bus.

One Port Interface Unit in each DMS-Bus plane is dedicated to each plane of DMS-Core, and each plane of the Application Processor is connected to DMS-Bus. A Port Interface Unit is also dedicated to each Input/Output Controller and to each plane of the Network Modules in a local/tandem application.

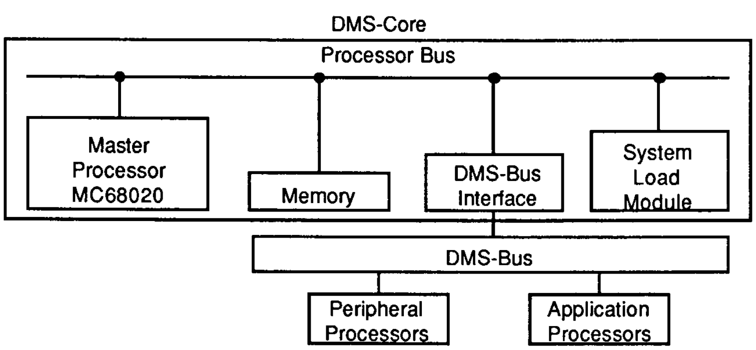


Figure 2. DMS-Core Architecture

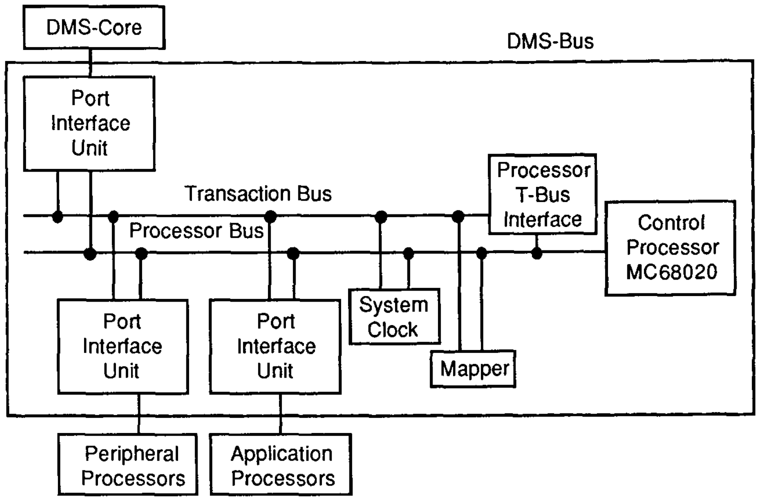


Figure 3. DMS-Bus Architecture

DMS-Bus has a compact, modular structure that allows it to be configured economically from a few to over 1400 Port Interface Units.

The DMS-Bus Mapper translates the logical subsystem addresses of messages destined for specific physical modules.

The system clock reference can be located either within DMS-Bus or as a separate external component interfacing to it. The built-in source is a synchronizable clock that conforms to Stratum-III standards. Stratum I and II performance standards are external options.

1.3 DMS-Link

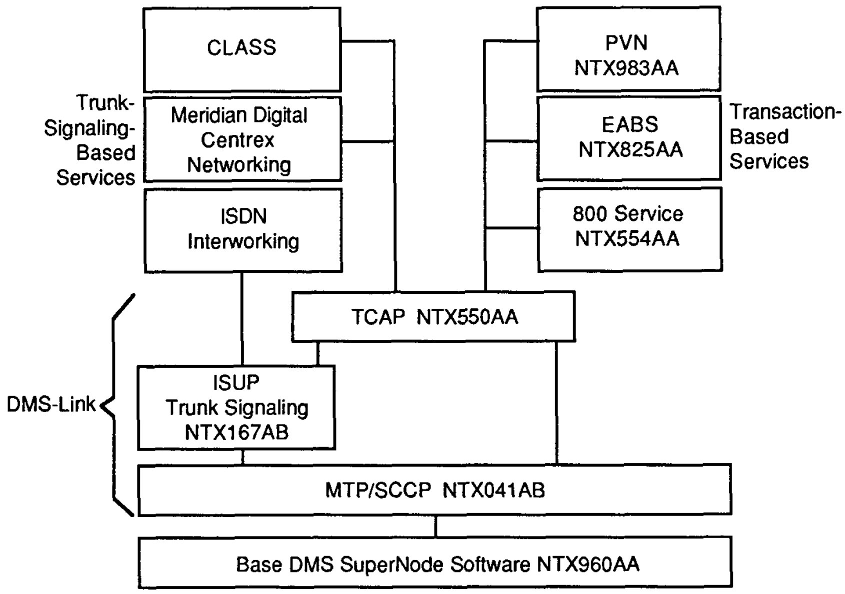
DMS-Link is the protocol structure used on signaling links between DMS SuperNode applications and nodes in the telecommunication network. It is the syntax of the language used between the network nodes and the subsystems that deliver new advanced services. DMS-Link also includes a standard set of application and base interfaces used in Custom Programming.

Protocol sets within DMS-Link include the CCS7 set for both transaction and trunk signaling, ISDN Access (Q.921 and Q.931), Network Operations Protocols (NOP, X.400), and X.25 for packet communications. These protocols provide a standard for manufacturers to enable their devices (e.g., computers) to function compatibly with the products of other vendors. Adoption of these standards allows the telephone operating company the flexibility to design a multiple-vendor network.

DMS-Link is the delivery vehicle for a set of services that represents major revenue opportunities for the telephone operating companies. The CCS7 service set is an excellent example of DMS-Link (see Figure 4), because it provides the capability for a number of central office (CO) switches to access a centralized data base that assists in call routing and translation for a whole array of new services. This central office functional capability is known as a Service Switching Point (SSP). The CCS7 protocol layer that implements SSP is the Transaction Capabilities Application Part (TCAP).

The TCAP protocol is used by an SSP to query the data base Service Control Point while processing calls such as 800 or automated credit card calls. In addition to this capability, CCS7 also is used to replace current low-speed interoffice signaling system capabilities with high-speed 64-kbps links.

The ISDN User Part (ISUP) protocol is used by the central office switching systems for signaling while setting up calls, either voice or data, both ISDN and non-ISDN, across a Local Access and Transport Area (LATA) network. The ISUP protocol contains provisions to provide the calling number within the call setup procedure as well as information about the calling party and call type. This capability is necessary to support the Custom Local Area Signaling Services (CLASS) feature set and Area-Wide Centrex. Calling party class and call type information in CCS7 permits routing of digital data and voice calls over the same trunk group on digital transmission facilities. Other services, such as Private Virtual Networking, exploit similar capabilities of CCS7.



DMS	Digital Multiplex System
CLASS	Custom Local Area Signaling Service
EABS	Exchange Alternate Billing Service
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
MTP	Message Transfer Part
PVN	Private Virtual Network
SCCP	Signaling Connection Control Part
TCAP	Transaction Capabilities Application Part

Figure 4. CCS7 Example of DMS-Link

The DMS-Link commitment to public standard protocols gives the telephone operating companies the ability to provide new revenue-earning services from their network. This important step ensures a successful transition into the Open Network Architecture and Intelligent Network environments.

2.0 APPLICATIONS

The deployment of Advanced Network Services, by means of DMS SuperNode system applications, provides maximum flexibility.

The integrated combination of DMS SuperNode applications in a telephone operating company network will enable the delivery of a broad range of services from a single network node.

For example, CCS7, also known as Signaling System No. 7 (SS7), is currently being deployed to offer transaction services and trunk signaling. The CCS7 network elements are the Service Switching Point (SSP), Signaling Transfer Point (STP), and Service Control Point (SCP).

These network elements can be deployed as separate systems or, with the DMS SuperNode system, they can be part of a multiple-function application (refer to Figure 1).

An analysis of individual network applications indicate that an integrated multiple-function node is a better economic choice than separate stand-alone applications based on operational efficiency and cost effective implementation of new service offerings.

In cases indicating multiple-function integration, the Signaling Transfer Point responsibilities could be added to a DMS SuperNode system configured as a Tandem Office. Or the Service Control Point responsibilities could be added to a DMS SuperNode central office where multiple-data-base access is needed to complete a call, e.g., the Intelligent Network scenario where certain end-office functions are slaved to the Service Control Point.

2.1 DMS-STP

The DMS-STP is a key component of Northern

Telecom's end-to-end SS7 portfolio. Interfacing with signaling points (SPs), Service Switching Points (SSPs), Service Control Points (SCPs), and other STPs, the DMS-STP provides efficient, economical, and reliable message transfer and signaling management between the nodes of an SS7 network (see Figure 5).

The architecture of Northern Telecom's DMS-STP is specifically designed to provide the flexibility that will allow easy, economical growth in an evolving SS7 network.

The modular design of the Link Peripheral Processor permits additional SS7 links to be configured through simple, plug-in provisioning. As demand for SS7 services increases, additional Signaling Data Links (SDLs) are merely added to the system already in place.

The DMS-STP obtains its exceptional message throughput and SDL capacity by coupling its highly efficient Link Peripheral Processors (LPPs) with the latest DMS SuperNode technology. The LPPs translate the logical address attached to all SS7 queries into the physical address where a message will terminate. Each of the 24 Link Interface Units (LIU7) in an LPP has its own MC68020 processor. The DMS-Bus enables extremely rapid interconnection between the various link processors. The distributed processor design of the DMS-STP allows most message processing to occur in the LPP, thus freeing the DMS-Core to administer the system as a whole and allowing messages to enter and leave the DMS-Bus with the greatest possible speed.

Supported by this DMS SuperNode system technology, the DMS-STP can be configured with 408 SDLs and can process up to 460 million SS7 messages per hour. Evolution plans will grow the DMS-STP to more than 1000 SDLs. The DMS-STP has been specifically designed to handle the full range of SS7 message lengths from 15 to a maximum of 279 octets in compliance with Bellcore requirements.

2.2 DMS-SCP

The DMS SuperNode system can be configured as a Service Control Point (DMS-SCP) with the addition of Application Processors and Operations, Administration and Maintenance (OAM) Processors, which perform data base OAM functions (see Figure 6).

A DMS-SCP Application Processor performs the processing functions necessary for database transactions, while DMS-Core provides overall system management functions. This architecture allows a high throughput of over three million queries per hour—a fast response time at full load—and significant growth through the addition of Application Processors.

The DMS-SCP is designed to meet all relevant industry standards and specifications. In addition, like the DMS-100 Family products, the DMS-SCP operates in a standard central office environment. Thus a special environment control room to accommodate computer equipment is not required.

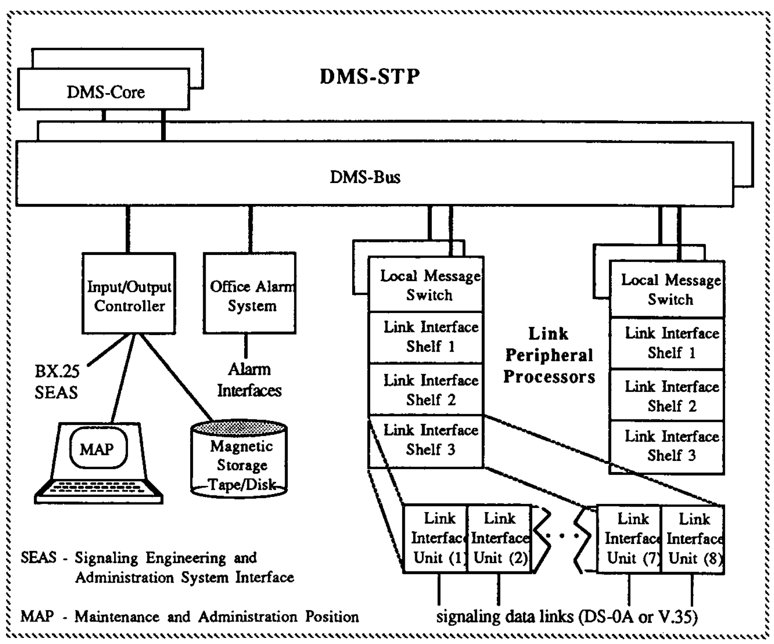
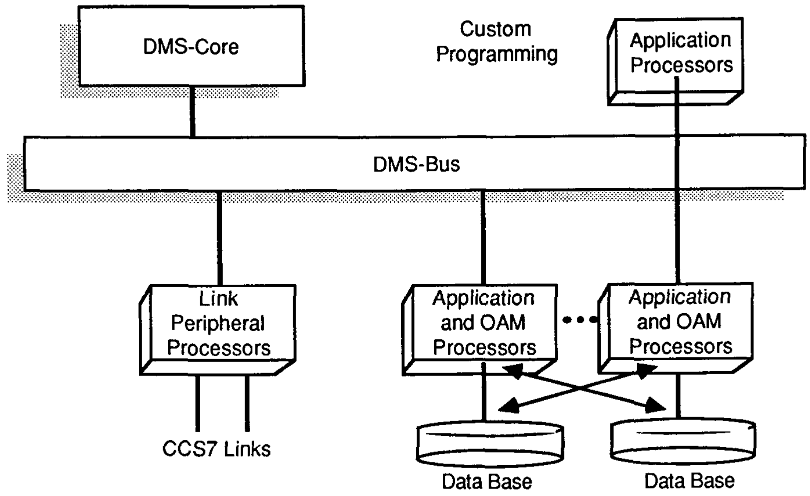


Figure 5. DMS-STP Architecture



OAM Operations, Administration and Maintenance
CCS7 Common Channel Signaling No. 7

Figure 6. DMS-SCP Architecture

The DMS-SCP also maintains commonality with previously installed DMS-100 Family equipment, further minimizing introduction costs by reducing the need for new maintenance, administration, and training procedures.

The DMS-SCP delivers Intelligent Network Services and introduces Custom Programming to the telephone operating companies. Custom Programming allows the telephone operating companies to control the feature programming of DMS-SCP data base transactions and is consistent with Bell Operating Company/Bellcore plans for the Intelligent Network.Custom Programming is a key commitment of the DMS SuperNode program allowing rapid service definition, market testing, and delivery of new service applications.

The Custom Programming Environment offers an integrated set of utilities for a whole range of Custom Programming Interfaces to provide the telephone operating companies with the ability to control the content and delivery of new services. Utilizing our First Applicatin Test Office (FAST) facility, operating companies will be able to ensure their applications meet all the requirements for trouble free introduction of new services.

The DMS SuperNode system brings the power of data base technology and signaling services to the local Class 5 office. By delivering new network service capabilities cost effectively, more users will be able to take advantage of information based services to create new revenue streams for the telephone operating companies. End users served by the telephone operating companies will stimulate the network with new service demands, broadening the requirement for advanced network features.

The installation of a DMS SuperNode system on existing DMS-100 switches that offer Advanced Network Services allows the expansion of both the application and network function integration. Network Meridian Business Services, known generically as Area-wide Centrex (AWC), offer the telephone operating companies a leading edge capability that combines multiple-location centrex groups to form a service-transparent network. The introduction of AWC is designed to offer the flexibility of interworking hybrid network environments (i.e., a combination of public and private networks).

2.3 DMS-DNX

Tandem offices are often the point of convergence for a significant proportion of both message trunks and special service trunks within a metropolitan area. Such offices are prime candidates for the deployment of a Digital Cross-Connect System (DCS), such as the DMS Digital Network Cross Connect (DMS-DNX) application.

The DMS-DNX can realize significant improvements in trunk use and transport network management in the vicinity of the node.

In the DMS SuperNode system, network cross-connect elements can be added either at the time of installation or in the course of network modernization. The common control and messaging infrastructure provided in DMS-Core, with individual applications processors and DMS-Bus, offers cost savings over individual, stand-alone implementations and reduces signaling link requirements.

In the DMS-DNX application, digital facilities—DS-1, DS-3, Optical Carrier Rate—terminate on a high-speed interface module and are connected into the network module, which contains the cross-connect matrix. DMS-Core provides the overall control of the cross connections. Control messages are routed through DMS-Bus from DMS-Core to the cross-connect matrix. A key advantage of this architecture is that it permits both switched and nonswitched services, which traditionally are carried on separate networks, to be provisioned through a common DMS SuperNode system.

3.0 DMS-SuperNode BENEFITS

The benefits of the DMS SuperNode system can be summarized as follows:

- Capacity: A plan for capacity evolution introduces commercially available, higher-powered microprocessors within the DMS SuperNode system to deliver 1,500,000 busy hour call attempts by 1990.
- Integration: DMS-Bus capabilities allow multiple network resources (e.g., STP, SCP, local/tandem) to reside within the same node.
- Innovation: Custom Programming encourages the telephone operating company to take control of feature delivery and to deploy resources according to its individual business plan.

The delivery of capacity increments within DMS-Core reflects a continuing evolution that does not end with the fivefold capacity increment. This continuing evolution will incorporate commercially available microprocessors as anticipated application requirements dictate.

The new internal configuration of the DMS SuperNode DMS-Bus introduces fast internal messaging between processing entities within the system. This internal messaging enables multiple network applications (e.g., local/tandem switch, STP, SCP, DNX) to exist within the same node. Integration allows the flexibility of cost-effective deployment of network resources through shared components and the corresponding rapid deployment of network services.

Commonality of spares, common maintenance and operation processes, consistent Maintenance and Administration Position (MAP) terminal procedures, and synergistic training programs also contribute to the benefits of integration. Hardware commonality reduces the expense of new system evaluation for DMS-STP and DMS-SCP, since they are an integrated part of the DMS SuperNode system.

Compared to stand-alone applications, an integrated multiple-application node is capable of optimal performance and network reliability. This unsurpassed performance is due to reduced communication delays and reduced processing demand realized by the elimination of physical links and transit times between integrated applications. The elimination of physical links also enhances overall network reliability. The high reliability of the individual multiple-application node is achieved by means of the redundant, two-plane architecture of DMS equipment. The common technological approach used in constructing the different DMS SuperNode applications allows a graceful migration from a stand-alone to an integrated node whenever economy, performance improvement, or new services are considered.

Another advantage of the DMS SuperNode system is its ability to handle application expansion. Unlike single-processor architectures, many of the applications that can be integrated with the DMS SuperNode system (e.g., DMS-STP, DMS-SCP) bring their own processing resources, thus increasing rather than decreasing the total processing power of the system. This attribute, combined with the integrating capability of the DMS SuperNode system, helps the telephone operating companies to build their networks and deliver advanced network services such as Private Virtual Network (PVN), 800 Service, and Exchange Access Alternate Billing Service (EAABS).

Custom Programming will become a shield in the increasingly competitive telephone operating company environment, as it enables the telephone operating company to control the speed of delivery of new or modified network services. This responsiveness to unique individual customer needs assures the telephone operating company's established subscriber base a future extension capability and attracts new or hybrid customers returning to public network use.