Meridian 1 and Succession Communication Server for Enterprise 1000

DPNSS1

Product Overview Guide

Document Number: 553-3921-100
Document Release: Standard 7.00
Date: January 2002

Printed in Canada

Revision history

January 2002

Standard 7.00. This document is up-issued to include content changes for Meridian 1 Release 25.40 and Succession Communication Server for Enterprise 1000 systems.

April 2000

Standard 6.00. This is a global document and is up-issued for X11 Release 25.0x.

October 1997

Issue 5.00 released as Standard for Generic X11 Release 23.0x. The feature descriptions previously contained in this NTP have been moved to the *DPNSS1: Features and Services Guide* (553-3921-300).

August 1996

Issue 4.00 released as Standard for Generic X11 Release 22.0

December 1995

Issue 3.00 released as Standard for Generic X11 Release 21.B.

July 1995

Issue 2.00 released as Standard for Generic X11 Release 21.A.

May 1994

Issue 1.00 released as Standard for Release 20.

July 1993

Standard version issued for Group H (Phase 8B).

October 1992

Standard version issued for Group G (Phase 7C).

Contents

About this document

This document applies to the Meridian 1 Internet Enabled and Succession Communication Server for Enterprise (CSE) 1000 systems.

This document is a global document. Contact your system supplier or your Nortel Networks representative to verify that the hardware and software described is supported in your area.

The DPNSS1 Product Overview Guide is part of the suite of Nortel Networks technical publications (NTPs) designed specifically for DPNSS1 applications.

This guide provides descriptive information on all relevant components of DPNSS1 functionality, such as application protocols and principles, hardware and software requirements.

Who should use this document

The intended audience of the DPNSS1 Product Overview Guide is network data managers, design personnel, marketing personnel, and anyone requiring a general information base for DPNSS1 functionality.

How this document is organized

The DPNSS1 Product Overview Guide has been arranged in the following sections:

- *Description of DPNSS1* - describes DPNSS1 signaling protocols and compliance to BTNR 188 requirements; describes channels and channel configurations; defines and illustrates application of APNSS; explains and illustrates DPNSS1 dialing plans and concepts
- *Hardware requirements* - lists and describes the hardware required to configure DPNSS1 and APNSS links

Description of DPNSS1

Contents

This section contains information on the following topics:

Reference list

The following are the references in this section:

- *Traffic Measurement: Formats and Output* (553-2001-450)
- *Basic and Network Alternate Route Selection: Description* (553-2751-100)
- *ISDN PRI: Installation* (553-2901-201)
- *Networking Features and Services* (553-2901-301)
- *ISDN PRI: Maintenance* (553-2901-501)
- *System Overview* (553-3001-100)
- *System Installation Procedures* (553-3001-210)
- *Features and Services* (553-3001-306)
- *General Maintenance Information* (553-3001-500)

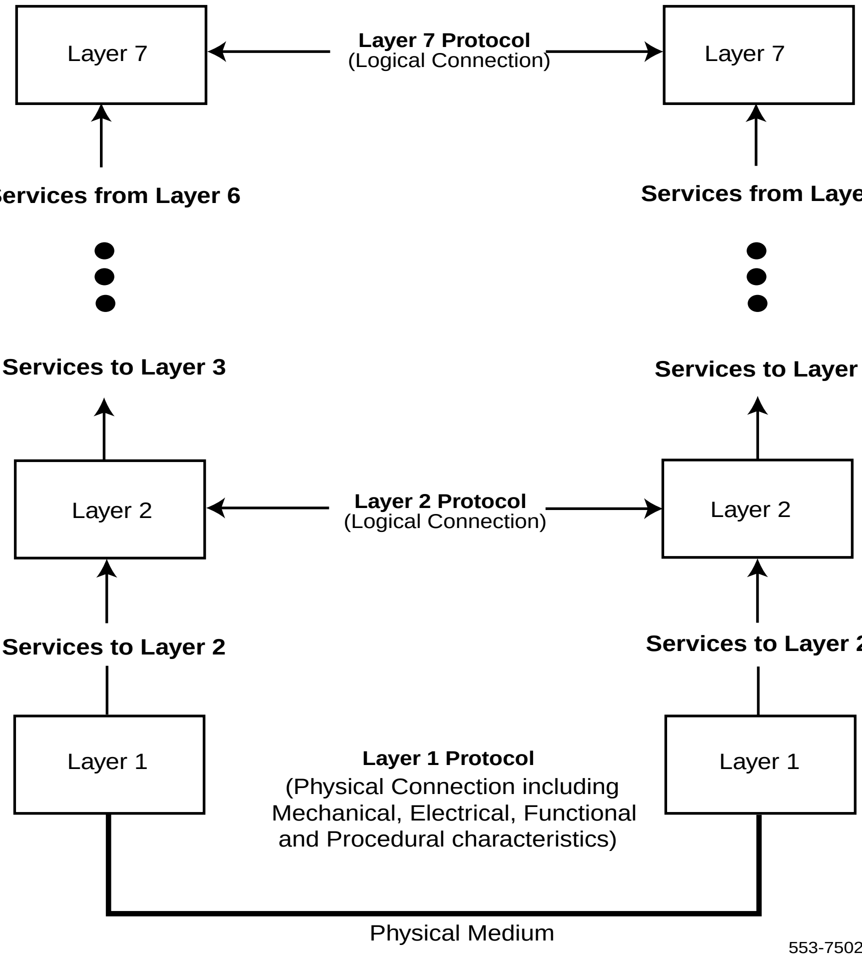
DPNSS1

British Telecom's Digital Private Network Signaling System No. 1 (DPNSS1) is the open signaling protocol standard for intelligent private network digital connections. DPNSS1 provides the signaling capability to establish simple telephony and data calls, as well as supplementary services (features).

DPNSS1 is a common channel signaling system. It is intended to be used between switches in a private network (via timeslot 16 of a 2.048 MBit/s digital transmission system), but can also be connected between switches through a dumb modem using a dedicated analogue or digital signaling path. This latter facility is known as the Analog Private Network Signaling System (APNSS).

DPNSS1 is specified in terms of the International Standards Organisation (ISO) reference model for Open Systems Interconnection (OSI). Level 1 (Physical) of the model is a 2.048 Mb/s digital interface and level 2 (Data Link) is the Link Access Protocol (LAP) defined for Digital Access Signaling System No.2 (DASS2). Level 3 (Network) is the message layer unique to DPNSS1. Figure 1 on page 11 illustrates the OSI Model.

Figure 1
How the OSI Model works

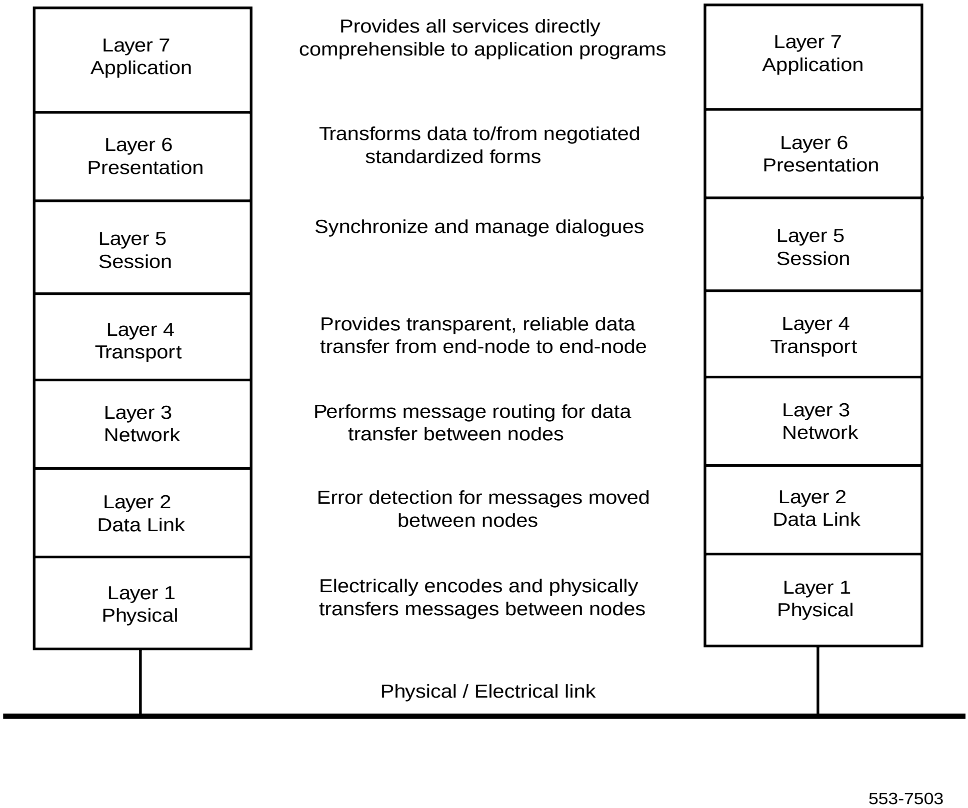


Each layer in the model depends on the services offered by the layer below it and, in turn, builds on those services to perform a specific set of communications functions. Protocols are the mechanism by which each layer accomplishes its communication functions. It then offers these functions to the layer above it in the form of its own set of services. Note that, while services are used between layers within a signaling entity (switch), protocols operate within the same layer of the OSI model but between different signaling entities.

The OSI layering approach effectively divides the complex task of communication between network signaling entities into a series of more easily manageable pieces, each of which can be modified without affecting the other pieces. This allows more flexible evolution and compatibility with the ongoing standards activities.

Figure 2 on page 13 shows the structure of the OSI Model and describes the functions of each layer.

Figure 2
The structure of the OSI Model and the functions of each layer



DPNSS1 application principles

Transmission system

The 2.048 Mb/s digital transmission is divided into 32 timeslots, numbered 0-31. Timeslots 1-15 and 17-31 provide 30 traffic channels. Timeslot 0 is used as a synchronisation channel. DPNSS1 is a message-based signaling system that uses a common signaling channel in timeslot 16. Each traffic channel has an associated Link Access Protocol (LAP). The LAPs operate in parallel over the signaling channel. Various messages are defined. Each message has mandatory data elements, and may include additional optional information.

Note: British Telecom (BT) numbers the traffic channels 1-30 (that is, timeslot 17 and LAP 17 are associated with traffic channel 16), but in the Nortel implementation the timeslot numbers are used to number the traffic channels.

Each traffic channel, together with its LAP, represents one trunk and can be used for an incoming or outgoing call independently of the other channels.

Each 2.048 Mb/s link can be connected to another PBX, using DPNSS1 signaling.

Link designation

The ends of each inter-PBX link are labelled arbitrarily A and B, and the ends of each DPNSS1 channel are designated X and Y. The X end has priority if both ends attempt to use the channel at the same time.

PBX functions

A PBX that connects a DPNSS1 channel to or from a non-DPNSS1 device is termed an end PBX. If that device is a trunk, then the PBX is termed a gateway. A PBX connecting two DPNSS1 channels is a transit.

Configuration of trunks

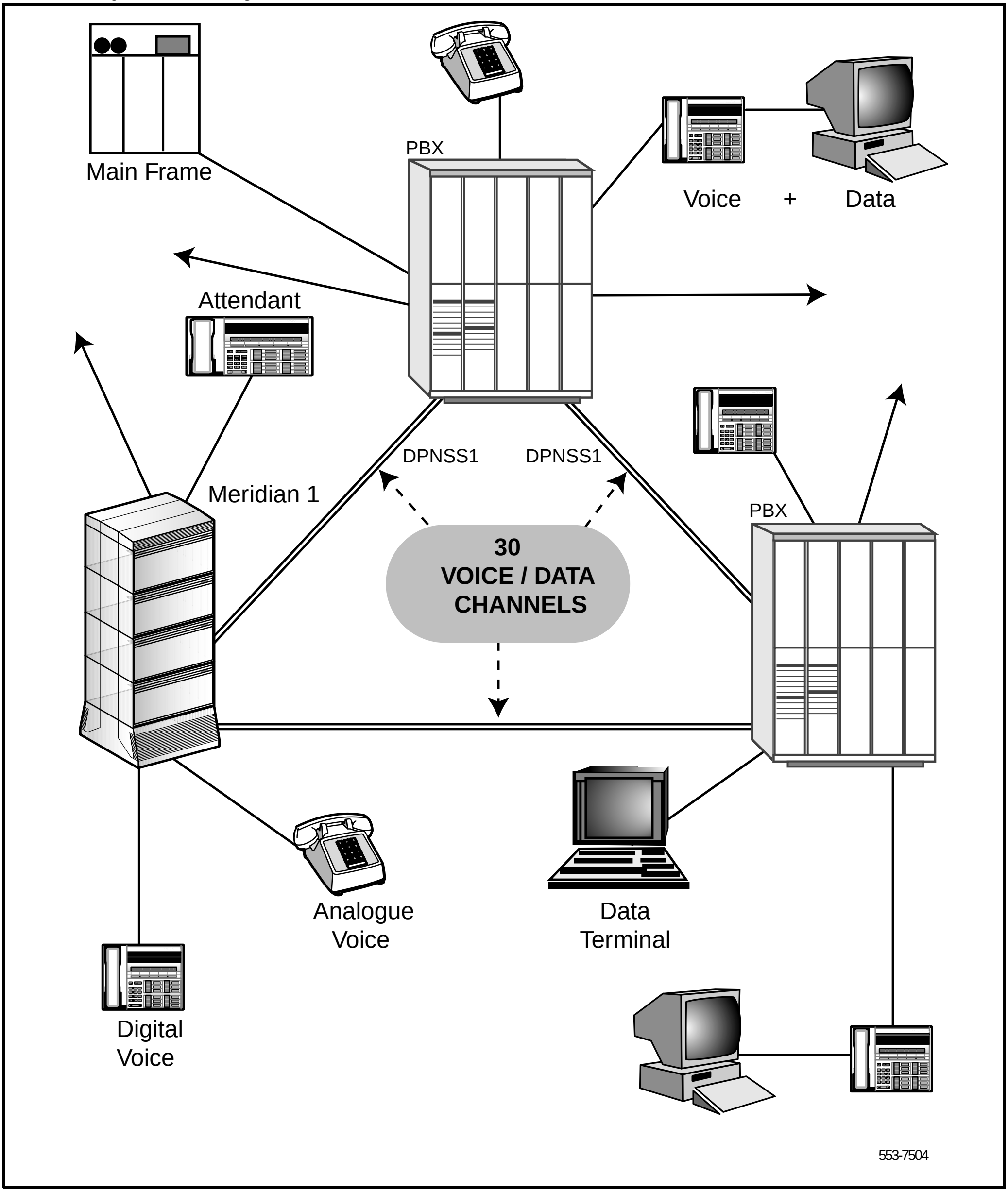
DPNSS1 trunks are configured using the same route and member method used for other trunks, thus:

- any number of routes may be associated with the same link
- a route may be associated with any number of links
- each route member must be assigned to one channel
- Not all channels need to be associated with members. These non-associated channels cannot, however, be used for calls.
- members and channels must be numbered separately
- Members are screened for outgoing calls using a linear search (Sequential Line) or round robin (Cyclic Line). For DPNSS1 links, a linear search should be used.

- each route may be configured only for incoming calls, only for outgoing calls, or for both
- each route must be configured with DPNSS1 channels only

Figure 3 on page 16 shows a typical DPNSS1 system configuration.

Figure 3
DPNSS1 system configuration



DPNSS1 and the Meridian 1

The support of DPNSS1 signaling on the Meridian 1 was developed to prepare for the introduction of Meridian 1 into the British market. DPNSS1 is the prevalent intelligent private network signaling system in the United Kingdom, and is unique in its allowance of intelligent networking between different-vendor PBXs.

The Meridian 1 uses unique hardware and software elements to provide the DPNSS1 functionality. This includes the implementation of BTNR 188 sections as indicated by Table 1 on page 17. Also, the Meridian 1 offers the same network functionality over analogue trunks and DTI2 or E-1 digital trunks (that is, APNSS) using a dedicated signaling link.

Table 1 on page 17 forms the compliance statement for DPNSS1. The table indicates the applicable BTNR 188 Section, and whether the service is supported on transit and/or end Meridian 1 PBXs.

Table 1
BTNR 188 DPNSS1 to Meridian 1 compliance (Part 1 of 3)

Sections	Function	
	End	**Transit only**
1 General	Mandatory	Mandatory
2 Physical Characteristics	Mandatory	Mandatory
3 Link Access Protocol	Mandatory	Mandatory
4 Message Types and Formats	Mandatory	Mandatory
5 Signaling Procedures	Mandatory	Mandatory
6 Simple Telephony Call	Mandatory	Mandatory
7 Circuit Switched Data Call	No	Yes
8 Swap	No	Yes
9 Call Back When Free	Yes	Yes
10 Executive Intrusion	No	Yes

Table 1
BTNR 188 DPNSS1 to Meridian 1 compliance (Part 2 of 3)

11 Diversion	No	Yes
12 Hold	No	Yes
13 Three Party Service	Yes	Yes
14 Call Offer	Yes	Yes
15 Non-specified Information	Yes	Yes
16 Service Strings	Yes	Yes
17 Call Waiting	No	Yes
18 Bearer Service Selection	No	Yes
19 Route Optimization	Yes	Yes
20 Extension Status	No	Yes
21 Controlled Diversion	No	Yes
22 Redirection	Yes	Yes
25 Night Service	No	Yes
26 Centralized Operator	No	Yes
27 Traffic Maintenance	No	NA
28 Remote Alarm Reporting	No	Yes
29 Add-on Conference	No	Yes
30 Time Synchronisation	No	Yes
31 Call Back When Next Used	Yes	Yes
32 Do Not Disturb	No	Yes

Table 1
BTNR 188 DPNSS1 to Meridian 1 compliance (Part 3 of 3)

33 Remote Registration of Diversion	No	Yes
34 Remote Registration of Do Not Disturb	No	Yes
35 Priority Breakdown	No	No
36 Call Back Messaging	No	Yes
37 Loop Avoidance	Yes	Yes
38 Forced Release	No	Yes
39 Text Message	No	Yes
40 Charge Reporting	No	Yes
41 Network Address Extension	No	Yes
42 Call Park	No	Yes

APNSS

The Analog Private Network Signaling System (APNSS) replaces analogue trunk signaling with DPNSS1 D-channel signaling, to provide the same basic capabilities as 2 MBit Digital Private Network Signaling System No.1 (DPNSS1).

APNSS is configured on a route basis, with each trunk on that route being associated with a D-channel number and a trunk identifier to identify the signaling channel for the trunk. Call set-up, establishment, and tear-down are controlled by the DPNSS1 signaling messages and call states.

A D-channel dedicated for APNSS signaling is used exclusively for analogue bearers, and cannot be used to support DPNSS1 digital bearers. One D-channel can support a maximum of 30 B-channels.

The B-channels for APNSS are normally carried over analogue two or four wire E&M trunk circuits, or AC15 trunks. However, digital (DTI2) TIE B-channels can also be used for APNSS.

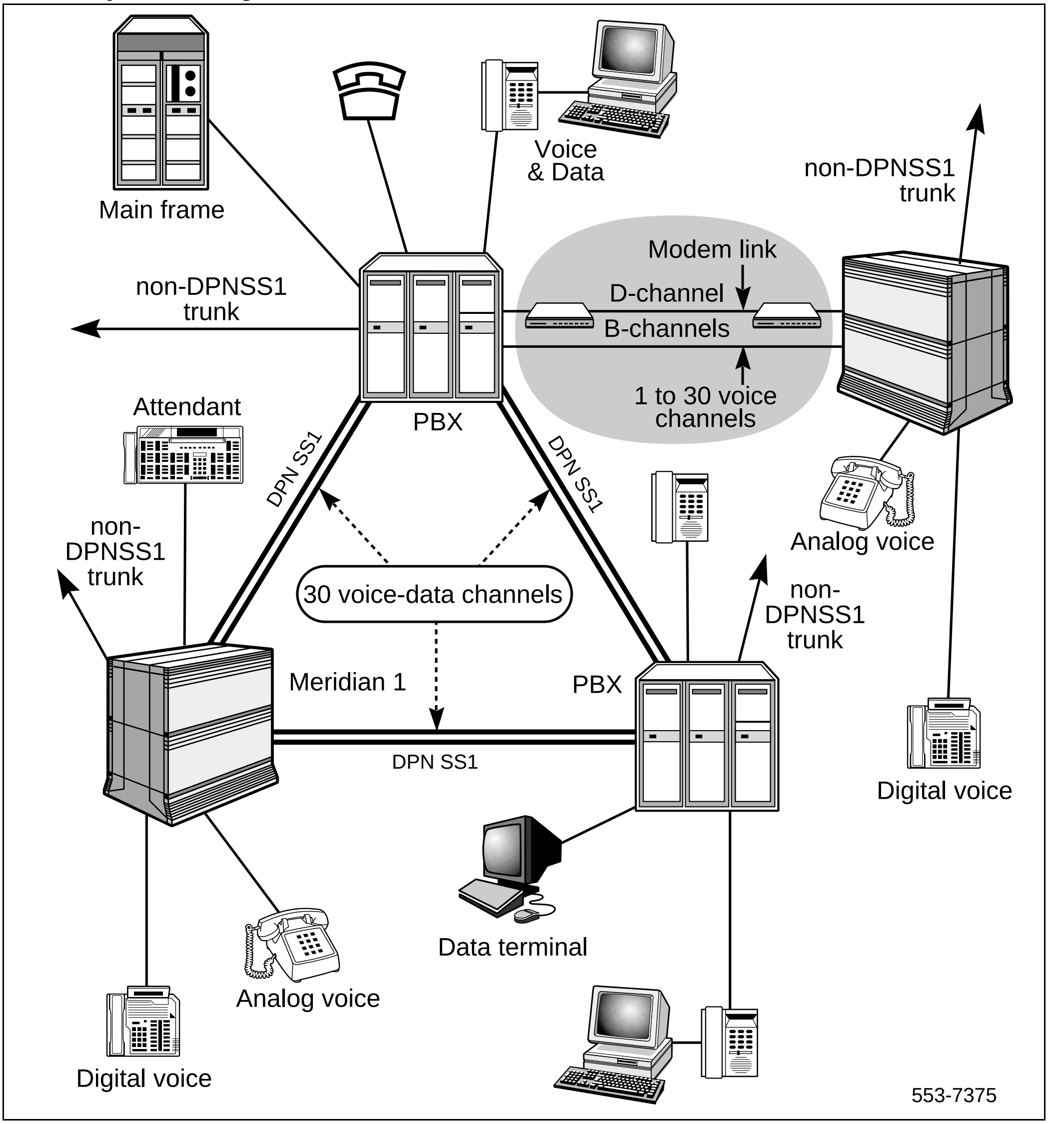
The D-channel may be carried over a 64 Kbit/s digital link, or an analogue link using modem equipment. Normally, the D-channel is run using leased-line modems, but may be also connected using dial-up modems, a 500 line card and any trunk circuit.

Virtual channels for APNSS are programmed on an unused loop within the Meridian 1.

Certain limitations apply to APNSS. APNSS supports only PBX to PBX (similar or different) connectivity; with APNSS there is no check for B-channel speech transmission.

Figure 4 on page 21 illustrates an APNSS system configuration.

Figure 4
APNSS system configuration



Channels

A channel is a circuit that carries information between two PBXs. Within an intelligent network, there are two types of channels — Bearer channels (B-channels) and Data channels (D-channels).

B-channel

The Bearer Channel (B-channel) carries the voice/data traffic for established connections; the call processing signaling information is *not* carried over a B-channel. Voice transmission can be over a digital or analogue B-channel. An analogue B-channel can be any type that is supported within a particular network. Data transmission requires that the B-channel be digital, with a transmission rate of 64 Kbit/s. There may be up to 30 B-channels per DPNSS1 link.

D-channel

The D-channel carries call processing information between PBXs for the associated B-channels (call set-up and tear-down information, network feature activation information). The message format is a High Level Data Link Control (HDLC) frame.

The D-channel may be a 64 Kbit/s digital channel, or an analogue channel. It may exist on the same or different carrying medium as the B-channels that it supports. One D-channel may support up to 30 B-channels.

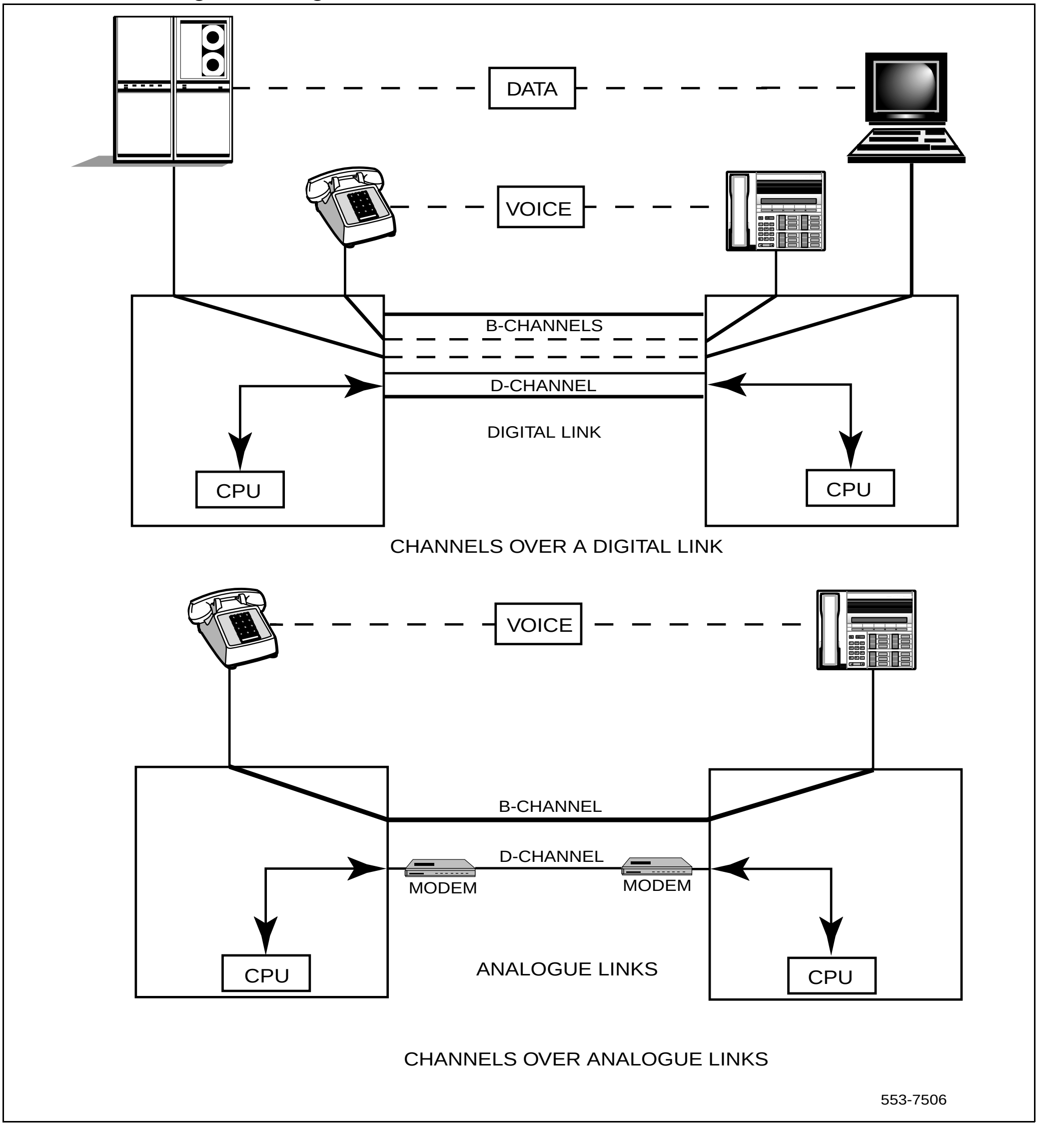
Virtual channel

A virtual channel is a layer 3 Link Access Protocol on D-channel (LAPD) which is not associated with a physical B-channel. Typically, a virtual channel is used to support a call processing activity which does not require a speech or data path. An example would be if the Call Back When Free supplementary service were to be requested due to congestion being encountered on DPNSS1 B-channels on a PBX to PBX link.

The virtual channel is supported by the DPNSS1 D-channel Interface. There may be up to 30 virtual channels on a DPNSS1 link.

Figure 5 on page 23 shows channels over digital and analogue links.

Figure 5
Channels over digital/analogue links



Channel configuration

DPNSS1

DPNSS1 channels are carried over 30B+D Primary Rate Access (PRA) 2 Mbs digital links. Up to 30 B-channels and one D-channel may be configured for each 2 Mbs digital link. However, on terminating PBXs, it is not necessary to configure all 30 B-channels.

Virtual B-channels do not have any effect on normal call processing over the real B-channels.

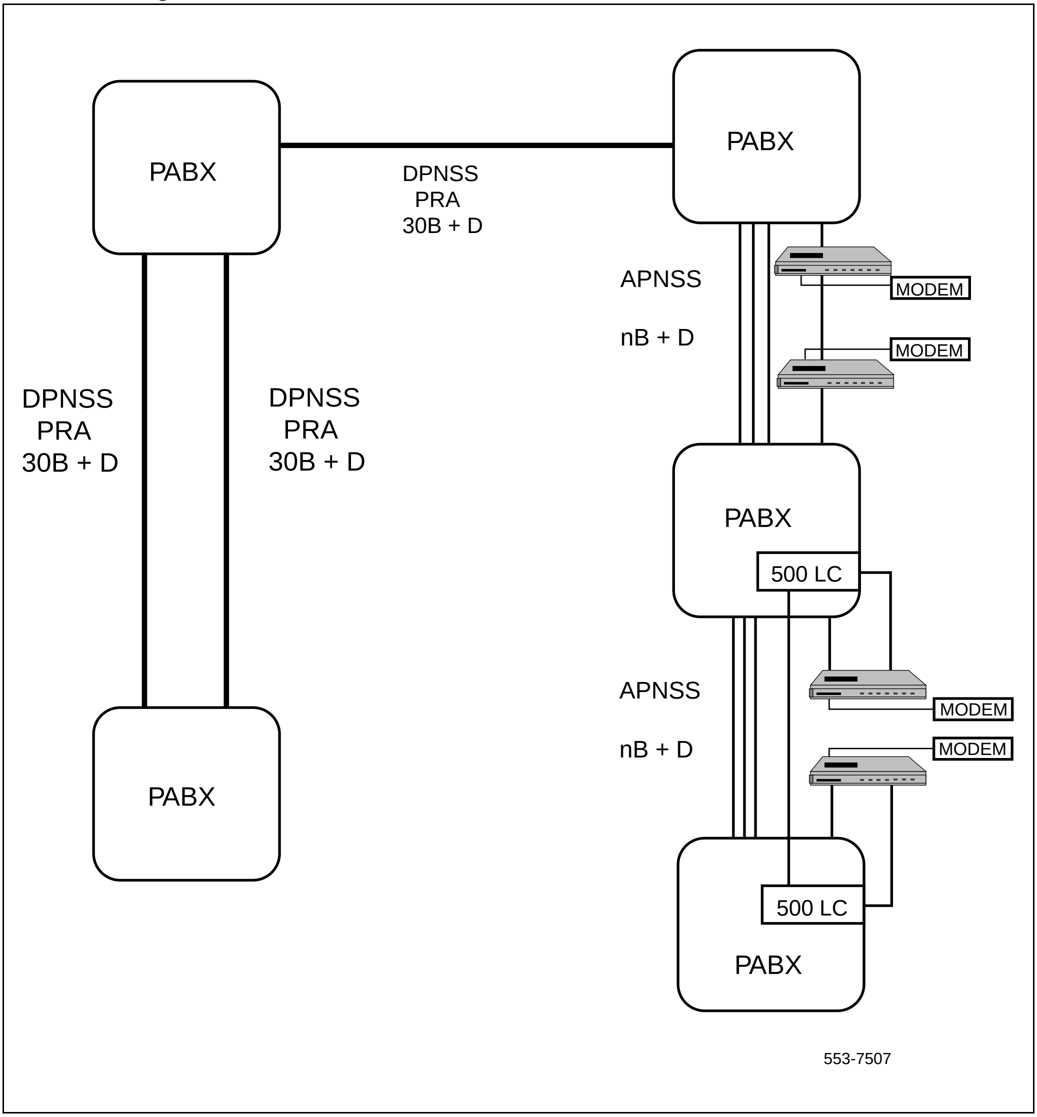
APNSS

The B-channels for APNSS are normally carried over analogue two or four wire E&M, or AC15 trunk circuits. However, digital (DTI2) TIE B-channels can also be used. Up to 30 B-channels, 30 virtual channels, and one D-channel may be configured per APNSS link. Virtual B-channels for APNSS are configured on an unused network loop within the network.

The D-channel may run at any speed and may be carried over a digital or analogue link. If it is carried over a 64KBit/s digital link, a data line card must be provided. An analogue D-channel is normally run through a leased line modem, but may be connected through a dial-up modem, a 500 data line card, and any trunk circuit.

The channel configurations for DPNSS1 and APNSS are illustrated in Figure 6 on page 25.

Figure 6
Channel configurations for DPNSS1, APNSS



Interworking with other signaling systems

DPNSS1 to ISDN PRI gateway

On Meridian 1, the preferred method of interconnection between Meridian 1 PBXs and other products in the Meridian family is the Q.931 intelligent private network signaling protocol (please refer to the Nortel Networks Publications *ISDN PRI: Installation* (553-2901-201), *Networking Features and Services* (553-2901-301), and *ISDN PRI: Maintenance* (553-2901-501) for information on international ISDN PRA functionality on the Meridian 1). Similarly, the preferred option for providing an intelligent 2Mbs digital connection to the ISDN public network is using the Q.931 interface.

A gateway is a means of connecting two different signaling schemes. DPNSS1 on the Meridian 1 offers transparent gateway working to the Q.931 signaling protocols, with the following functions:

- Basic Call Service
- Calling Line Identification
- Called Line Identification
- Display update on call diversion
- Coordinated Dialing Plan

DPNSS1 to ISDN BRI, QSIG, and EuroISDN gateway

The following services are provided with the DPNSS1 to ISDN BRI (line and trunk applications), QSIG, and EuroISDN gateways:

- basic call service (3.1 kHz, speech, 64 Kbit/s restricted/ unrestricted digital information)
- overlap sending and receiving
- 64 Kbit/s bearer capability

DPNSS1 to R2MFC gateway

The DPNSS1 to R2MFC interworking provides an interface for R2MFC DID and DOD calls. For R2 MFC DID calls routing onto DPNSS1 TIE trunks, this feature offers the following capabilities:

- an option is provided in the DPNSS1 route data to define whether the DPNSS1 route can accept Calling Number Identification (CNI) in the call setup messages
- the feedback message from the far end of the DPNSS route is mapped into the appropriate R2 MFC backward signal

For R2 MFC DOD calls originating from DPNSS trunks, this feature provides the following enhancement:

- The R2 MFC backward status signal received from the Central Office is mapped into the appropriate message

The R2 MFC to DPNSS Gateway feature also provides the following enhancements in order to provide CNI support for R2 MFC DID to DPNSS tandem calls:

- The ability to request CNI for an incoming R2 MFC call is possible immediately after a predetermined number of digits are received. The allowable range for this option is 0 to 7.
- The ability to request CNI for an incoming R2 MFC call is possible immediately after an ESN code is dialed. The ESN codes recognized for this purpose are Distance Steering Codes (DSC), Trunk Steering Codes (TSC), AC1s, and AC2s.

Gateway interworking with other signaling systems

Table 2 on page 28 and Table 3 on page 29 outline the gateway working between DPNSS1 and other signaling systems, as well as the DPNSS1 services offered across the gateway.

Note: Please be advised that to date, DPNSS1 has only been launched as part of the Meridian 1 product in the United Kingdom, and that the gateway working is only supported between DPNSS1 and the interfaces listed below. For information regarding gateway working to a signaling system not listed in the table, please contact Nortel Networks Product Management.

Table 2
DPNSS1 gateway to other signaling systems

DPNSS1 Gateway to Signaling System	**Yes/No**
PSTN	Yes
DASS2	Yes
Q.931 (Meridian 1 to Meridian 1)	Yes
Private ISDN/QSIG (ETS 300 172)	Yes
BRI line and trunk interface (NET3 compliant)	Yes
EuroISDN	Yes
R2MFC	Yes
10pps	Yes
SSMF5	No
Non-gateway able to make and receive calls to:	Yes/No
PSTN	Yes
DASS2	Yes
10pps	Yes
SSMF5	Yes

Table 3
DPNSS1 services offered across gateway to signaling system

DPNSS1 Services		**Signaling System**				
BTNR Section	Title	PSTN	DASS2	10pps	SSMF5	Q.931
6	Simple telephony call	2	2	2	2	2
7	Circuit switched data call		2			
16	Supplementary information strings	1	1	1	1	2
18	Bearer service selection		1*			
9	Call Back When Free					2
14	Call Offer					2
31	Call Back When Next Used					2
37	Loop Avoidance					2

1 = interworking supported, but not with an equivalent service of the other signaling system.
2 = interworking between DPNSS1 service and equivalent service of the other signaling system.
blank = no interworking
* = Bearer Service Selection to request specific transmission path capabilities on outgoing calls, as required at the DASS2 to DPNSS1 gateway.

DPNSS1 dialing plans

When a Meridian 1 with DPNSS1 is to be incorporated into a Private Network, it's numbering plan is implemented using the Coordinated Dialing Plan feature (CDP).

The Uniform Dialing Plan (UDP) feature supplements CDP. UDP uses BARS translations to route calls originated from a telephone or non-DPNSS1 trunk at a Meridian 1 node. Usually, BARS Special Numbers (refer to the section explaining Special Numbers, which follows) are programmed to route calls to public network numbers via the private network, before “breaking out” into the public network. The digits received for an incoming DPNSS1 call may not be translated using UDP.

In practice, the uniform dialing plans, normally implemented using the BARS feature, may be implemented on the Meridian 1 using the CDP feature.

The nature of DPNSS1 imposes certain constraints on numbering plan flexibility, in order that supplementary services may function correctly between network nodes. These constraints mean that close attention must be paid to numbering plans when including a Meridian 1 in a DPNSS1 network.

The following sections describe the network facilities which are available to implement DPNSS1 network numbering plans on the Meridian 1. After these descriptions have been presented, examples of DPNSS1 numbering plan configurations are provided.

Network routing facilities on DPNSS1

The network routing facilities which can be used to implement DPNSS1 numbering plans are briefly described. For each one, an NTP reference is quoted where more complete information can be obtained.

Basic Alternate Route Selection and Special Numbers

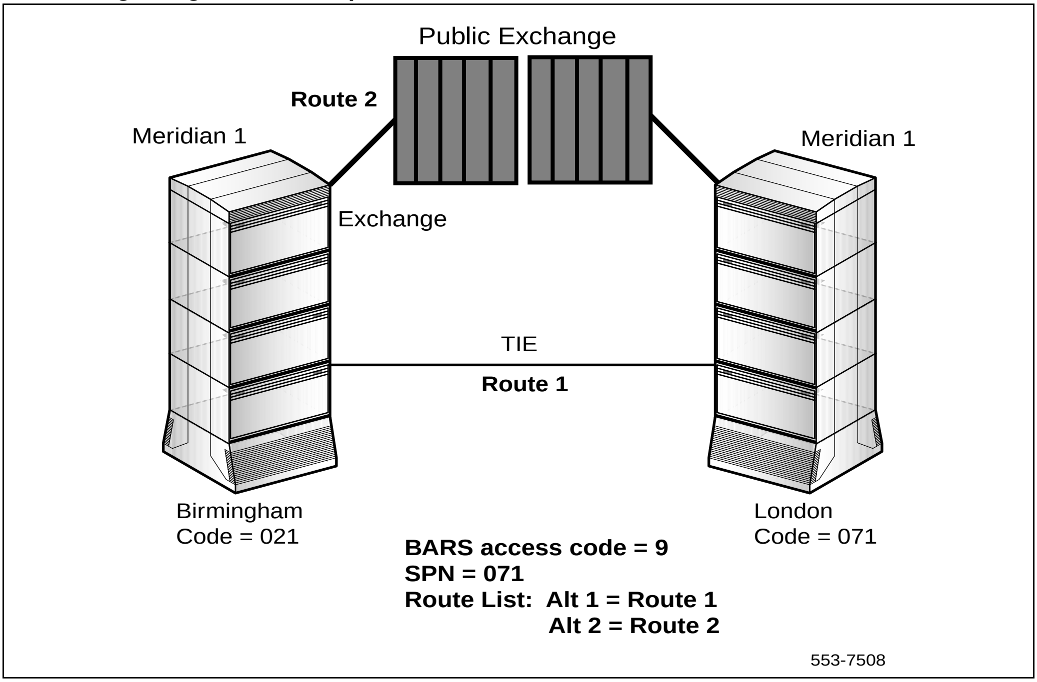
In DPNSS1 networks, the BARS feature is used to implement the routing of calls outside the private network using Special Numbers (SPNs). SPNs may be between one-ten digits long. To allow access to a DPNSS1 network, a one or two digit NARS access code can be programmed.

In the example that follows, a customer has two PBX sites in major cities, Birmingham and Central London. The two sites are connected by a DPNSS1 link. If a user of the Birmingham PBX calls a PSTN number in the London area, rather than routing the call via the public network all the way from Birmingham to London, the call is routed to the London area on the private network, and then “breaks out,” or “hops off,” onto the public network. In this way, a long distance call is made at local call cost.

To achieve this, the following configuration is required at the Birmingham PBX. The BARS access code is given to users as the PSTN access code (“9” - in this case). The London code 071 is programmed as a special number. The first choice route for this SPN is the DPNSS1 route to the London PBX.

Digit manipulation may be applied to the dialed digits, so that the digits received at the London PBX are not the same as those dialed. Figure 7 on page 31 illustrates call routing using BARS and Special Numbers.

Figure 7
Call routing using BARS and Special Numbers



Coordinated Dialing Plan

A Coordinated Dialing Plan (CDP) permits a customer to define a simple dialing plan for an entire network. Each user within the network is assigned a unique 3-10 digit telephone number that does not conflict with any other in the network. All telephone numbers at a particular location must be the same length.

A calling party at one node calls a destination party at another node by simply dialing the telephone number assigned to the destination party. No access codes or pauses for dial tone are required with CDP.

A Coordinated Dialing Plan telephone number is composed of a unique 1-7 digit prefix, known as a steering code, which identifies the network node on which an extension is located, followed by the remaining digits that uniquely identify the extension. A steering code cannot be the same as any access code or other extension number.

There are three types of steering codes:

- Distant steering code
- Local steering code
- Trunk steering code

Distant steering code

A distant steering code (DSC) is uniquely associated with one PBX in the private network. A steering code for one node in a network must be programmed, along with the necessary routing information, at all the other PBXs in the network. Each node may have many steering codes associated with it (there may be up to 10,000 steering codes defined in a Meridian 1 network). The distant steering code will be a prefix of the full number of one or more telephone sets on its associated node.

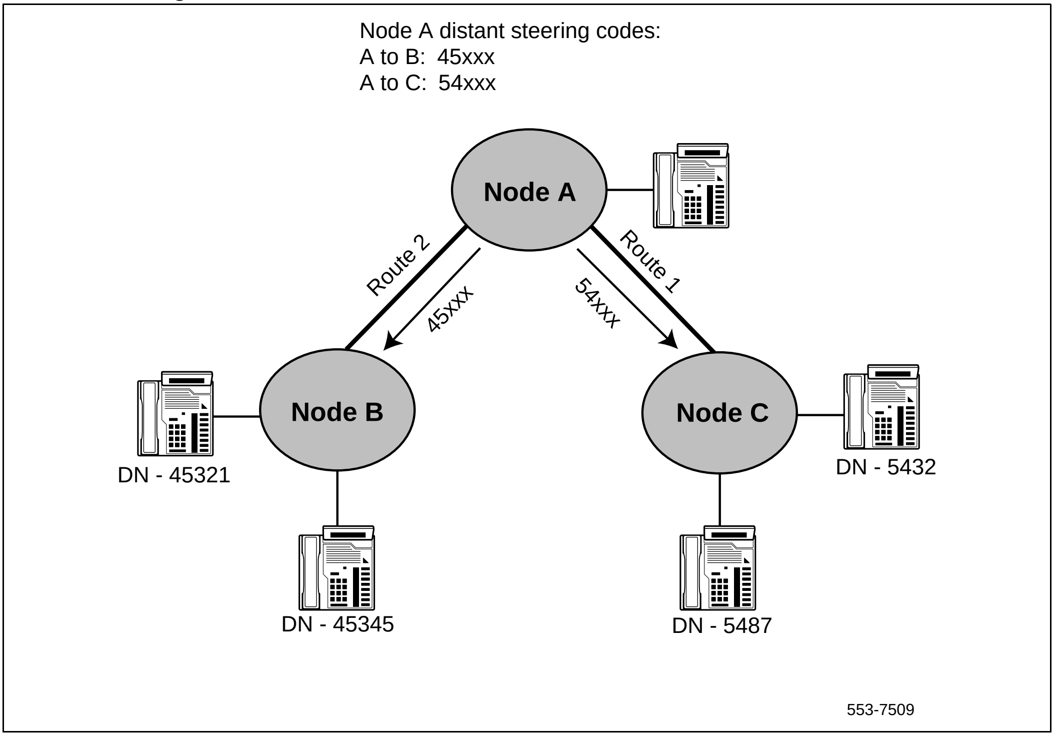
Distant steering codes are generally used to program network routing for numbers of a predetermined length, usually numbers internal to the private network, that is, network extensions. The **Flexible Numbering Plan** feature allows extension numbers of different lengths to exist in a private network. Extension numbers on a single network node may also be of varying lengths. Note that the requirement for all network numbers to be leftwise unique still applies. Refer to Nortel Networks Publication (NTP) *Networking Features and Services* (553-2901-301) for details on the Flexible Numbering Plan feature.

In the example which follows, all DNs in the network with the leading digits "45" are located at node B, and are five digit DNs (fixed length, so distant steering codes are used). Similarly, all DNs in the network with the leading digits "54" are located at node C, but are four digit DNs (fixed length, so distant steering codes are used).

Distant steering codes are programmed at node A. If a DN "45xxx" is dialed, it will be routed via route 2 to node B. If a DN "54xx" is dialed, it will be routed via route 1 to node C.

The Meridian 1 allows digit discrimination on the first seven digits of a distant steering code. The maximum length of a network number programmed using a distant steering code is ten digits. Figure 8 on page 33 illustrates a distant steering code.

Figure 8
Distant steering code



Trunk steering code

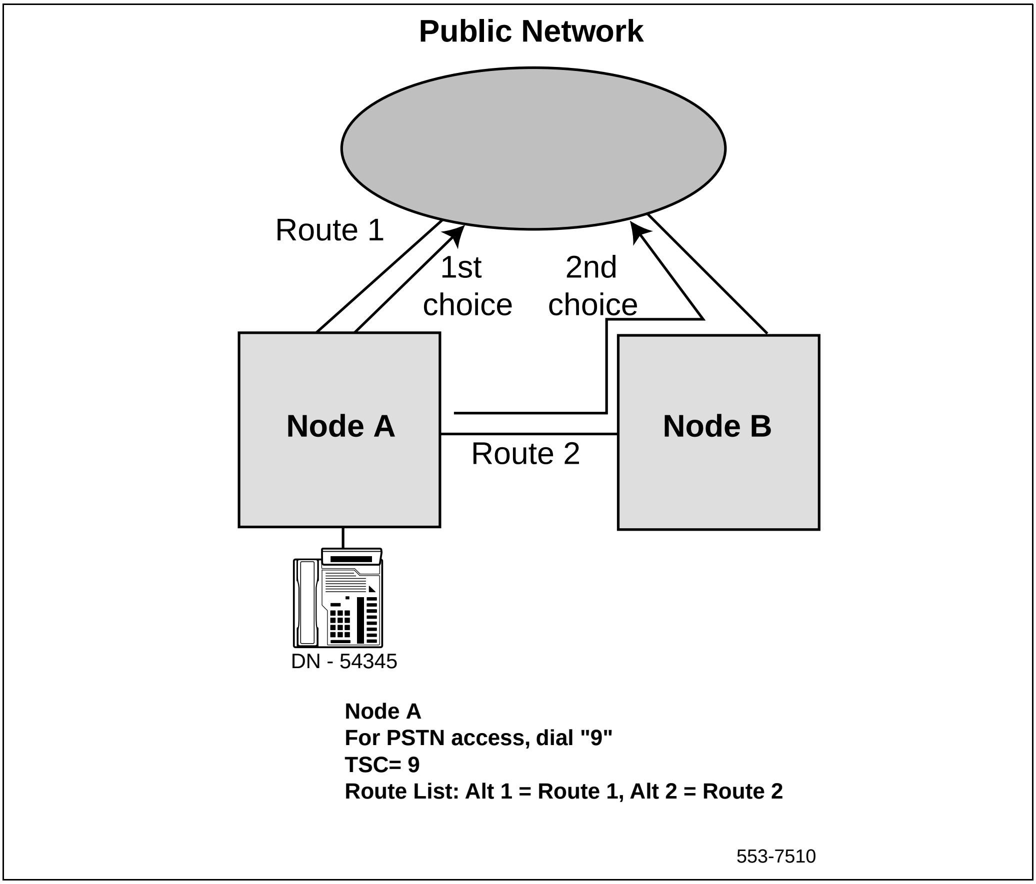
A trunk steering code (TSC) is not necessarily uniquely associated with one PBX in the private network (although in most cases it is). It differs from a distant steering code in that it is used to program network routing for numbers which are not of the fixed CDP length. For example, when calling a foreign country via the PSTN from a private network, the total number of digits dialed will depend on the country which is called.

Typically, a trunk steering code is used to access a particular remote trunk route, a trunk route type (such as a PSTN), or to route to a remote attendant console group. A trunk steering code is also used to program steering codes for network numbers which are longer than ten digits.

In the example that follows, if a private network has more than one node which is linked to the PSTN, routing to the PSTN would be done using a trunk steering code. The trunk steering code would allow a call to route across the private network to a remote PSTN access point if local PSTN access was blocked.

Trunk steering codes allow discrimination on the first seven dialed digits. Figure 9 on page 34 illustrates trunk steering codes.

Figure 9
Trunk steering codes



Local steering code

A local steering code (LSC) can be used to keep locally programmed DNs shorter than the overall network dialing plan, or to overcome conflicts between local extension numbers and a network numbering plan such as, for example, when an existing standalone node is absorbed into a private network. Its function is most easily illustrated with an example.

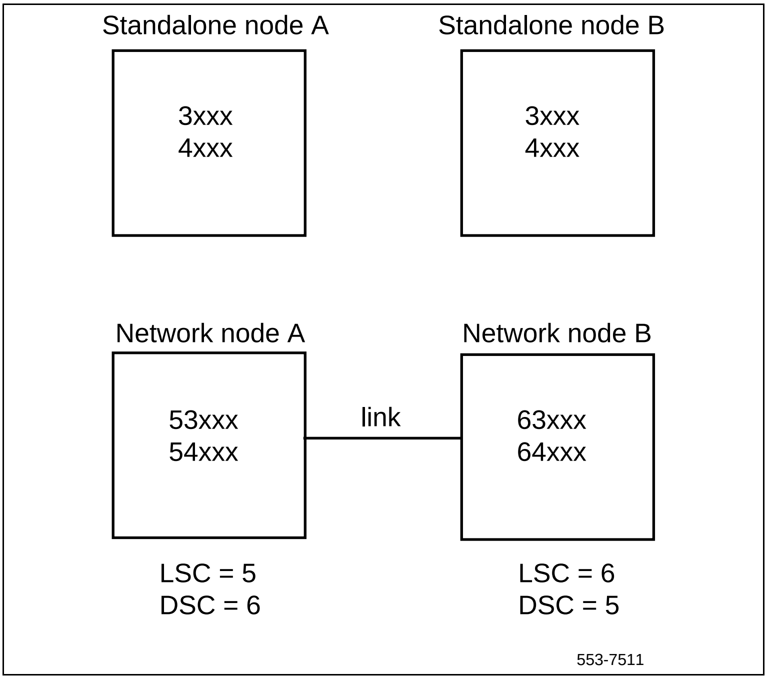
Standalone node A uses a 4 digit numbering scheme, all extensions start with a leading 3 (3xxx) or 4 (4xxx). Standalone node B also uses a 4 digit numbering scheme, all extensions start with a leading 3 (3xxx) or 4 (4xxx).

If the two nodes are to be combined into a network without the need to reprogram every extension number, then an additional leading digit can be introduced at both sites. At node A, all extensions now begin with 53xxx or 54xxx. At node B, all extensions now begin with 63xxx or 64xxx.

At node A, ‘5’ is defined as a local steering code. When a number beginning with 5 is presented to the digit translator, the leading digit is stripped, then the DN is presented a second time to the translator. At node A, ‘6’ is programmed as a distant steering code routing calls to node B. At node B, ‘6’ is defined as a local steering code. When a number beginning with ‘6’ is presented to the digit translator, the leading digit is stripped, then the DN is presented a second time to the translator. At node B, ‘5’ is programmed as a distant steering code routing the calls to node A.

Figure 10 on page 36 shows an example of local steering codes.

Figure 10
Local steering codes



Digit Insertion

A fixed string of up to 8 digits, programmable on a route basis, may be inserted in front of any received digits on an incoming call. This facility can be used to overcome numbering plan conflicts between network and local DNs on Meridian 1 nodes in DPNSS1 networks.

DDI Incoming Digit Conversion

DDI Incoming Digit Conversion allows the private network numbering plan to differ from the public numbering plan with respect to DDI extensions within the private network. Each DDI route may have a unique IDC table assigned to it which will allow full or partial digit conversion. For more details see the *Features and Services* (553-3001-306).

Numbering plan recommendations

When a DPNSS1 call is originated, be this by a telephone or incoming non-DPNSS1 trunk, the routing digits which are “outpulsed” down the DPNSS1 trunk are referred to as the Destination Address (DA). The specification for DPNSS1 requires that the DA pass through each transit node, enroute to the destination PBX, without being changed. In other words, for DPNSS1 incoming to DPNSS1 outgoing, “what goes in must come out.” This consistency of DA is essential in order for many of the DPNSS1 supplementary features to work correctly.

With this overall constraint in mind, the following recommendations are made about the way in which digit insertion and manipulation features are used in DPNSS1 networks.

DPNSS1 and Digit Insertion

On any particular Meridian 1 node, it is recommended that the same digits be inserted on all incoming DPNSS1 routes (that is, the same response to the INST prompt in LD 16).

DPNSS1 and Local Steering Codes

When an incoming DPNSS1 call terminates locally, following digit insertion and pretranslation, a Local Steering Code may be used to delete some of the leading digits of the received Destination Address. The LSC might also be used to insert digits in place of the deleted digits. Where possible, the insertion of digits should be avoided. Also, if digits are to be deleted, then the same number of digits should be deleted from every LSC. For example, do not allow the following manipulation:

Received DALocal DN

[23]456------->456

[245]36------->36

DPNSS1, Digit Insertion and Outgoing Digit Manipulation

If the Digit Insertion feature is used to insert digits on an incoming DPNSS1 call, and the call is to be routed through the Meridian 1 node and out on a DPNSS1 trunk, this will be achieved using either a DSC or a trunk steering code. In either case, digit manipulation may be applied to the call to modify the outpulsed digits. The manipulation should be used to delete the digits inserted by the Digit Insertion feature. This ensures that the Destination Address passes through the transit node unchanged.

DPNSS1 and Trunk Identities

In order for the Calling Line Identity feature to function correctly, a pair of numbers, the PBX Reference Number and the Trunk Group Reference Number, must be assigned to each non-DPNSS1 route on a Meridian 1.

DPNSS1 and the use of BARS

When a call originates from a Meridian 1 PBX, the BARS feature may be used to translate the number dialed into the Destination Address to be sent. It is quite conceivable that this same DA could be received at the node, for example, if the node is acting as a transit. As stated earlier, the BARS feature cannot be used to translate digits for incoming DPNSS1 calls. This implies that two sets of routing data would be required, the first for locally originated calls, the second for DAs received from other PBXs.

For further clarification, please refer to the following examples of DPNSS1 network numbering schemes.

Network numbering schemes

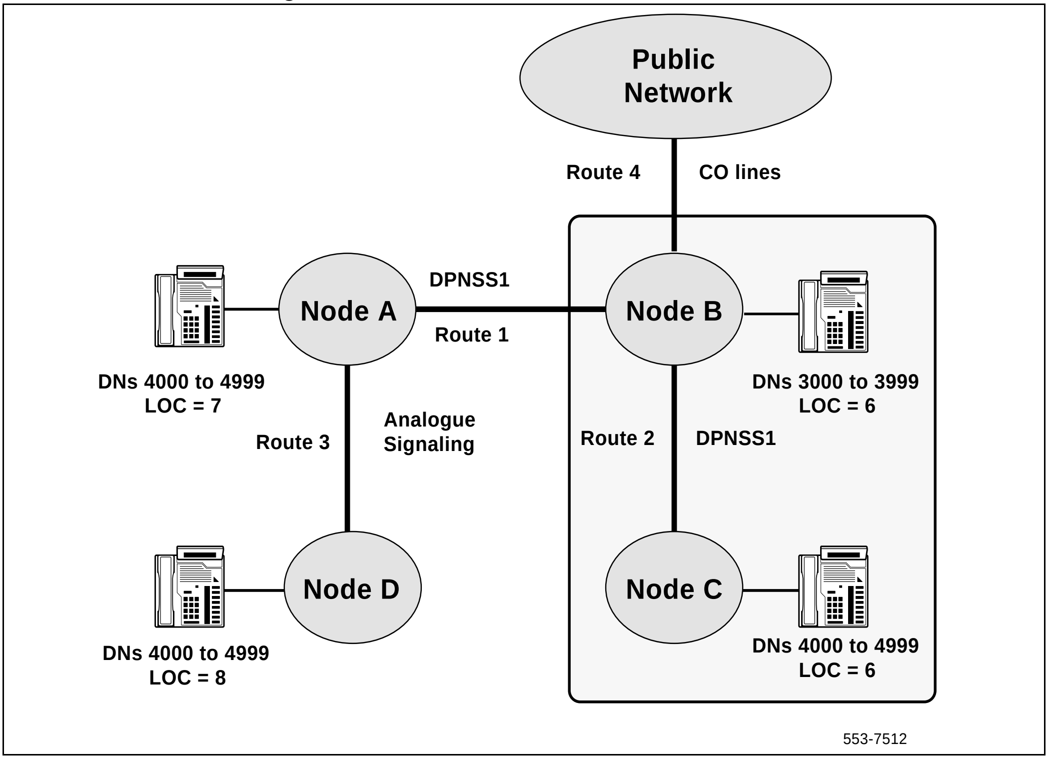
The following sections provide examples of numbering scheme applications for DPNSS1 Meridian 1 networks.

Location Code numbering scheme

In the DPNSS1 Meridian 1 network configuration illustrated in Figure 11 on page 39, the PBXs are identified by Location Codes. The Location Codes used are 6, 7 and 8.

Nodes B and C share the same location code 6. To the other nodes in the network, B and C are seen as a single PBX. When a call from node A reaches node B, the first digit of the DN following the location code is used to determine whether the call is intended for node B or node C.

Figure 11
Location code numbering scheme



In effect, there is a localized coordinated dialing plan between B and C. A caller on B will always be aware that an extension on D is remote because a location code must be dialed. However, from B, to reach a remote extension on C, an apparently local DN is dialed, so the caller is unaware that the extension is remote.

Normally, on a non-DPNSS1 Meridian 1 network, this type of numbering scheme would be implemented primarily using the BARS/NARS features, with the CDP feature being used to implement only the dialing between B and C.

This example shows how the Coordinated Dialing Plan feature can be used to emulate NARS/BARS, and thus to implement the entire numbering plan. The telephone user's view of the dialing plan is as follows.

To place a call to a remote extension, the following digit fields must be dialed:

AC (5) + LOC (7) + DN (4000)

where AC is the network access code, LOC is the location code, and DN is the extension at the remote node.

To make a local call the “AC+LOC” part of the number can be omitted. This applies equally to calls made between nodes B and C. Only node B has exchange lines and attendants. Access to these facilities from other nodes is obtained by dialing 9 and 0 respectively. Routing to node B for these facilities is done using Trunk Steering Codes.

Call Routing - Distant Steering Codes

Variable length distant steering codes are to be used. Six digit codes are required for calls between nodes with different location codes, when the full AC+LOC+DN must be dialed. Four digit codes are defined for calls between nodes A and B, when only the extension number is dialed.

Table 4
Example of Call Routing - Distant Steering Codes

PBX A			PBX B			PBX C		
DSC	Flen	Route List	DSC	Flen	Route List	DSC	Flen	Route List
563	6	101	4	4	201	3	4	301
564	6	101	57	6	202	57	6	302
58	6	102	58	6	202	58	6	302

Call Routing - Trunk Steering Codes

Trunk Steering Codes are defined at nodes A and C to allow access to exchange lines and attendant consoles at node B with single digit dialing. The trunk steering codes are defined as follows.

Table 5
Example of Call Routing - Trunk Steering Codes

PBX A		PBX C	
TSC	**Route List**	**TSC**	**Route List**
0	103	0	303
9	103	9	303

The trunk steering codes are subject to digit manipulations which are described below.

Call Routing - Routing Lists

Digit manipulations are required in the route lists associated with attendant and PSTN access codes at nodes A and C, so that the digits actually sent to node B correspond to the appropriate Local Steering Code. Similarly, digit manipulations are required in the route lists used for dialing ‘4000’ extensions from node A, and ‘3000’ extensions from node B, so that the digits actually sent correspond to the full network number of the extension.

Table 6
Examples of Call Routing - Routing Lists

PBX A				PBX B				PBX C			
Route List	Route No	DMI		Route List	Route No	DMI		Route List	Route No	DMI	
		Del	Ins			Del	Ins			Del	Ins
101	1	-	-	201	1	-	56	301	2	-	56
102	3	-	-	202	2	-	-	302	2	-	-
103	1	-	56	203	2	-	-	303	2	-	56

Call Termination for Internal Network Calls - Local Steering Codes

For incoming network calls which are to terminate on local extensions, local steering codes are required which will translate the received Destination Address (DA) into the correct local DN. For example, an incoming call to node A, with the DA 574100 is identified as being intended for a local extension 4100. In order to terminate on the local extension, the leading two digits must be stripped away. Table 7 on page 43 provides examples of call termination where local steering codes are required to translate the received DA into the correct local DNs.

Table 7
Examples of Call Termination – Local Steering Code translations

PBX A			PBX B			PBX C		
LSC	**DMI**		**LSC**	**DMI**		**LSC**	**DMI**	
	Del	**Ins**		**Del**	**Ins**		**Del**	**Ins**
57	2	-	563	2	-	564	2	-
			560	2	-			

Note that LSC 560 defined at node B is reduced to ‘0’, the local attendant DN. This corresponds to the TSCs defined at nodes A and C.

Call Termination at node B - PSTN Access

The route access code for the PSTN route located at a transit node B is “569”. When “9” is dialed from a node B extension, it is programmed as a Trunk Steering Code. Digit manipulation is used to convert the outpulsed digits to “569”. The call is then routed to node B, were the “569” is programmed as the PSTN route access code.

Hardware requirements

Contents

This section contains information on the following topics:

DPNSS1 hardware requirements

The following hardware is required for each DPNSS1 link on Meridian 1 system Options 21/21E, 51/51C, 61/61C, 71, and 81/81C:

- one NTAG54 Dual Daughterboard (for NTCK43AB or higher vintages of the Dual PRI)

  or

- one NT5K35 D-channel Handler Interface

  or

- one NT5K75 D-channel Handler Interface - an enhanced version of the NT5K35 which provides up to 160 D-channel port addresses. This card supports two switch-selectable modes of operation — standard mode and expanded mode. Standard mode D-channels may be assigned an input/output port address in the range 0-15; expanded mode D-channels may be assigned port addresses in the range 0-159. Each port has a set of DIP switches allowing full configuration flexibility. Please see the section entitled "Engineering note pertaining to port addressing modes" on page 49 in this chapter.

  or

- one NT6D11AE/AF D-channel Handler Interface - an enhanced version of the NT5K75 which is fully backward compatible with the NT5K75 and NT5K35. This card supports two switch-selectable modes of operation — standard mode and expanded mode. Standard mode D-channels may be assigned an input/output port address in the range 0-15; expanded mode D-channels may be assigned port addresses in the range 0-159. Each port has a set of DIP switches allowing full configuration flexibility. See the section entitled "Engineering note pertaining to port addressing modes" on page 49 in this chapter.

  Note: The NT5K75 and NT6D11AE/AF cannot operate in expanded addressing mode on Meridian 1 Options 21 and 21E.

- one NTCK43 dual-port PRI card (NTCK43AB or higher)

  or

- one NT8D72 Primary Rate Interface card (NT8D72BA is required for EuroISDN applications)
- one QPC949D CPU ROM (up to and including Group G) and NTND08AA CPU ROM (up to and including Group H) are required to support the expanded capability of the NT5K75 and NT6D11AE/AF DCHI
- one loop of the QPC414 ENET dual loop network interface card
- one of the following cables:
  - NT5K40AA PRI to Line Terminating Equipment cable (15 pin D-type to twin BNC, 4 meters)

- — NT5K41AA PRI to Line Terminating Equipment cable (15 pin D-type to twin BNC, 8 meters)
- — NT5K86AA PRI to Line Terminating Equipment cable (15 pin D-type to twin BNC, 12 meters, TX shield connected to FGND)
- — NT5K86BA PRI to Line Terminating Equipment cable (15 pin D-type to twin BNC, 12 meters, RX shield connected to FGND)
- — NT5K86AA PRI to Line Terminating Equipment cable (15 pin D-type to twin BNC, 12 meters, TX and RX shields connected to FGND)

- one QCAD328 DCHI to PRI cable
- one NT8D85 ENET to PRI cable
- for the NTCK43 DPRI card, the following cables are used:
  - — NTCK45AA 120 Ohm Dual PRI to I/O Panel cable (8ft)
  - — NTCK78AA 120 Ohm Dual PRI cable for ST Machines (50ft
  - — NTCK79AA 75 Ohm Dual PRI Coax Cable (40ft)
  - — NT8D7217 Dual PRI I/O Panel to Multiplexer cable (50ft)
  - — NTCK46AA Dual PRI to DASS/DPNSS NT6D11 DCHI cable (6ft)
  - — NTCK46AB Dual PRI to DASS/DPNSS NT6D11 DCHI cable (18ft)
  - — NTCK46AC Dual PRI to DASS/DPNSS NT6D11 DCHI cable (35ft)
  - — NTCK46AD Dual PRI to DASS/DPNSS NT6D11 DCHI cable (50ft)
  - — Clock Controller cables (1 to 2 port cables):
    - – NTCK47AA Dual PRI to Clock Controller cable (2ft)
    - – NTCK47AB Dual PRI to Clock Controller cable (4ft)
    - – NTCK47AC Dual PRI to Clock Controller cable (6ft)
    - – NTCK47AD Dual PRI to Clock Controller cable (8ft)

    – NTCK47AE/AF Dual PRI to Clock Controller cable (10ft)

  — Clock Controller Cables (1 to 4 port cables)

    – NTCK81AA Dual PRI to Clock Controller cable (2ft)
    – NTCK81AB Dual PRI to Clock Controller cable (4ft)
    – NTCK81AC Dual PRI to Clock Controller cable (6ft)
    – NTCK81AD Dual PRI to Clock Controller cable (8ft)
    – NTCK81AE/AF Dual PRI to Clock Controller cable (10ft)

- one QPC775 Clock Controller (QPC775E is required on Option 81/81C machines, and where EuroISDN functionalities are being supported). This cable is required if the DPNSS1 loop is to be used as a timing synchronisation source for the Meridian 1 PBX.
- one NT8D79AD PRI to Clock Controller cable. This cable is required if the DPNSS1 loop is to be used as a timing synchronisation source for the Meridian 1 PBX.

  Note: Presently, the network loop used for DPNSS1 cannot be odd-numbered if the associated even-numbered loop is programmed as being used for existing peripheral equipment, that is, as TERM, TERD, or TERQ in Overlay 17. If all peripheral equipment is IPE, this constraint applies only when Meridian Mail is equipped.

Table 8
Programming of network loops

ENET LOOP	ALLOWED					NOT ALLOWED
EVEN	Meridian Mail	PRI	PRI	ANY	---	Meridian Mail
ODD	Meridian Mail	PRI	Meridian Mail	---	ANY	PRI

Hardware requirements for DPNSS Standalone Meridian Mail

To support Standalone Meridian Mail access over DPNSS, a Meridian Mail module and standard attachments are required.

Engineering note pertaining to port addressing modes

There is a distinction between Group G and Group H functionality regarding port addressing modes.

Group G and earlier

Standard address mode **(0-15)** can be any of the following:

- DPNSS1 (DDSL)
- DASS2 (DDSL)
- APNSS (LSSL)
- Q931 (DCHI)
- ISL (DCHI)
- SDI
- ESDI

Expanded address mode **(0-159)** can be either of the following:

- DPNSS1 (DDSL)
- DASS2 (DDSL)

The expanded mode addressing has no impact on the standard mode addressing, that is, DPNSS1 D-channel (DDSL) 7 in the expanded mode can exist with the Q931 D-channel (DCHI) 7 in the standard mode.

Theoretically, it is possible to have 160 DPNSS1 D-channels and 16 other I/O devices. In practise, however, there is a limit of 40 addresses in expanded mode and 16 in standard mode, for a total of 56 addresses.

The port address numbers assigned to the NT5K75 and NT6D11AE/AF operating in expanded mode must not conflict with addresses assigned to other I/O port types. To avoid potential conflicts and to simplify system configuration, it is recommended that, in the expanded mode, the port addresses for the NT5K75 and NT6D11AE/AF avoid the standard mode range (0-15) and be numbered in the range 16-159 instead.

Group H and later

Standard address mode **(0-15)** can be any of the following:

- DPNSS1 (DDSL)
- DASS2 (DDSL)
- APNSS (LSSL)
- Q931 (DCHI)
- ISL (DCHI)
- SDI
- ESDI

If the MSDL is used, standard mode can have a range of **0-63,** and can be any of the following:

- Q931 (DCHI)
- ISL (DCHI)
- ESDI

Expanded address mode **(0-159)** can be either of the following:

- DPNSS1 (DDSL)
- DASS2 (DDSL)

The expanded mode addressing has no impact on the standard mode addressing, that is, DPNSS1 D-channel (DDSL) 7 in the expanded mode can exist with the Q931 D-channel (DCHI) 7 in the standard mode.

Theoretically, it is possible to have 64 addresses using the MSDL with Q931, ISDL, or ESDI, plus 160 addresses using the expanded mode for DPNSS1 for a total of 224 addresses. In practise, however, there is a limit of 64 addresses using MSDL with Q931, ISDL, or ESDI, plus 40 addresses using the expanded mode for DPNSS1, for a total of 104 addresses.

Presently, MSDL does not support SDI ports on DPNSS1 or APNSS, so the likely configuration would involve a mixture of standard mode addressing, MSDL addressing, and expanded mode addressing for DPNSS1. Such an example could be as follows:

0-7 (8 addresses) in the standard mode;

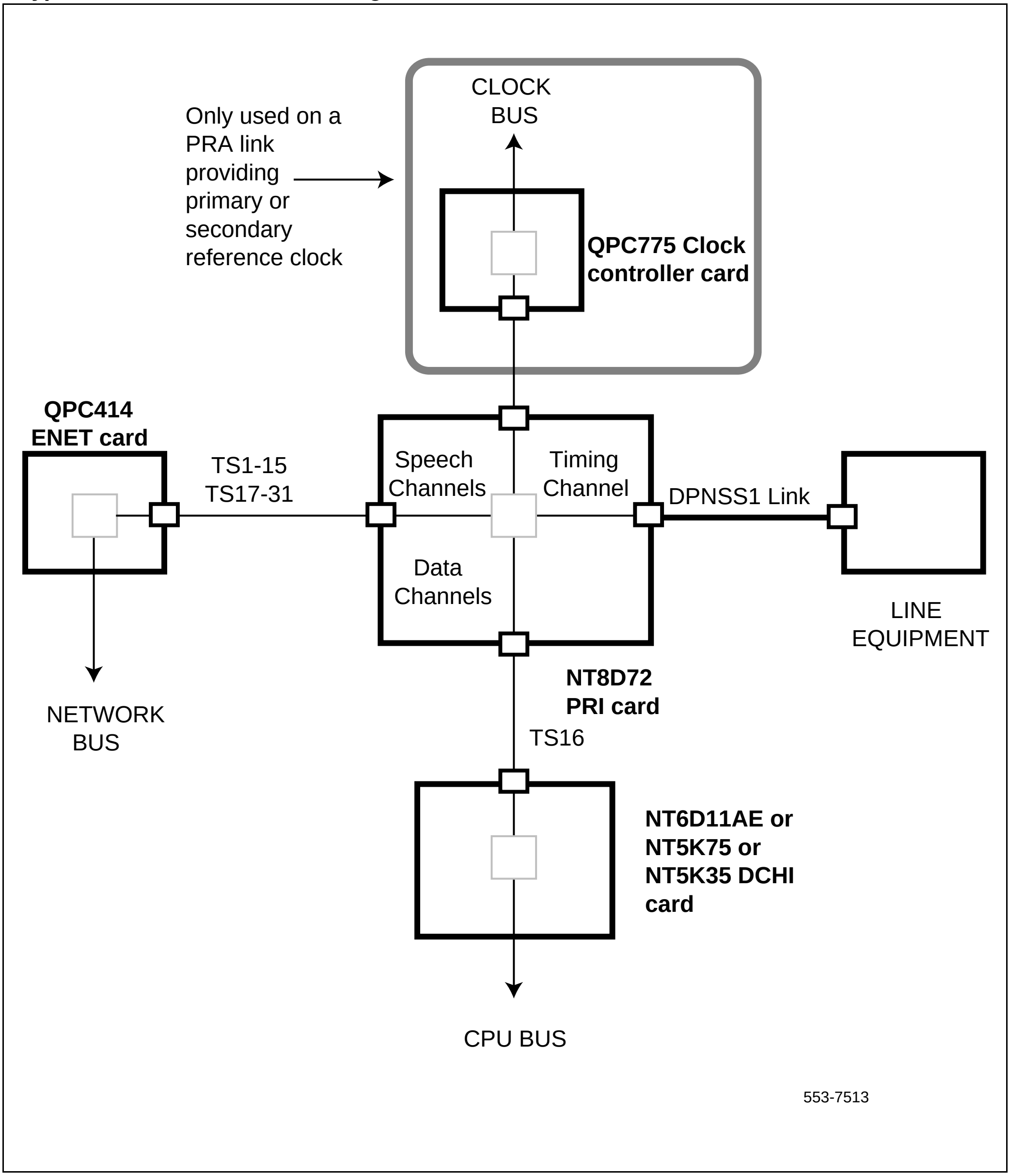
8-15 (32 addresses) in the MSDL mode;

16-55 (40 addresses) in the expanded mode.

The port address numbers assigned to the NT5K75 and NT6D11AE/AF operating in expanded mode must not conflict with addresses assigned to other I/O port types. To avoid potential conflicts and to simplify system configuration, it is recommended that, in the expanded mode, the port addresses for the NT5K75 and NT6D11AE/AF avoid the standard mode range (0-15) and be numbered in the range 16-159 instead.

Figure 12 on page 52 illustrates a typical DPNSS1 hardware configuration.

Figure 12
A typical DPNSS1 hardware configuration



APNSS hardware requirements

The following hardware is required to support APNSS on Meridian 1 system Options 21/ 21E/21C, 51/51C, 61/61C, 71, and 81/81C, and machine types ST, STE, NT, and XT:

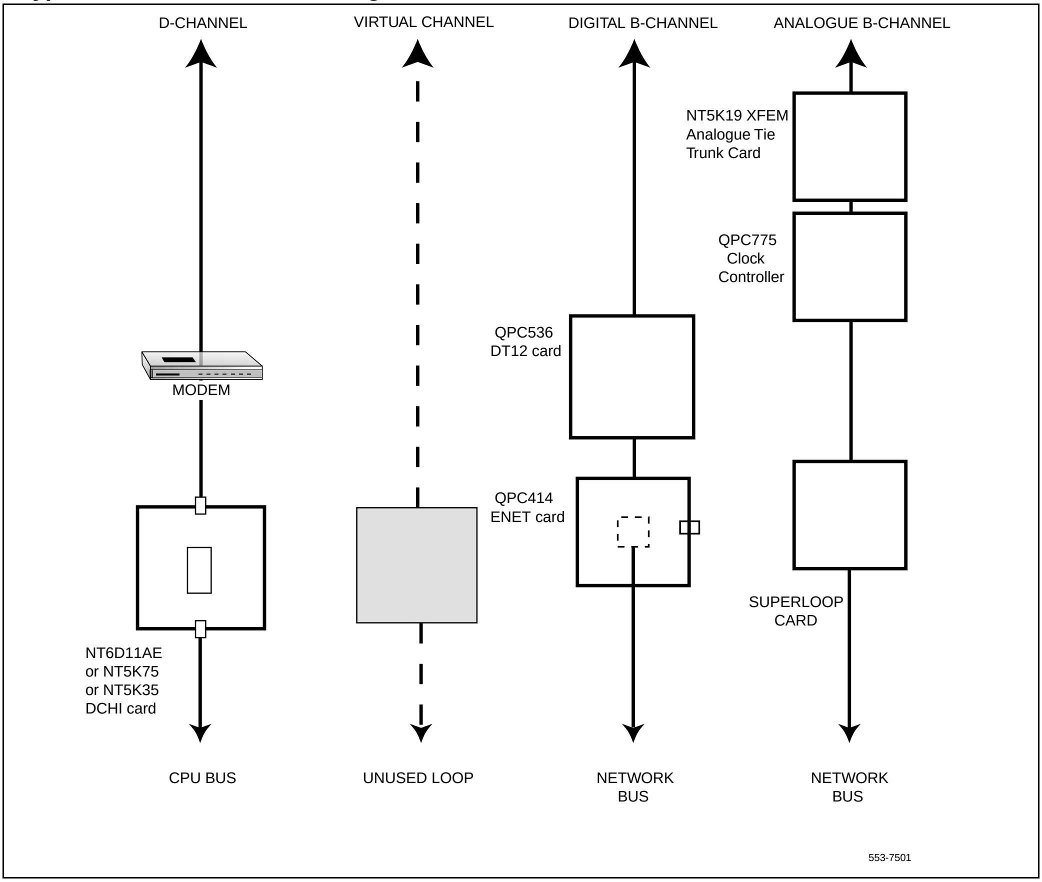
- one NT5K35 DCHI, **or** the NT5K75 DCHI, **or** the NT6D11AE/AF DCHI

  Note: Standard mode addressing 0-15 only is allowed for the NT5K75 or NT6D11AE/AF; the expanded addressing mode is not allowed.

- one NT5K19 XFEM Analogue TIE Trunk card. It is equipped with an Intel 8052-type microprocessor which performs the functions of card identification, self-test, status reporting to the controller, and maintenance diagnostics. The NT5K19 provides four analogue trunks, the following which may be configured for APNSS: 4 wire E&M Type 1 TIE trunk (DC5), 2 wire E&M TYPE 1 TIE trunk (DC5), or AC15 bearer trunk.
- either one of the following modems (the list of modems supporting APNSS working is subject to change. Please contact NT Product Management for information specific to a particular requirement):
  - — BT 4242VSX modem
  - — Datel 4960FTX modem
- one QPC536 DTI2 card
- one 500 set line card

Figure 13 on page 54 illustrates a typical APNSS hardware configuration.

Figure 13
A typical APNSS hardware configuration



Meridian 1 and Succession Communication Server for Enterprise 1000

DPNSS1

Product Overview Guide

Publication number: 553-3921-100
Document release: Standard 7.00
Date: January 2002
Printed in Canada

NORTEL NETWORKS™