Meridian 1

Electronic Switched Network

Description

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Revision history

October 1997

Issue 8.00 released as Standard for Generic X11 Release 23.0x.

July 1995

Standard release 7.0 introduces the following X11 release 21 features and capabilities:

- Collect Call Blocking

- DPNSS!/DASS2 UDP interworking

All changes are indicated with change bars closest to the outside edge of the page.

July 1994

Standard release 6.0 introduces the following X11 release 20 features and capabilities:

- Interchangeable Numbering Plan Area Codes, and

- Federal Communications Commission Equal Access Carrier Access Code Expansion.

- Flexible Numbering Plan.

August 1993

This document is reissued to include changes for X11 release 19.

May 1992

This document is reissued to include some content changes.

December 1991

This document is reissued to include technical content changes.

December 1990

This document is reissued to include updates and changes for X11 release 16.

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Introduction

The Electronic Switched Network (ESN) is a private communications network intended for use by large business customers with distributed operating locations.

This document introduces the reader to the concepts of the ESN with emphasis on the switching components.

References

For more information on the Electronic Switched Network or on networking features and load configuration, refer to the following Northern Telecom Publications (NTPs):

— *Electronic Switched Network signaling guidelines* (309-3001-180)

— *Electronic Switched Network transmission guidelines* (309-3001-181)

— *Features and services for Generic X11 supplementary features* (Appendix 2 to 553-2311-105) for X11 release 19 and earlier, or *X11 features and services Reference Guide* (553-3001-306) for X11 release 20 and later

— *X11 data administration input/output guide including supplementary features* (Appendix 1 to 553-2311-311)

— *International ISDN PRA Associated feature descriptions* (553-2921-100)

— *X11 features and services* (553-3001-305)

— *Basic and Network Alternate Route Selection description* (553-2751-100)

— *Coordinated Dialing Plan description* (553-2751-102)

— *ISDN Primary Rate Interface description and administration* (553-2901-100)

— *ISDN Primary Rate Interface installation* (553-2901-200)

— *ISDN Primary Rate Interface maintenance* (553-2901-500)

— *X11 input/output guide* (553-3001-400)

The prime element of an ESN is the ESN node. ESN nodes are strategically located (see Figure 1) to concentrate on-network traffic and access off-network facilities efficiently and economically. An ESN can be a single ESN node serving a few locations in a metropolitan area or multiple ESN nodes serving up to 999 locations that can be located around the world.

The ESN nodes direct calls from a switch in one geographical location to a switch in any other geographical location in a cost-efficient and easy-to-use manner by:

— eliminating long, complex dialing plans and replacing them with an abbreviated Uniform Dialing Plan (UDP) common to all switches which are part of the ESN

— providing a means of controlling the number and type of trunks that are available to each network user and of the time of day that access to a trunk (or group of trunks) is allowed

— automatically selecting the least-cost trunk route available to complete a call between switches

— providing uniform network access to stations served directly by the ESN node and stations served at other switches (ESN Mains, Conventional Mains) connected by means of tie trunks to an ESN node as shown in Figure 1

— providing the call originator with the option to either accept or refuse a call that is to be completed over an expensive trunk route if there are not any least-cost trunk routes currently available

— providing optional queuing features that allow the call originator (when all trunks are busy) to either remain off-hook until a trunk becomes idle or hang up and receive a callback from the SL-1 when a trunk becomes idle, thus eliminating repeated, time-consuming dialing attempts

— collecting and printing traffic data related to the ESN operation (thus allowing the efficiency of the network to be monitored)

To accomplish the efficient call-handling operations in an ESN, each ESN node utilizes some, or all of the following unique ESN software features listed below and described in this document:

— Transparent Data Networking (TDN, described in *Transparent Data Networking,* 553-2731-110), which provides a transparent data channel for data modules to perform end-to-end protocol exchange. With TDN, two data modules wait for a circuit path to be established before exchanging protocol parameters

— Network Class of Service (NCOS)

— Network Alternate Route Selection (NARS)

— Network Signaling (NSIG)

— Network Traffic Measurements (NTRF)

— Off-Hook Queuing (OHQ)

— Call-Back Queuing (CBQ)

— Coordinated Call-Back Queuing (CCBQ)

— Call-Back Queuing to Conventional Mains (CBQCM)

— Free Calling Area Screening (FCAS)

— Coordinated Dialing Plan (CDP)

— Flexible Numbering Plan (FNP)

— Network Authorization Codes (NAUT)

Switch definitions

In the context of this publication, the following definitions may be applied to the various switch types that are considered to be part of an ESN network. These definitions are used for convenience and do not constitute the only possible ESN configuration.

ESN node

A switch equipped with features identified in Table 1 and configured within the network as shown in Figure 1.

ESN main

A switch equipped with features identified in Table 1 and that is connected by means of tie trunks to a single ESN node. An ESN main can also be equipped with the Basic Alternate Route Selection (BARS) feature to provide alternate route selection capabilities for calls placed to satellite switches that are located on the ESN main. See *Basic and Network Alternate Route Selection description* (553-2751-100).

Conventional main

A switch that is connected to an ESN node and equipped with none of the features listed in Table 1. Included in this category are other switch types such as Step-by-Step (SXS), Electronic Tie Network (ETN), and DIMENSION.

Table 1
Feature package requirements for ESN nodes and ESN mains

Description	ESN node	ESN main
Network Alternate Route Selection	X	
Off-Hook Queuing	X	
Call-Back Queuing	X	
Coordinated Call-Back Queuing	X	X (optional)
Call-Back Queuing to Conventional Mains	X	
Network Signaling	X	X
Free Calling Area Screening	X	
Network Class of Service	X	X
Coordinated Dialing Plan	X	X (optional)
Basic Alternate Route Selection		X (optional)
Flexible Numbering Plan	X (optional)	X (optional)
Network Authorization Code	X	
Basic Authorization Code		X (optional)
Network Traffic Measurements	X	X (optional)

Note: A switch is termed a Conventional main if none of the above feature packages are equipped at the switch.

Figure 1
Example of an Electronic Switched Network
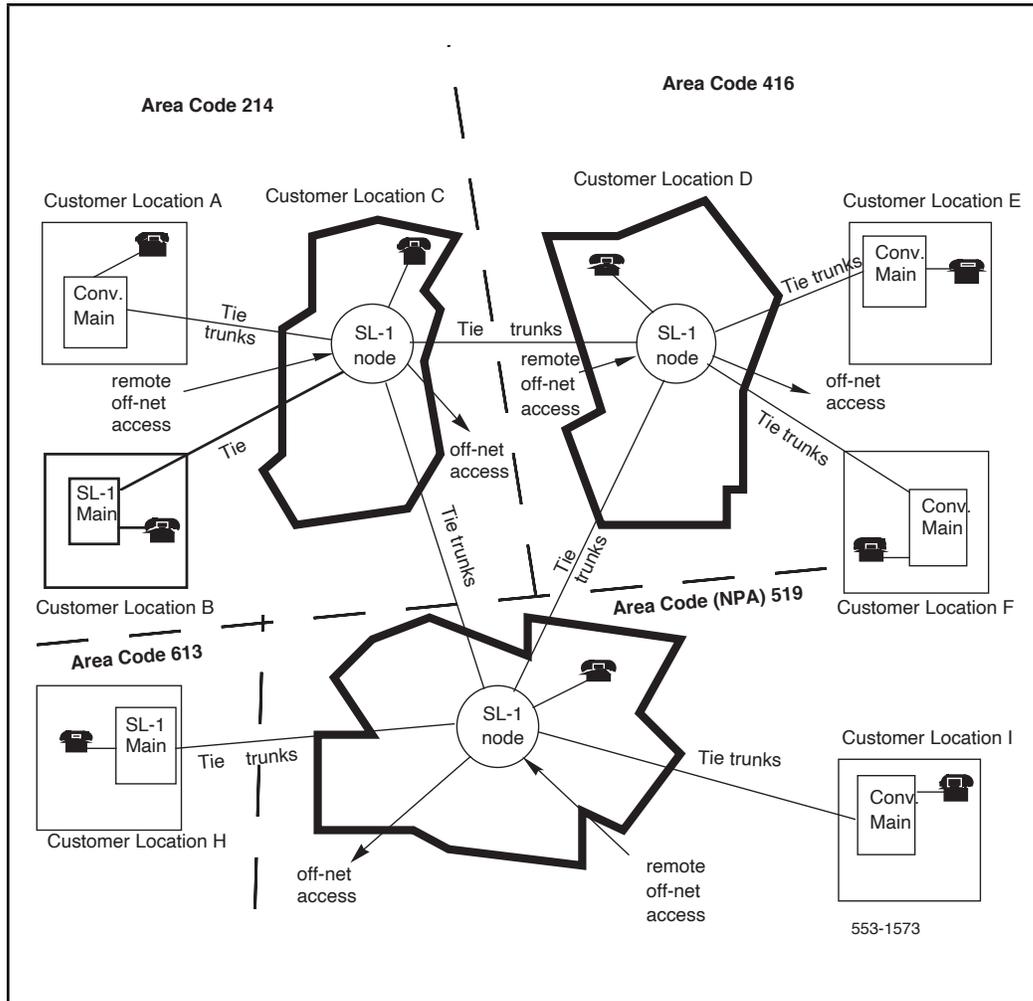
Network Class Of Service

The Network class of service feature (NCOS) is an integral part of network control and routing control in an ESN. NCOS provides the means to control:

— which trunk routes are eligible for access to attempt call completion

— whether or not queuing is offered to a call originator

— whether or not the originator of a network call receives a warning tone when an expensive trunk is selected to complete the call

— whether or not the user is allowed to access the Network Speed Call (NSC) feature

ESN nodes and mains can each accommodate 100 (0–99) NCOS groups with each group made up of different network-access characteristics. Once each NCOS group is defined through service change, the lines, trunks, and attendants connected directly to the switch are assigned to the NCOS group which best serves their particular requirements. The NCOS group to which they are assigned is independent of the regular class of service assigned to them. Incoming tie trunks which connect another switch (ESN main, Conventional main, ETN switch) to the ESN node are also assigned to an NCOS group which determines their level of access to the network facilities at the ESN node.

Note: Pre X11 Release 13, a ESN node can accommodate 16 (0–15) NCOS groups.

Facility Restriction Level

Included as part of each NCOS group is a Facility Restriction Level (FRL) number which ranges from 0 (low-privilege) to 7 (high-privilege). The FRL is used by the software to determine the alternate route selection choices available for specific network call attempts by members of an NCOS group.

For example, a user assigned in an NCOS group having an FRL of 3 would be allowed access only to alternate route selection choices assigned an FRL of 3 or less; access to trunks with an FRL greater than 3 would be denied. Thus, by assigning low-privilege network users to an NCOS group having a low FRL, and high-privilege network users to an NCOS group having a higher FRL, the customer can control access to all network facilities.

Expensive Route Warning Tone

In some instances, expensive trunk routes can be assigned to an NCOS group with an FRL which would allow them to be accessed by certain network users. When this occurs, the originator of the network call may be sent an optional Expensive Route Warning Tone (ERWT).

The ERWT tone alerts the caller that an expensive route has been selected to complete the call, and provides the caller with the option of either accepting or rejecting the call before it is completed over the expensive route. Eligibility for ERWT is allowed or denied to individual lines and incoming trunk groups on an NCOS group basis.

Queuing

Each NCOS group also defines whether or not the various queuing features are available to lines or trunks assigned to the group.

Network Alternate Route Selection

The Network Alternate Route Selection (NARS) feature provides a comprehensive and flexible networking package that can be configured to satisfy the specific requirements of a customer's network. Prime elements of the NARS feature are:

— simple network access codes

— a uniform dialing plan (UDP)

— a Flexible Numbering Plan (FNP)

— dialing transparency

— automatic least-cost routing

— Time-of-Day (TOD) routing

— flexible ESN "0" routing

— automatic on-network (on-net) to off-network (off-net) overflow

— network controls through Network Class of Service (NCOS) and Facility Restriction Levels (FRL)

— 1–10 digit translation, restriction, recognition (X11 release 5 and later),

— Free Calling Area Screening (FCAS)

— Expensive Route Warning Tone (ERWT)

— NARS bypass control

— Network speed call

— Network Call Transfer (NXFER)

— 1+ Dialing

Table 2 lists the minimum and maximum parameter settings for the various networking elements.

Table 2
Networking feature parameters

Parameter	Features equipped at switch		
	CDP	**BARS**	**NARS**
NCOS groups	0–99 (0–3)	0–99 (0–7)	0–99 (0–15)
Facility Restriction Levels	0–7	0–7	0–7
Digit manipulation tables	1–31	1–255	1–255 [1–999]
Route list blocks	0–31	0–127	0–255 [0–999]
Route list block entries	0–6 (0–2)	0–63 {0–31} (0–7)	0–63 {0–31} (0–7)
FCAS tables		1–127	1–255
FSNS tables			[1–255]
SDR blocks X11 release 5 and later X11 release 4 and earlier		256 32	512 256

Legend:

NCOS = Network Class of Service
FCAS = Free Calling Area Screening
FSNS = Free Special Number Screening
SDR = Supplemental Digit Restriction
Values in parenthesis () are for releases prior to X11 release 13.
Values in braces {} are for releases prior to X11 release 15.
Values in brackets [] apply if the Flexible Numbering Plan (FNP) package (160) is equipped.

Note 1: If the New Flexible Code Restriction (NFCR) feature (see *X11 features and services* [553-3001-305] or *X11 features and services Reference Guide* [553-3001-306]) is equipped in conjunction with either BARS and/or CDP, the number of available NCOS groups is 8.

Note 2: If the Coordinated Dialing Plan (CDP), Basic Alternate Route Selection (BARS), and Network Alternate Route Selection (NARS) features are equipped in the same switch but for different customers, the

highest parameter values apply to that switch; for example, if one customer has CDP, another customer has NARS and another customer has BARS, the NARS parameters apply to the all customers.

NARS access codes

To access NARS, the user at an ESN node, ESN main, or Conventional main dials either one of two customer-assigned network Access Codes, AC1 or AC2. These access codes are typically "8" for on-net and long distance calls (AC1), and "9" for off-net and local calls (AC2). However, any one-digit or two-digit code can be used if the Flexible Numbering Plan (FNP) package (160) is not equipped or any one-digit to four-digit code can be used if FNP package (160) is equipped, provided the access code assigned for AC1 is different from that assigned for AC2, and there is no conflict with any other part of the dialing plan.

Note: Only tie trunks allow digit insertion on the AC1 code. DISA (CO) trunks require the user to dial the AC1 code.

Dialing a NARS access code triggers NARS to perform the necessary call processing and routing using a specified set of network translation tables. This mechanism is used to implement the UDP for private networks. (NARS dial tone may or may not be provided to the caller after an access code is dialed, at the option of the customer.)

Uniform dialing plan

The UDP enables users at an ESN node, ESN main, or Conventional main to dial all calls in a uniform manner, regardless of the location of the calling party or the route which the call takes.

End-of-dial timing

Prior to X11 release 20, calls that where routed using Basic Alternate Route Selection (BARS) or NARS used a software defined Network Interdigit Timer (NIT) which was set to eight "8" seconds to determine the end-of-dialing. With X11 release 20 and later the NIT is now user definable on a per-customer basis. It is defined by responding to the NIT prompt in LD 15 with a number in the range from two "2" to eight "8". This value indicates the maximum number of seconds allowed between digits being dialed. If the user does not dial another digit within the time input in response to the NIT prompt, the software considers dialing as being complete.

To achieve shorter call processing times the user may dial an # (octothorpe, pound, number sign) at the end of a dialed digit string. The # informs the software that all required digits have been dialed and that the digits may now be analyzed for call processing purposes. If the user does not use the #, then the system waits for the NIT to expire prior to analyzing the dialed digits.

UDP for on-net calling

An on-net call is one which terminates at a customer-owned location. To reach any on-net location, the user dials the on-net access code (AC1), followed by seven digits. The format for this call would be:

AC1 * LOC + XXXX

>**Legend:**
>
>**AC1**   = the on-net access code,
>
>*****   = pause for NARS dial tone (optional)
>
>**LOC**   = a three-digit location code assigned for the destination location (area code)
>
>**XXXX** = the extension number of the party to be reached at the destination location

Each switch which is part of the network (including the ESN nodes) is identified by a unique three-digit location (LOC) code assigned at the ESN node. If 1+ Dialing is used, there must be no conflict between the location code number assigned for a switch and all Number Plan Area (NPA) codes.

A customer-owned location can be either physically connected to the network (by means of private trunk facilities) or virtually connected to the network (by means of public facilities). If a location is virtually connected to the network, the dialed LOC code is translated and converted by NARS translation (at the ESN node) into the public number for the virtual location; for example, the Direct Distance Dialing (DDD) number or the Direct Inward Dialing (DID) number.

Example

Figure 2 illustrates an ESN network with a typical UDP. A user at LOC 776 (Conventional main, location I) wishing to call extension number 3283 at LOC 777 (ESN main, location H) would first dial 8 (AC1), pause for the

optional NARS dial tone from ESN node at location G, then dial 777–3283. A user at any other customer location which is part of the network would dial these same numbers to reach extension 3283.

UDP for off-net calling

An off-net call is one which does not terminate at a customer-owned location, even though some on-net facilities may be used to complete a portion of the call routing. Referring to Figure 2, a call would be termed off-net if a user at LOC 776 called a number associated with CO 758–XXXX in the foreign area code 214.

Table 3 lists the dialing formats for the various types of UDP calls.

UDP for switch equipped with directory number expansion

The Directory Number Expansion (DNXP) package allows an internal Directory Number (DN) to have up to seven digits. If the DNXP package is equipped, a seven-digit LOC call to an ESN switch can be terminated to a seven-digit internal DN. This is accomplished by using the Digit Manipulation Index (DMI) for a Home Location Code (HLOC). The HLOC can have an optional DMI which defines digits to be inserted and leading digits to be deleted. The DMI option can be selected and defined in LD 90 (North American X11 users refer to *X11 input/output guide* [553-3001-400]; International X11 users refer to *X11 data administration input/output guide including supplementary features* [Appendix 1 to 553-2311-311]).

A seven-digit LOC call to an ESN switch with five-, six-, or seven-digit internal DNs can be achieved by manipulating its HLOCs—deleting the first three digits and inserting one digit, two digits, or three digits respectively.

Example

An existing ESN switch with LOC 646 and four-digit dialing plan is upgraded to a five-digit dialing plan by prefixing the digit "2". An incoming on-net (LOC) call can be handled as follows:

1   Define a DMI for the HLOC 646 by:

—   Deleting the first 3 digits (for example, 646)

—   Inserting the digit "2"

2   The LOC call 646–2359 to a telephone of this switch has become a HLOC call in the switch (with the same digit string). Therefore, it is converted to 22359 and terminated to the desired telephone.

Figure 2
Example of an ESN with a typical Uniform Dialing Plan

553-1572
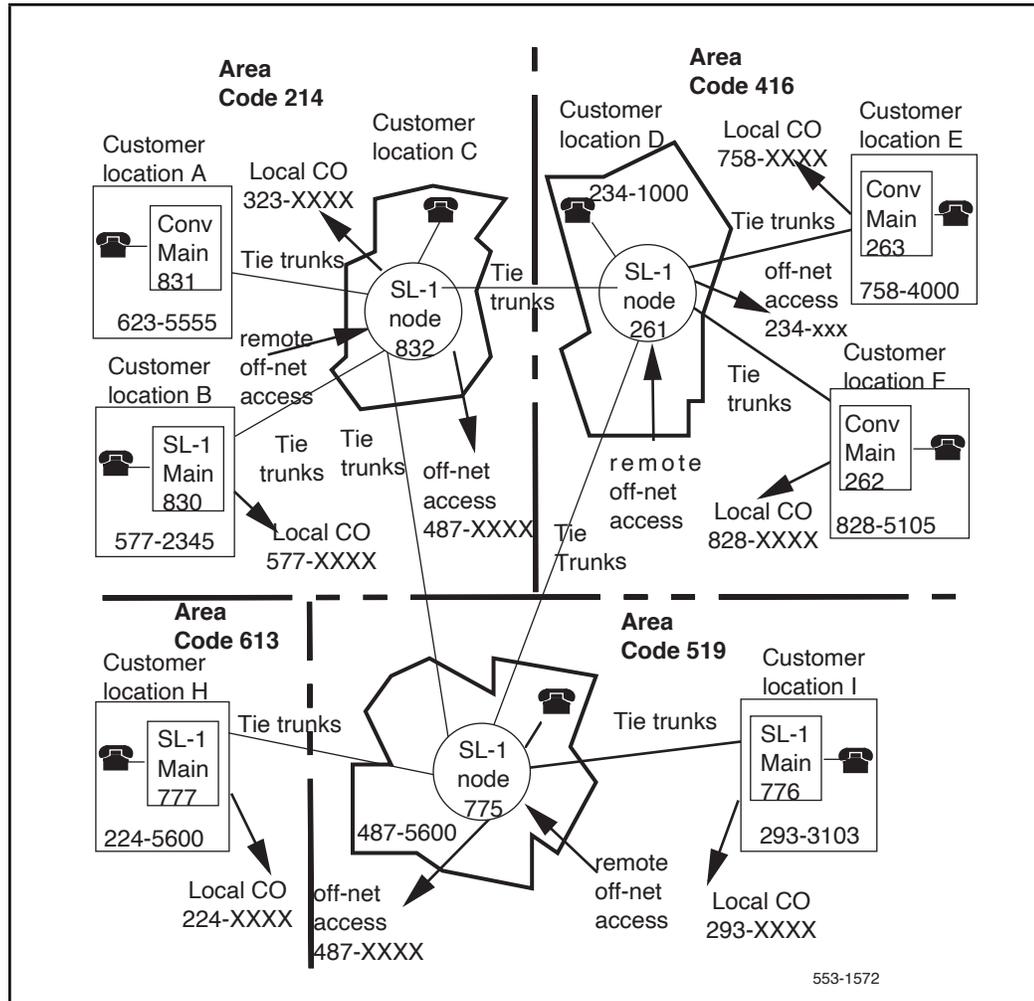
Table 3
Dialing formats for NARS UDP calls (Part 1 of 2)

Call type	Dialing format	Code capacity
On-net (Notes 1, 2 and 3)	AC1 * LOC + XXXX	640
DDD FNPA (Note 1)	AC1 * 1 + NPA + NXX + XXXX	160
Network Speed Call	AC1 * LA + LN	1
Operator-assisted DDD	AC1 * 0 + NPA + NXX + XXXX	160
International DDD	AC1 * 011 + CC + NN	99
Operator-assisted International DDD	AC1 * 01 + CC + NN	99
DDD HNPA (Note 1)	AC2 * 1 + NXX + XXXX	1
DDD operator	AC2 * 0	1
Local calls (Note 1)	AC2 * NXX + XXXX	640
Special local services	AC2 * SPN	8
Toll-free calls	AC2 * 800 + NXX + XXXX	1
Toll-free calls (Note 1)	AC2 * 1 + 800 + NXX + XXXX	1
Toll special numbers	AC2 * 900 + NXX + XXXX	1
Toll special numbers (Note 1)	AC2 * 1 + 900 + NXX + XXXX	1

Note 1: If 1+ Dialing is used, the on-net and Local Calls code capacities are increased to 800 and 792 respectively.

Note 2: If the code 1XX is reserved for future 1+ Dialing use, and not for Network Speed Call codes, then the location code capacity will be reduced to 639 if a three-digit NSC code is used, 632 if a two-digit NSC code is used, or 560 if a one-digit NSC code is used.

Note 3: When 1+ Dialing is used, Network Speed Call access will be in the form of 2XX–9XX as a subset of the location codes utilized in the UDP. The location code capacity will be reduced to 799 if a three-digit NSC code is used, 792 if a two-digit NSC code is used, or 720 if a one-digit NSC code is used.

Table 3
Dialing formats for NARS UDP calls (Part 2 of 2)

Legend:	
AC1	Access code for on-net, long distance and Network Speed Calls. Any one or two digit number if FNP (package 160) not equipped. Any one to four digit number if FNP (package 160) equipped.
AC2	Access code for local calls. Typically the digit "9," can be either one digit or two digits in length.
*	Symbol meaning wait for NARS dial tone (optional).
NPA	Numbering Plan Area (NPA) code. Any number of the form NPX for X11 release 19 and earlier or NXX for X11 release 20 and later.
HNPA	Home Numbering Plan Area (HNPA) code. Any number of the form NPX for X11 release 19 and earlier or NXX for X11 release 20 and later.
FNPA	Foreign Numbering Plan Area (FNPA) code. Any number of the form NPX for X11 release 19 and earlier or NXX for X11 release 20 and later.
CC	Country Code. Any one-, two-, or three-digit number.
NN	National Number. Depends on national dialing plan; max 12 digits including Country Code
N	Any of the digits "2" to "9".
P	The digit "0" or "1".
X	Any of the digits "0" to "9".
LA	List access code. Any one-, two-, or three-digit number.
LN	List element number. Any one-, two-, or three-digit number, maximum of 1000 elements per list.
LOC	Three-digit location code for each UDP network location.
NXX	Local Exchange Code.
XXXX	Four-digit directory (extension) number.
SPN	Special numbers: for example, 411, 611, or may be XXXX.

Flexible Numbering Plan

Flexible Numbering Plan (FNP) package 160 was introduced to the International marketplace as part of the X11 with Supplementary Features Group E (Phase 5) release.

FNP accommodates Global Numbering Plan Requirements by modifying the Electronic Switched Network (ESN) dialing plan. The dialing plans are divided into two areas:

— On-net dialing — which deals with all the possible dialing situations required when dialing to a station located within the Local (private) Network

— Off-net dialing — which deals with all the possible dialing situations required when dialing to a station that is not part of the Local Network (typically the Public Numbering Plan)

FNP was enhanced in the Group F (Phase 6Biv) release to include the ability of inhibiting the time out handling process for ESN Basic Alternate Route Selection (BARS) and Network Alternate Route Selection (NARS) Special Numbers (SPN) and Coordinated Dialing Plan (CDP) Trunk Steering Codes (TSC). The enhancement ensures that all digits are collected prior to seizing a trunk. This enhancement meets Chinese requirements.

Network Alternate Route Selection (NARS) package 58 is a prerequisite for FNP.

With X11 Release 20 FNP is introduced to the Global marketplace.

FNP interacts with both NARS and Coordinated Dialing Plan (CDP) to introduce:

— Universal Numbering Plan (UNP)

— Transferrable Directory Numbers (TNDN)

— Group Dialling Plan (GDP)

— Arbitrary length DNs on a node

— Free Special Number Screening (FSNS)

For further information about FNP refer to the Flexible Numbering Plan chapter in this document, and *Flexible Numbering Plan Description, operation, and administration* (553-2751-105).

Dialing transparency

Extending the UDP to a remote-access switch (ESN main or Conventional main) is accomplished by forming a single tie trunk access group between the remote switch and the ESN node. Users at this remote switch access the trunk group to the node by dialing the on-net access code (AC1). The ESN node is arranged to insert the digit for AC1 on each incoming call from the switch automatically, this allows access for on-net and long distance calling in a transparent fashion. Local calling is arranged through conventional dial "9" CO trunks at the remote access switch.

Note: If an ESN node replaces a tandem switch in a Tandem Tie Trunk Network (TTTN), other tandem switches in the network can "tandem through" the ESN node using the same access codes as before. This requires that there are not any dialing conflicts between the access codes for the TTTN trunks and the dialing plan implemented at the ESN node.

Automatic least-cost routing

For each "on-net" or "off-net" call translated at an ESN node, NARS selects a route from a list of up to eight outgoing alternate routes to complete the call. A list of alternate routes to a particular destination is called a route list, and each route specified in the list is called an entry. Any combination of trunks, for example, Central Office (CO), Foreign Exchange (FX), or TIE, can be specified in a route list.

Note: With X11 release 13 and 14, NARS can select from a list of up to 32 outgoing alternate routes. With X11 release 15 and later, NARS can select from a list of up to 64 outgoing alternate routes

Note: Using the Meridian Bandwidth Controller (DCA System 9000) improves the capacity of T1 based tandem networks. Its dynamic alternate routing capability can independently choose the optimum path for a voice or data call. However, it will be necessary to coordinate the Meridian Bandwidth Controller routing lists with the ESN routing lists.

Typically, the first entries (routes) in a route list are the least-cost routes to a destination and comprise the initial set (I set) of routes in the list. The remaining routes in the list (if any) are the more expensive routes to a destination and they are the extended set of routes in the list. An initial set marker, defined through service change, determines which routes comprise the initial route set. Refer to the CBQ and OHQ sections for more information on I set and extended set routes.

Associated with each entry in a route list is information relevant to:

— the route number (0–511)

— the minimum FRL required for access

— the time of day the route can be accessed

— whether or not queuing (CBQ or OHQ) is allowed on the route

— whether or not the route is to receive expensive route warning tone treatment

— a digit manipulation table index number, (0–255) if the Flexible Numbering Plan (FNP) package is not equipped, (0–999) if the FNP is equipped

— a FCAS table index number (0–255)

— a FSNS table index number (0–255) if FNP package (160) is equipped

— information for conversion from an on-net call to an off-net call

Route eligibility

NARS translates a dialed LOC, NPA, NXX, or SPN (special number) into a route list and searches the list sequentially for an available route. Route eligibility for a given call is based on the caller's NCOS, the NCOS-defined FRL, the current TOD, and COS.

Because each entry in a route list has a minimum FRL required for access and all network users are assigned an FRL through their NCOS, the network communications manager can restrict the type of calls allowed to users.

Example

If the minimum FRL for all calls is 1, except for special local services numbers which are assigned an FRL of 0, a user assigned to an NCOS group with an FRL of 0 would only be able to make calls to the special numbers. In addition, the communications manager can restrict using high-cost facilities by assigning a high FRL to the expensive routes in a route list and a lower FRL to a user's NCOS.

Digit manipulation

Any trunk type can be specified in a route list. However, when certain trunk types are accessed, the digits dialed by the user must be manipulated to conform to the dialing requirements of the trunk. To do this, NARS uses digit manipulation tables to modify the dialed digits.

There can be a maximum of 1000, when Flexible Numbering Plan (FNP) Package (160) is equipped, or 256, if FNP is not equipped, digit manipulation tables. Each table is referenced by a digit manipulation index number and defined at each ESN node as shown in Figure 3. Digit manipulation can delete up to 15 leading digits and insert up to 20 leading digits.

Example

See Figure 2 for an example of an ESN with a typical Uniform Dialing Plan. A user at Conventional main Location I dials the number 8–613–596–9084 to reach an off-net station in the 613 NPA associated with ESN main, Location H.

At the ESN node, NARS selects the appropriate route list for call completion to NPA 613 and finds that the only available route to that NPA is a local CO trunk which requires the insertion of the leading digit "1" for long distance calls. The route list entry for this route specifies a digit manipulation index number (0–999 if Flexible Numbering Plan [FNP] package [160] equipped, 0–255 if FNP not equipped; "0" means no digit manipulation is required). NARS references the digit manipulation table indicated by the index number, deletes digits as specified in the table (none in this case), inserts the required digits ("1" in this case) and completes the call on this route.

Time-of-day routing

NARS provides for up to eight (0–7) TOD schedules. Each entry (route) in a route list is assigned to the TOD schedule which specifies the hour(s) that the particular entry can be accessed. Thus, based on the current time of day, the most cost-effective route alternatives can be specified. A typical TOD schedule is shown in Table 4. A TOD schedule can be associated with any number of arbitrarily selected 15-minute periods. However, any one 15 minute period can appear only in one TOD schedule.

Based on the TOD schedule in Table 4, a route list entry assigned to TOD schedule 2 is accessed only between the hours of 00:00 to 07:44 and 17:30 to 23:59. Access to the route at any other time is denied. TOD schedules can be turned "on" or "off" through service change as the traffic conditions change. A TOD schedule is turned on for an entry by turning off all other TOD.

Table 4
A typical TOD schedule

TOD schedule	Time period
2	00:00 to 07:44 17:30 to 23:59
1	07:45 to 08:59 12:00 to 13:14 16:00 to 17:29
0	09:00 to 11:59 13:15 to 15:59

Flexible ESN "0" Routing

Flexible ESN "0" Routing (an X11 release 16 feature) allows routing of calls on different routes based on a few predefined non-left wise unique dialing sequences. Non-left wise unique means that each entry in the table cannot match the leftmost portion of any other entry in the table. For example, if "123" is an entry in the table, then no other entry may begin with "123."

The ESN translation table will allow any or all of the following non-left wise unique numbers (along with their associated route list) to be entered into the ESN translation table:

— 0

— 00

— 01

— 011

Flexible ESN "0" Routing is part of the existing BARS (57) and NARS (58) packages and has no interaction with other features besides these. Since NARS has two translation tables, two Flexible ESN "0" Routing data blocks will be included in NARS. This means that a call could be configured to route in two different ways.

Flexible ESN "0" Routing is applicable to all route types and network types that are supported by ESN. For information on the appropriate prompts and responses in service change (LD 90), refer to the *X11 input/output guide*.

Automatic on-net to off-net overflow

If all on-net facilities to a location are busy or blocked, NARS can convert a dialed UDP number to the Listed Directory Number (LDN) or DID number of the destination location and use off-net facilities to complete the call. This process is called conversion and this feature is activated on each route list entry where required.

After dialing AC1 + LOC, if an incomplete DN (or no DN at all) is dialed, LDN is outpulsed on routes with conversion (CNV) set to YES. This works because enough digits have been dialed to determine the destination node.

Example

A user at Conventional main Location I (Table 4) dials 8–777–3283 to reach a party with extension number 3283 at ESN main Location H. At the ESN node, NARS translates the dialed LOC number (777) into a route list, and searches all eligible routes in the list. Failing to find an available tie trunk route, NARS then seizes local off-net facilities and, to complete the call, outpulses either:

— 224–3283, if Location H is arranged for DID

— 224–5600, if Location H is not arranged for DID

Requirements

— Only one LDN may be defined per location code (LOC)

— DID numbers must have the same NXX as the LDN

— Only one contiguous DID DN range can be defined per location. DNs which lie outside the range are converted to the LDN

Multiple DID office code screening (X11 Release 5+)

Multiple DID office code screening is an enhancement to the on-net to Off-net Overflow capability of the NARS feature. This enhancement permits on-net calls which are routed through the public network using on-net to off-net conversion to terminate at any DN which has been defined in the Location Code data block of memory.

For each LOC defined, Multiple DID Office Code Screening allows:

— the definition of multiple NXX codes

— the definition of multiple DN ranges within each NXX

The following arrangements of multiple office codes (NXX) and multiple DN ranges are possible:

— single office code with a single DN range (the only alternative prior to X11 Release 5)

— single office code with multiple DN ranges

— multiple office codes, each with a single DN range

— multiple office codes with multiple DN ranges

Requirements

— Only one NPA per LOC code is allowed.

— Ranges defined within a LOC code must be unique. Overlapping or duplication of ranges is not permitted.

— The number of digits in each DID range must be 4.

— A maximum of 20 DID ranges may be defined per location code, regardless of the number of office codes.

Incoming trunk group exclusion (X11 Release 5+)

Incoming Trunk Group Exclusion is an enhancement to the NARS feature which blocks calls from Main users who use the network to reach destinations in the home NPA or other restricted NPAs, NXXs, LOCs and SPNs. When the feature is configured, users cannot use the network to circumvent the restrictions. They are forced to dial off-net instead and become subject to whatever restrictions are imposed at the Main.

Standard call blocking is applied on outgoing calls to specific NPA, NXX, SPN or LOC at the ESN node if the call is from a specific incoming trunk group.

— This prevents loopback routing through the caller's home switch, for example, home NPA, NXX. Calls which should have been made off-net from the caller's home switch are blocked outgoing at the node.

— Main users are prevented from using ESN to make calls to certain NPA, NXX, SPN or LOC that they are restricted from making at the home switch.

Customers define their own sets of restricted trunk routes to specific NPA, NXX, SPN or LOC. There is one Incoming Trunk Group Exclusion Index (maximum 255) for each defined NPA, NXX, SPN or LOC. Each index points to an Incoming Trunk Group Exclusion (ITGE) table. A maximum of 128 restricted routes can be defined in each ITGE table. Incoming Trunk Group Exclusion provides full ten-digit restriction for NPA and SPN codes, seven-digit restriction for NXX codes and LOC codes. The code itself may be restricted.

When an ESN call is received, NARS tests to see if the dialed code is a restricted type (Supplemental Digit Recognition/Restriction). If it is, NARS checks whether or not it has an ITGE restriction and if there is an Incoming Trunk Exclusion Index (ITEI) number (1–255) associated with it. If an ITEI is defined, the appropriate ITGE table corresponding to the dialed code is searched. If the incoming trunk route is a member of the ITGE, the NARS process is terminated and the call is blocked. Otherwise, call processing continues.

Off-net number recognition

Off-net Number Recognition eliminates the need of using two extra CO trunks when a subscriber, using the private network, dials a DID or DDD number that terminates at an ESN Location. Calls are routed directly to the dialed DN (DID calls) or to the LDN (DDD calls), rather than being switched from the terminating ESN switch to the CO and back again.

Off-net Number Recognition parameters for local and remote DDD and DID locations are defined by the customer in the Network Translation tables and Supplemental Digit Recognition/Restriction blocks (SDRR). Recognition of up to 10 digits can be defined.

Table 5
Network translation tables

Call type	Network translation table (number of digits)	SDRR block (number of digits)
NPA	3	1–7
NXX	3	1–4
SPN	4 1–11 when Flexible Numbering Plan (FNP) package (160) equipped	1–7

Up to 512 SDRR blocks can be defined. Each table can contain up to 64 entries. Off-net numbers are recognized at the last intelligent NARS/BARS switch. Translation of the NPA, NXX or SPN identifies the

method of treatment for the call. If the data type is SDRR and the index is an SDRR table index, supplemental digit recognition/restriction is applied by comparing the dialed digits with the numbers declared in the SDRR block.

— If no match is found in the SDRR, route selection is called, call processing resumes and the call is routed to the CO of the terminating off-net number.

— If a match is found and the number is in the "denied" block, standard call blocking takes place.

— If a match is found and the number is recognized as a terminating number at the local switch (for example, the last intelligent NARS/BARS switch), the call is terminated at DN (DID calls) or at the attendant DN (DDD calls).

— If a match is found and the dialed number is a recognized number terminating at a remote conventional main, route selection is called, the appropriate digit manipulation takes place and the call is routed directly to the conventional main. DID calls terminate at the dialed number and DDD calls terminate at the attendant DN.

Digit translation/ restriction/ recognition

The ESN provides a 1-digit through 11-digit translation/restriction/recognition capability through the use of network translation tables. There are two network translation tables, one associated with each of the network access codes (AC1 and AC2).

Normal translation mechanisms translate the dialed network access code, for example, 8 or 9, determine that the call is to be processed by NARS, and select the appropriate network translation table, see Table 5. The NARS translation determines the method to be used to process the call and applies digit restriction or recognition where required. The result of translation is to invoke either route selection with a specified route list, or standard call blocking. More information on digit recognition can be found under the "Off-Net Number Recognition" section.

The following information is contained in the network translation tables.

Each NPA (area code) translation entry, excluding the Home NPA (HNPA) contains:

— a route list index number (0–255 or 0–999 when Flexible Numbering Plan [FNP] package [160] equipped) which indicates which route list to use in processing a call to this NPA,

— whether or not there are telephone numbers within this NPA to which network calls are to be blocked; for example, denied,

— whether or not there are telephone numbers within this NPA to which network calls are to be blocked because of ITGE restrictions (X11 release 5+),

— whether or not there are numbers under this NPA that are to be recognized as DID or DDD codes to an on-net location (X11 release 5+), and

— a list of up to 64, one- to seven-digit numbers that follow the NPA and are to be blocked or recognized in this NPA.

Each NXX office code translation entry contains:

— a route list index number (0–255 or 0–999 when FNP [package 160] equipped) which indicates which route list to access in processing a call to this NXX,

— whether or not there are telephone numbers within this NXX to which network calls are to be blocked,

— whether or not there are telephone numbers within this NXX to which network calls are to be blocked because of ITGE restrictions,

— whether or not there are numbers under this NXX that are to be recognized as DID or DDD codes to an on-net location, and

— a list of up to 64, one- to four-digit numbers that follow the NXX and are to be blocked or recognized in this NXX.

Each LOC location code translation entry, excluding the Home LOC code contains:

— a route list index number (0–255 or 0–999 when FNP [package 160] equipped) which indicates which route list to access in processing a call to this LOC,

— the Listed Directory Number (LDN) to which the LOC number is to be converted when using off-net DDD facilities,

— the ranges of DID numbers to which the LOC number can be converted when using DID facilities, and

— whether or not there are LOC numbers to which network calls are to be blocked because of ITGE restrictions.

Each SPN (special number) translation entry contains:

— a route list index number (0–255 or 0–999 when FNP [package 160] equipped) which indicates which route list to access in processing a call to this SPN,

— whether or not there are digits following SPN numbers to which network calls are to be blocked,

— whether or not there are SPN numbers to which network calls are to be blocked because of ITGE restrictions,

— whether or not there are SPN numbers that are to be recognized as codes to an on-net location, and

— a list of up to 64 entries, one of one to seven numbers that are to be blocked or recognized when following the SPN.

Supplemental digit restriction (release dependent)

Supplemental digit restriction blocks, refer to Table 6, function as follows:

— block (deny) access to certain telephone numbers,

— recognize off-net calls dialed to on-net locations, and

— prevent routing of calls to the home switch of the originating trunk group by either on-net or off-net facilities.

Figure 3
NARS elements accessed at an ESN node to process a network call

User dials 8 (AC1), then LOC,
NPA, or SPN number

User dials 9 (AC2), then
NXX or SPN number

Network translation
table for AC1

L	N	S
O	P	P
C	A	N
.	.	.
.	.	.
.	.	.
L	N	S
O	P	P
C	A	N

Network translation
table for AC2

N	S
X	P
X	N
.	.
.	.
.	.
N	S
X	P
X	N

Route List Index
0, 1, 2, 3, ...255

Supplemental digit
restriction block

N	S
P	P
A	N
.	.
.	.
N	S
P	P
A	N

Supplemental digit
restriction block

N	S
X	P
X	N
.	.
.	.
N	S
X	P
X	N

Route List 0

Entry   0 - Route #
.
.
.
Entry   7 - Route #

Termination of Standard
Call Blocking

Time-of-Day Schedule
Facility Restriction Level

Route List 255

Entry   0 - Route #
.
.
.
Entry   7 - Route #

Digit Manipulation Index
0, 1, 2, 3, ...255

Digit Manipulation 0

Reserved for System use;
No Digit Manipulation

Digit Manipulation 1

Delete xx (0-15)
Delete xx (0-20)

Digit Manipulation 255

Delete xx (0-15)
Delete xx (0-20)

FCAS Index
0, 1, 2, 3, ...255

FCI 0

Reserved for System use;
no screening

FCI 1

NPA-Restrict NXX. . . NXX
NPA-Restrict NXX. . . NXX

FCI 255

NPA-Restrict NXX. . . NXX
NPA-Restrict NXX. . . NXX

553-1578

The customer can also specify through service change the treatment that blocked calls receive. For example, overflow tone, intercept to attendant, or recorded announcement. One block can be assigned per NPA, NXX, or SPN.

Table 6
Supplemental digit restriction blocks per NARS or BARS

Network package	X11 release 4	X11 release 5 and later
ESN node	256	512
BARS	32	256
Note: For X11 release 4 and earlier, one block can recognize or restrict up to 16 numbers. For X11 release 5 and later software, one block can recognize or restrict up to 64 numbers.		

If the Flexible Numbering Plan (FNP) package (160) is equipped, Special Numbers (SPN) may have an Alternate Remote Routing Number assigned in the Supplemental Digit Restriction or Recognition table. For further details refer to *Flexible Numbering Plan Description, operation, and administration* (553-2751-105).

Free Calling Area Screening

Free Calling Area Screening (FCAS) is a NARS feature that provides full six-digit (NPA–NXX) screening to determine the route choice for completion of off-net calls. With FCAS, a customer can allow calls to NXX codes within the "free calling area" surrounding a particular on-net location, and restrict (deny) calls to those NXX codes that would incur long distance charges.

FCAS is implemented in a similar fashion to digit manipulation (through tables). A Meridian 1 ESN node equipped with NARS can accommodate up to 255 FCAS tables. Each table can contain up to 15 NPA codes. Up to 800 NXX codes can be restricted within each NPA code. Each FCAS table is referenced by a Free Calling Index (FCI) number (0–255), where "FCI = 0" is a system default meaning no Free Calling Area Screening is required. The appropriate FCI number is then assigned to the applicable route list entries.

Whenever a route list entry is being evaluated for an off-net call (for example, 8–NPA–NXX–XXXX), NARS checks to see if there is an FCI number (other than "0") referred to by the entry. If an FCI number other than "0" is defined, the appropriate FCAS table for the dialed NPA is found and used for NXX screening. If the dialed NXX is denied in the table, NARS does not use the route list entry for call completion, but continues to search for another eligible route list entry. If the dialed NXX is not denied in the table, the route list entry is eligible for the call. Calls converted to the LDN of a location are screened only if the NPA is included as part of the LDN. NXXs allowed in an FCI table are the only ones allowed for that route list entry.

Free Special Number Screening

Free Special Number Screening (FSNS) is a NARS feature that provides 1-to 11-digit Special Number screening to determine the route choice for completion of calls when the Flexible Numbering Plan (FNP) package 160 is equipped.

FSNS is implemented in a similar fashion to digit manipulation (through tables). A Meridian 1 ESN node equipped with NARS and FNP can accommodate up to 255 FSNS tables. Each table can contain up to 15 SPN codes. Up to 1000 XXX codes can be restricted within each SPN code. Each FSNS table is referenced by a Free Special Number screening Index (FSNI) number (0–255), where "FSNI = 0" is a system default meaning no Free Special Number Screening is required. The appropriate FSNI number is then assigned to the applicable route list entries.

Whenever a route list entry is being evaluated for a call (for example, 545 192), NARS checks to see if there is an FSNI number (other than "0") referred to by the entry. If an FSNI number other than "0" is defined, the appropriate FSNS table for the dialed SPN is found and used for XXX screening. If the dialed XXX is denied in the table, NARS does not use the route list entry for call completion, but continues to search for another eligible route list entry. If the dialed XXX is not denied in the table, the route list entry is eligible for the call.

Expensive Route Warning Tone

This feature enables the network manager to select certain users to receive an Expensive Route Warning Tone (ERWT). Eligibility for this tone is based on the user's NCOS. The tone which is three 256 ms bursts of 440 Hz notifies the user that NARS has selected facilities designated as expensive to complete the call. Upon receipt of ERWT, the user has the choice of either allowing the call to complete over the expensive facilities, or going on-hook to avoid the increased expense. The user must make this choice within a programmable time of 0 to 10 seconds. The tones must be activated for the customer group and the expensive route cannot be part of the I set in the route list.

If the call originator is located at an ESN node or ESN main and the Ring Again feature is defined for the user and the user is CBQ(a) eligible, then ring again may be activated to queue the call, see the various queuing features for more information.

If the ESN node is equipped for Call Detail Recording (CDR), acceptance of an expensive route after ERWT is received is noted in the CDR record.

NARS bypass control

A customer can allow selected users to bypass the NARS feature for call completion between any two locations; for example, two locations which share a high community of interest. To do this, routes and trunks are set up between the two locations and assigned an access code distinct from the AC1 and AC2 codes used to access NARS.

The normal trunk controls; for example, Trunk Group Access Restriction (TGAR), class of service, code restriction, are then used to enable access only to the selected users. All other users are denied access to the trunk group and are forced to use NARS for all calls.

Network speed call

The NSC feature enables a user at an ESN node, ESN main, or Conventional main who is normally restricted from making certain types of NARS calls, to make such a call if the destination is a company approved number defined in a System Speed Call (SSC) list. This feature requires that the System Speed Call feature be equipped in addition to Network Speed Call. See *X11 Features and Services*.

Access to the NSC feature is allowed after the NARS access code is dialed. After receiving the NARS dial tone (optional), the user dials a customer-defined Network Speed Call access code of one to three digits. The NSC access code must be unique from all LOC, NPA and NXX codes, and special numbers defined in the translator for the NARS access code.

The NSC access code is associated with a previously defined System Speed Call list (0–4095) through service change in the network translation overlay. If the SSC list has its length (size) changed, the list access code and list number must be deleted and reentered into the NARS translator. An NCOS number is associated with each SSC list. The NCOS assigned to the SSC list is applied to the call only if the FRL (0–7) is greater than that associated with the call originator's assigned NCOS.

> *Note:* Pre X11 release 13, the number of SSC lists was 254 (0–253).

> *Note:* If 1+ Dialing is specified for an NPA, NXX or SPN number in a translator, the digit "1" must not be used as the leading digit for Network Speed Call list codes in that translator.

The user then dials the number of the desired entry in the SSC list. Entry numbers can range from 0 to 9, 00 to 99, or 000 to 999 depending upon the number of elements allocated when the list was defined through service change. After the dialing is finished, the digits defined for the list entry are passed to NARS/BARS translation for processing. Route and feature (OHQ, CBQ) eligibility for call completion are based on the FRL of the NCOS associated with the SSC list only if the FRL of the user's assigned NCOS is lower than that of the list.

Network Call Transfer (NXFER)

This feature improves the operation of the existing Call Transfer (XFER) feature between two switches when a call is transferred back to the originating switch. The regular XFER feature requires two tie trunks to complete the call. With NXFER, and if the call is transferred back to the originating switch by means of a tie trunk of the same trunk group, the originating switch completes the transfer within itself and the tie trunks are dropped. Refer to *ISDN Primary Rate Interface description and administration* (553-2901-100) for a detailed description.

The benefits of the NXFER feature include:

— minimal use of access tie lines,

— improved transmission performance, since tie lines are not used for the completed connection, and

— similar in operation to the existing XFER feature.

Network Call Transfer example

Figures 4 and 5 assume that telephone A receives an incoming trunk call from B and transfers it to C. As shown in Figure 4, the NXFER feature allows telephone A at one ESN switch (I) to transfer the tie trunk call from telephone B (switch II) to a third party, telephone C (switch II). NSIG software is needed in addition to NXFER software at both ends of tie trunk. As shown in Figure 5, if the transfer is allowed, stations B and C are connected on switch II and the ESN tie trunks are dropped when the transfer is completed. In comparison, regular Call Transfer (XFER) requires two tie trunks and both switches to connect stations B and C, as shown in Figure 6.

Figure 4
Connection during NXFER

553-1574
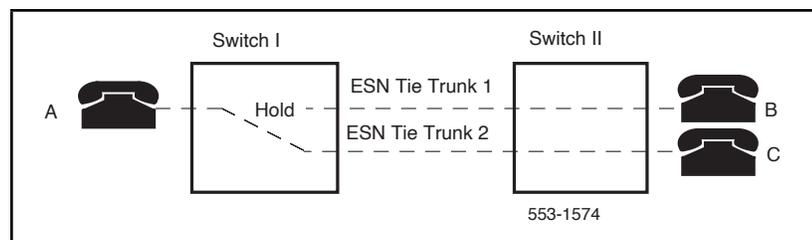
Figure 5
Connection after NXFER

553-1575
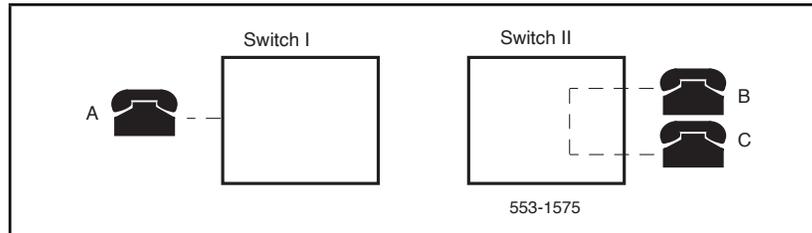
Figure 6
Connection after XFER

553-1576
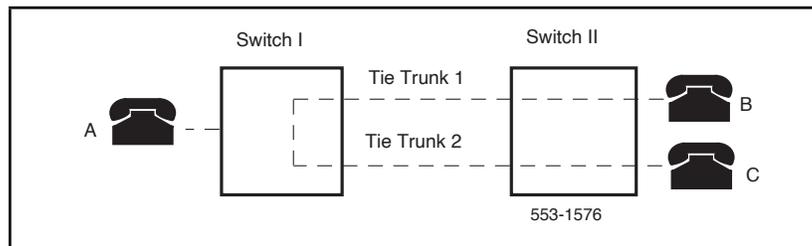
1+ Dialing

Translation tables

With 1+ Dialing, both NARS translation tables are equipped for four-digit translation (based on the first one, two, three or four digits), thus allowing NARS customers the option of dialing 1+ after the NARS access code for long distance calls. See Table 3 for dialing formats for NARS Uniform Dialing Plan (UDP) calls.

Code ambiguity

The 1+ Dialing capability also eliminates ambiguity between identical three-digit NPA, NXX and LOC codes so that the NARS customer can route calls to an NPA, NXX or LOC code which conflicts with one of the customer's three-digit codes.

Limitation

If 1+ Dialing is specified for an NPA, NXX or SPN number in a translator, the digit "1" must not be used as the leading digit for Network Speed Call list codes in that translator.

Interchangeable Numbering Plan Area codes impact

Due to he inevitable depletion of available Numbering Plan Area (NPA) codes in North America, the Interchangeable NPA codes plan was developed. This plan modifies the North American Numbering Plan (NANP) by removing the limitation of zero (0) or one (1) being the second digit in the three digit NPA code. By allowing the second digit of area codes to be any number between zero (0) and nine (9) the available NPA codes are increased from 160 to 800; but due to the fact that eight NPA codes are reserved for special purposes the actual increase is from 152 to 792. Interchangeable NPA codes are effective as of July 1, 1995. Table 7 shows the NANP dialing formats with and without Interchangeable NPA codes.

Table 7
NANP dialing formats with and without Interchangeable NPA codes

Dialing format with Interchangeable NPA codes	Call type
[0/1] + NXX + NXX + XXXX	10 digit public number (NPA)
[0/1] + NXX + XXXX	7 digit public number (NXX)
NXX + XXXX	7 digit private number (LOC)
Dialing format without Interchangeable NPA codes	**Call type**
[0/1] + NPX + NXX + XXXX	10 digit public number (NPA)
[0/1] + NXX + XXXX	7 digit public number (NXX)
NXX + XXXX	7 digit private number (LOC)

Legend:

[0/1]   Optional digits: 0 indicates operator assisted call.
                            1 indicates Direct Distance Dial (DDD) call.

N   Digits 2 to 9.

P   Digits 0 or 1.

X   Digits 0 to 9.

Home Number Plan Area (HNPA) codes and NPAs using the NPX format only are allowed in X11 release 19 and earlier, while HNPAs and NPAs using both NPX and NXX formats are allowed in X11 release 20 and later.

Due to the fact that the NPA codes now use the NXX format in North America, dialing plan conflicts are inevitable. Bellcore recommends the use of 1+ Dialing. Under the recommended 1+ Dialing method all ten digit calls are preceded by the digit "1" while no seven digit calls are preceded by the digit "1". Table 8 shows the Bellcore recommended 1+ Dialing format:

Table 8
Bellcore recommended 1+ Dialing format

Dialing format	Call type
[0] + 1 + NXX + NXX + XXXX	10 digit public number (NPA)
[0] + NXX + XXXX	7 digit public number (NXX)
NXX + XXXX	7 digit private number (LOC)

Legend:	
[0]	Optional: indicates operator assisted call
1	Indicates 10 digit public number to follow (NPA).
N	Digits 2 to 9.
X	Digits 0 to 9.

Refer to *Basic and Network Alternate Route Selection description* (553-2751-100) for recommended implementation information.

System administrators must also be aware of the fact that the North American Toll Denied (TLD) class of service restriction will no longer bar all toll calls with Interchangeable NPA codes due to the fact that the TLD class of service restriction only checks to see if the second digit of an NPA is "0" or "1". Similarly, the North American toll CDR option will also cease to function accurately.

If toll calls are to be restricted with Interchangeable NPA codes the system administrator must use either the Code Restriction or the New Flexible Code Restriction feature for calls that are not routed by BARS or NARS. BARS and NARS will still be able to reliably identify toll calls.

Federal Communication Commission Equal Access Carrier Access Code Expansion impact

In May 1991, the Federal Communications Commission (FCC) mandated that Call Aggregators (CA) allow customers *Equal Access* to interexchange carriers. This capability is available with X11 release 17 and later. This allows callers to use interexchange carriers regardless of the CA's prescribed carrier. As a concession to CA's the FCC has allowed the optional restriction of direct dialed Equal Access toll calls.

Any call preceded by a Carrier Access Code (CAC) is considered to be an Equal Access call. The CAC consists of an Equal Access identifier and a Carrier Identification Code (CIC) which identifies the desired interexchange carrier for a given call. The FCC Equal Access CAC Expansion allows the Equal Access identifier to be expanded from two to three digits, and the CIC to be expanded from three to four digits. Table 9 gives examples of both the original and expanded CAC formats:

Table 9
Original and expanded CAC formats

CAC formats	Equal Access Identifier	Carrier Identification Code
Original	10	XXX
Expanded	101	XXXX

The expanded format is effective as of the first quarter 1995, both formats, original and expanded, will be allowed to coexist for approximately 18 months at which time the original format will be discontinued (fourth quarter 1996).

Along with the introduction of the expanded CAC the FCC Equal Access CAC Expansion feature also eliminates the Selective Carrier Restriction method capabilities, while retaining the General Carrier Restriction capabilities. This results in a single restriction method which will be referred to as Equal Access toll call restriction.

Dialing Plan considerations

To assist Network Dial Plan Administrators in planning for the CAC expansion the following tables show the formats supported and the time frames they are supported in:

Table 10
CAC formats supported until December 31, 1994

Operator-assisted dialing to North American and International locations:
10CIC + 0
10CIC + 0 + NPA + NXX + XXXX
10CIC + 0 + NXX + XXXX
10CIC + 0 + SAC + NXX + XXXX
10CIC + 01 + CC + NN
Direct Distance Dial (DDD) dialing to North American and International locations:
10CIC + 1 + NPA + NXX + XXXX
10CIC + 1 + NXX + XXXX
10CIC + 011 + CC + NN
Where: CIC may be any of the following, 000 to 099, 110 to 149, and 170 to 199. 100 to 109 and 150 to 169 are reserved.

Table 11
CAC formats supported from January 1, 1995 to May 31, 1996

Operator-assisted dialing to North American and International locations:

10CIC + 0

10CIC + 0 + NPA + NXX + XXXX

10CIC + 0 + NXX + XXXX

10CIC + 0 + SAC + NXX + XXXX

10CIC + 01 + CC + NN

101ECIC + 0

101ECIC + 0 + NPA + NXX + XXXX

101ECIC + 0 + NXX + XXXX

101ECIC + 0 + SAC + NXX + XXXX

101ECIC + 01 + CC + NN

Direct Distance Dial (DDD) dialing to North American and International locations:

10CIC + 1 + NPA + NXX + XXXX

10CIC + 1 + NXX + XXXX

10CIC + 011 + CC + NN

101ECIC + 1 + NPA + NXX + XXXX

101ECIC + 1 + NXX + XXXX

101ECIC + 011 + CC + NN

Where:
   CIC may be any of the following, 000 to 099, 110 to 149, and 170 to 199 and
   ECIC may be 5000 to 6999.

Table 12
CAC formats supported from June 1, 1996 onward

Operator-assisted dialing to North American and International locations:
101XXXX + 0
101XXXX + 0 + NPA + NXX + XXXX
101XXXX + 0 + NXX + XXXX
101XXXX + 0 + SAC + NXX + XXXX
101XXXX + 01 + CC + NN
Direct Distance Dial (DDD) dialing to North American and International locations:
101XXXX + 1 + NPA + NXX + XXXX
101XXXX + 1 + NXX + XXXX
101XXXX + 011 + CC + NN

During the time when both original and expanded CAC formats are supported it should be noted that the original CICs will be supported by the expanded CAC format if "0" is dialed before the original CIC. Table 13 shows the interactions between CAC formats during the various time frames:

Table 13
CAC format interactions

Supported CAC formats	Dialing sequences	Example
Original only	10XXX + ...	10123 + 1 + NPA + NXX + XXXX
Original and Expanded	10XXX + ... 1010XXX + ...	10123 + 1 + NPA + NXX + XXXX 1010123 + 1 + NPA + NXX + XXXX
Expanded only	1010XXX + ...	1010123 + 1 + NPA + NXX + XXXX

Carrier Access Codes dialing sequences with special characters

The Meridian 1 recognizes two special characters in any dialing sequence. These characters are the * (star or asterisk) and # (number sign, pound, or octothorpe). The *, when detected in a dialing sequence, causes a pause in the outpulsing of digits, while the #, when detected in a dialing sequence, indicates end-of-dialing, i.e., no further digits are required to process the call.

Due to an interaction with Equal Access if the Meridian 1 is configured to restrict international toll calls, then direct dialed Equal Access operator calls (101XXXX + 0) can not be terminated with an #. If the Equal Access operator call is terminated with an # the call will be restricted. Table 14 depicts this interaction:

Table 14
Octothorpe with Equal Access interaction

If	101XXX + 011 + CC + NN	**calls are restricted.**
Then	101XXX + 0 + #	**calls will also be restricted.**
But	101XXXX + 0	**will not be restricted.**

Configuring Equal Access within a Network

Equal Access toll restriction is intended for use on an outgoing route from a Meridian 1 to a Central Office. This feature is not intended for restriction of calls which terminate on a network node. Therefore, network signaling (ESN3, ESN5, or ETN) is not supported.

Within a network Equal Access toll calls should be restricted at the outgoing node (the node which is directly connected to the Central Office). Refer to *Basic and Network Alternate Route Selection description* (553-2751-100) for implementation information.

Network control

Network control is an enhancement to the NCOS feature that extends NCOS controls to users located at ESN main switches. Network control requires that the ESN main and serving ESN node be equipped with the NSIG feature.

ESN main NCOS

Users (lines, trunks, attendants) at an ESN main are assigned an NCOS, which is used to determine their level of access to network facilities at the serving ESN node. When a user at an ESN main initiates a call to, or through, an ESN node, the user's assigned NCOS can be transmitted on TCOS, depending on tie trunk settings (ESN, ESN2, etc.). If the user's NCOS is transmitted to the serving node and the node is equipped with BARS, only NCOS 0–7 can be assigned at the node. Therefore, only NCOS 0–7 should be assigned at the ESN main even though an ESN main with NSIG can have NCOS 0–15.

If the node is equipped with NARS, then NCOS 0–15 can be assigned both at the node and at the ESN main. The transmitted NCOS (or TCOS) overrides the NCOS (or FRL) assigned to the incoming tie trunk group at the node, and is used to determine the user's eligibility for network resources/features at the ESN node. Thus, a user at an ESN main has the same network access capabilities as a user at the ESN node who is assigned the same NCOS.

> *Note:* If the user at the ESN main enters a valid authorization code prior to placing a NARS call, the NCOS associated with the authorization code is transmitted to the ESN node in place of the user's assigned NCOS.

Calls from a Conventional main to the ESN node are controlled by the NCOS assigned to the incoming trunk group at the ESN node, since the Conventional main does not have NSIG.

ESN node TCOS

Network Control at an ESN node can provide a Traveling Class of Service (TCOS) mechanism that controls route access and Off-Hook Queuing (OHQ) eligibility for calls placed to or through another ESN node or an associated ESN main, and enables the ESN node to interface with switches that are part of an ETN. Provided that the SIGO setting on the tie trunk is set for ETN at both ends.

The Traveling Class of Service is, in effect, the FRL of a user's assigned NCOS. When a user at an ESN node initiates a call to another ESN node or an ESN main, the TCOS (for example, the FRL of the user's assigned NCOS) is transmitted to the other ESN node. At the receiving ESN node, the TCOS (0–7) replaces the FRL of the NCOS assigned to the incoming trunk group.

Route access and OHQ eligibility for the call are, therefore, based on the NCOS of the incoming trunk group with the modified FRL (for example, TCOS).

Note: The Network Control (NCTL) data block (LD 87) is used to define OHQ eligibility on a per FRL (TCOS) basis. For example, if FRL 4 is defined as OHQ eligible, then all users who have an NCOS with a FRL of 4 are eligible for OHQ on calls placed to another ESN node or to an associated ESN main.

If a user at an ESN main or Conventional main initiates a call that tandems through the serving ESN node to another ESN node or ESN main, TCOS applies to the call as if the call originated at the serving ESN node.

ETN switch compatibility

The TCOS is equivalent to the Traveling Class Mark (TCM) used at ETN switches. See Technical Publication 42709, "TIE Trunk Signaling Compatibility for Connecting to a DIMENSION PBX," July 1979.

When a 10-digit UDP call or Distance Steering Code (DSC) CDP call is made from an ESN node to an ETN switch, the dialed digits, together with the TCOS number (0–7), are sent to the connected ETN switch. At the ETN switch, the TCOS number received from the ESN node is used as a TCM to determine route access and off-hook queuing eligibility at the ETN switch.

Similarly, when a call is made from an ETN switch to an ESN node, the dialed digits, together with the TCM number (0–7), are sent to the connected ESN node. The ESN node interprets the received TCM number as a TCOS number. The received TCM (for example, TCOS) replaces the FRL of the NCOS assigned to the incoming trunk group from the ETN switch. This new FRL (for example, TCM) is then used to determine route access and off-hook queuing eligibility for the call.

However, if a DSC CDP call is terminated on an switch as a Local Steering Code (LSC) call, the TCOS value transmitted by the connected switch will not be collected and saved by this switch.

Network signaling

The Network Signaling (NSIG) feature provides the required signaling protocol to interface nodes with ESN mains, nodes with other nodes, and nodes with Electronic Tie Network (ETN) switches.

Installing NSIG at an conventional main enhances it and it becomes an ESN main. When callers at an ESN main place calls through a node with NSIG, their NCOS or TCOS travel with the call and are interpreted at other NSIG equipped switches. The tie trunk settings determine and control the operation of this feature.

When the NSIG feature is equipped at a switch, there are options available (Route Data Block, LD 16) to define the signaling arrangements between that switch and any other switch that are connected to it by means of tie trunks. These options define what call information is to be transmitted to a connected switch and what call information is to be received from a connected switch. The option selected depends on the type of connected switch (ESN node, ESN main, conventional main, ETN) and the options (for example, CCBQ, CBQCM) that are available to the connected switch.

The signaling options are: STD (standard), ESN, ESN2, ESN3, ESN5 (Electronic Switched Network), and ETN (Electronic Tie Network).

STD Arranges the tie trunk group for transmission/reception of the called number between switches. Sends outpulsed digits.

ESN (X11 release 2 only) Arranges the tie trunk group for transmission/reception of the call type, NCOS/TCOS, and called number between switches, and is required on systems equipped with the CCBQ/CBQCM feature. Sends call type, NCOS or TCOS, and dialed digits.

ESN2 (X11 release 3 and later) Arranges the tie group as described for ESN in X11 release 2. Used unless switch has NXFER or Satellite Link Control (SAT).

ESN3 (X11 release 3) Arranges the tie group as described for ESN in X11 release 2 and is required on systems equipped with the NXFER or Satellite Link Control features.

ESN5 (X11 release 5 and later) Arranges the tie group as described for ESN in X11 release 2; needed with DTI.

ETN Arranges the tie trunk group for transmission/reception of the called number and TCOS/TCM between switches and is used when connected to an ETN switch. Sends outpulsed digits and TCOS.

Application

Following is a description of how these options are applied to accommodate the different switch types that can be connected to an ESN main or ESN node that is equipped with the NSIG feature.

ESN node An ESN node can be connected by means of tie trunks to another ESN node, an ESN main, a Conventional main, and/or an ETN Switch.

— If the ESN node connects to another ESN node, both ends of the connecting tie trunk group are defined with the ETN option.

— If the ESN node is equipped with X11 release 2 and connects to an ESN main equipped with X11 release 2, both ends of the connecting tie trunk group are defined with the ESN option.

— If the ESN node is equipped with X11 release 3 and the ESN main is equipped with X11 release 3, both ends of the connecting tie trunk group are defined with the ESN3 option.

— If the ESN node is equipped with X11 release 2 and the ESN main is equipped with X11 release 3, the node end of the connecting tie trunk group is defined with the ESN option, and the Main end is defined with the ESN2 option.

— If the ESN node is equipped with X11 release 3 and the ESN main is equipped with X11 release 2, the node end of the connecting tie trunk group is defined with the ESN2 option, option and the Main end is defined with the ESN option.

— If the ESN node connects to a Conventional main, the node-end of the tie trunk group is defined with the STD option.

— If the ESN node connects to an ETN switch, the node-end of the tie trunk group is defined with the ETN option.

ESN main An ESN main can be connected by means of tie trunks to an ESN node and satellite switches.

— If the ESN main is equipped with X11 release 2 and connects to an node equipped with X11 release 2, both ends of the connecting tie trunk group are defined with the ESN option.

— If the ESN main is equipped with X11 release 3 and the ESN node is equipped with X11 release 3, both ends of the connecting tie trunk group are defined with the ESN3 option.

— If the ESN main is equipped with X11 release 2 and the ESN node is equipped with X11 release 3, the Main end of the connecting tie trunk group is defined with the ESN option, and the node end is defined with the ESN2 option.

— If the ESN main is equipped with X11 release 3 and the ESN node is equipped with X11 release 2, the Main end of the connecting tie trunk group is defined with the ESN2 option, and the node end is defined with the ESN option.

— If there are satellite switches (non-ESN) connected to the ESN main, the main-end of the tie trunk groups from the satellite switches are defined with the STD option.

Requirements

The following requirements apply:

— An ESN main can connect to only one ESN node. Both switches must have NSIG for NSIG related features.

— TIE trunks between ESN nodes and ESN Mains must be arranged for Dual Tone Multi-Frequency (DTMF) sending/receiving, wink-start operation and have answer supervision.

— ESN node compatibility with ETN switches is limited to 7-digit on-network, 10-digit off-network and DSC CDP calls.

Satellite link control

Tandem trunk calls, when connected through more than one communications satellite trunk, are subject to transmission distortion due to propagation to and from communications satellites. The Satellite Link Control feature ensures that the configuration of a call does not include more than one communications satellite trunk.

Requirements

— This feature applies to ESN network calls (NARS/BARS/CDP) only.

— ESN Proprietary Signaling (NSIG) is required among ESN switches.

— Routes which receive digits from satellites or send digits to satellites have to be marked as SATELLITE routes.

Routing control

The Routing Control feature provides a mechanism for changing a user's network-access capabilities when a special TOD schedule is in effect, when an extended TOD is in effect, or when the user presses a Routing Control key on the console.

NCOS map

With the NARS feature, TOD Schedule 7 is the special TOD schedule. Associated with the special TOD schedule is a NCOS map. The NCOS map lists all NCOS numbers.

Associated with each listed NCOS is an alternate NCOS number (greater than, equal to, or smaller than) that replaces the original NCOS number when the special TOD schedule is in effect. Table 15 illustrates a typical NCOS map.

Invoking routing control

The alternate NCOS numbers associated with special TOD Schedule 7 are normally invoked when the time specified for TOD Schedule 7 corresponds to the time in the system clock. Additionally, the alternate NCOS numbers can be scheduled for implementation (through service change) for the full 24-hour period of specified days of the week. This capability enables network-access capabilities to be reduced automatically on weekends or company holidays.

The attendant can also manually invoke the special TOD schedule by using a Routing Control (RTC) key on the console. Pressing the RTC key lights the associated lamp and invokes the special TOD schedule. To deactivate routing control, the RTC key is pressed again. The associated lamp goes dark and normal TOD schedules are once again in effect.

Table 15
Typical NCOS map for special TOD Schedule 7

Original NCOS	Alternate NCOS	Original NCOS	Alternate NCOS
0	0	8	2
1	0	9	3
2	0	10	3
3	1	11	4
4	1	12	4
5	2	13	5
6	2	14	5
7	2	15	5
Note: When TOD Schedule 7 is in effect, the alternate NCOS replaces the user's original NCOS.			

Note: Authorization code can be used to override the restrictions imposed through routing control. If a user enters a valid authcode, the NCOS number associated with the authcode is applied for the duration of the call.

Call-Back Queuing

The CBQ is an ESN node feature which provides queuing for network calls which encounter busy or blocked facilities at the ESN node. CBQ enables the calling party to go on-hook after activation of the Ring Again feature and receive a callback from the ESN node when a network facility becomes available. See the *X11 Features and Services* NTP.

The CBQ feature is available only to stations located at an ESN node. Unlike OHQ, CBQ is offered only at the originating ESN node. Access to CBQ is accomplished through the existing Ring Again feature.

Options

Two options for CBQ eligibility are defined by the call originator's NCOS. The first option, CBQ(i), means that CBQ may be offered after only the initial route set of a route list has been examined for an available route. The second option, CBQ(a), means that CBQ may be offered after both the initial and extended (for example, all) route sets of a route list have been examined. In either case, a call offered CBQ is first queued against the initial route set.

Eligibility

Before offering CBQ to a call originator, the following eligibility tests are performed:

— At least one of the routes in the initial route set is defined as CBQ eligible.

— The user's NCOS is defined as permitting CBQ; either CBQ(i) or CBQ(a).

— The call is not eligible for OHQ. Calls that are eligible for both OHQ and CBQ will be offered OHQ.

— The user's telephone is allowed access to the Ring Again feature and does not have another CBQ or Ring Again call already in the queue.

— The CBQ feature is enabled for this customer.

CBQ(i) eligible   For call originations by a caller defined as CBQ(i) eligible, the system searches the initial route set for an available route. If no available route is found, CBQ is offered to the caller subject to the CBQ eligibility tests.

CBQ(a) eligible   For call originations by a caller defined as CBQ(a) eligible, the system examines the initial route set for an available route. If no available route is found, the extended route set is then searched for an available route. If an available route is not found in the extended set, then CBQ is offered, subject to the CBQ eligibility tests. However, if an available route in the extended route set is found that is designated as expensive, and the user's NCOS allows ERWT, and ERWT is enabled for the customer, the tone is given and the system delays terminating the call. During this delay the user has the following options:

— Refuse the expensive route by abandoning the call.

— Wait, and allow the call to complete over the expensive route.

— Activate the Ring Again feature (feature key or access code) to place the call in the CBQ. The user must be CBQ(a) eligible; otherwise, operation of the Ring Again feature is ignored.

Offer

The CBQ offer consists of an optional recorded announcement, followed by overflow tone. If the user wishes to accept the CBQ offer, Ring Again must be activated within 30 seconds. Ring Again activation follows present feature operation for SL-1 and 500/2500 telephones. See the *X11 Features and Services* NTP. The CBQ offer can be refused by going on-hook. If the user neither accepts nor refuses the CBQ offer within 30 seconds, the call is force disconnected. If the user wishes to accept the CBQ offer, Ring Again must be activated within the programmed time (default is 20 seconds).

CBQ calls are placed in a priority-ordered trunk queue (together with OHQ calls, if any) with a starting priority and maximum priority (see LD 87) defined by the call originator's NCOS. (Refer to Off-Hook Queuing for additional information on priority queuing.) At the same time, two timers are started, a queue promotion timer and a route advance timer. Each timer is started with values defined through the originator's NCOS

At intervals defined by the queue promotion timer, the priority of the call is incremented until it reaches its maximum priority.

Each time the call priority is incremented, its position in the CBQ is advanced. If the route advance timer reaches its maximum value before the call can be terminated on a route in the initial set, the extended set of routes is added to the routes that the call is currently queued against.

Note: An RADT timer set to "0" never expires. The user always queues for I set routes only.

Expensive route warning tone is not given to calls which have been queued, even if terminated on expensive facilities. Unless cancelled by the call originator, CBQ calls remain in the queue until they have been offered a trunk; there is no time limit on CBQ calls. Calls can only be routed on routes in the I set or extended set if the FRL in the NCOS is equal to or greater than FRL assigned to the route in the route list.

Callback

When a trunk becomes available for a CBQ call, it is seized to prevent incoming originations during the CBQ callback period. Outpulsing of digits (either those originally dialed by the user or those required as a result of digit manipulation) is started at a slow, fixed rate. The number or digits to be outpulsed determines how long the trunk can be held while the CBQ callback is being offered to the originating station. The system computes this time by allowing 10 seconds before the first digit is outpulsed and 256 seconds between subsequent digits.

The originator of the call is alerted to the CBQ callback by either tone buzzing and a winking Ring Again feature lamp (SL-1 telephone), or short bursts of ringing (500/2500 telephone). The SL-1 telephone user must accept the callback within the computed value of outpulse time or the service-changeable CBQ time limit of 10 to 30 seconds, whichever is less. A user with a 500/2500 telephone must accept the callback within 6 seconds. Acceptance of the CBQ callback is performed with present Ring Again operating procedures.

When a CBQ callback is answered at a digit display SL-1 telephone, the originally dialed digits are displayed. If the user does not answer the callback within the time limit, the call is removed from the queue and discarded. If the user accepts the callback within the time limit, the call is terminated. A CBQ call can be cancelled by the originating station by means of the existing procedures for Ring Again cancellation.

Feature interactions

The CBQ feature interacts with the following features:

Barge-In, Force Disconnect

Between the time a trunk is seized for a CBQ call and the user accepts the CBQ callback, the trunk can be stolen by the attendant or force disconnected through service change. If this occurs, there is no guarantee that the call can be terminated when the user accepts the CBQ callback. Under these circumstances, the call is treated like a new origination and NARS/BARS is used to reattempt termination. This can result in the call being blocked and being offered CBQ a second time.

Hunting, Call Forward, Multiple Appearance DN

CBQ call backs to stations at an ESN node are offered only to the originating station, regardless of the hunting or call forwarding which may be in effect. Other appearances of a station's Directory Number (DN) are not offered the callback.

Attendant functions

Because the Ring Again feature is not supported at attendant consoles, CBQ is not offered to an attendant regardless of the CBQ eligibility of the NCOS assigned to the attendant.

Off-Hook Queuing

Off-Hook queuing is a software feature that can be equipped at an ESN node and/or ESN main. The feature enables a call originator to remain off-hook for a short time (customer programmable) until a network facility for call completion becomes available at the ESN node or ESN main.

Eligibility

Network calls may be placed in an OHQ if all trunk routes (entries) in the initial route set of a route list (see Note) are busy, and the following criteria are met:

— OHQ has been allowed for that customer group.

— At least one of the trunk routes in the initial route set of a route list is defined as being eligible for OHQ.

— The NCOS of the call originator (at an ESN node or an ESN main) is defined to permit OHQ.

— The incoming trunk group at the ESN node or ESN main is defined in software to permit OHQ for incoming calls. Route Data Block

— The TCM received at the ESN node from an ETN switch is compatible with a FRL that is defined to permit OHQ.

— The TCOS received at the ESN node from another ESN node is compatible with an FRL that is defined to permit OHQ.

— The probability that the call times out in the OHQ before a trunk becomes available is below a specific threshold.

— The OHQ feature is enabled.

Note: A marker determines which route list entries are in the initial route set (see automatic least cost routing). Typically, the initial route set contains the cheaper routes to a particular destination. The remaining routes in the route list, if any, comprise the extended route set and are usually the more expensive routes to the destination. Only routes in the initial route set should be defined to allow OHQ. OHQ are not offered by routes in the extended route set even if they are defined to allow OHQ.

Calls which do not meet the preceding requirements for OHQ eligibility can be offered CBQ at this point.

Availability

The OHQ software performs an "availability" test to prevent calls from entering the OHQ when there is a high probability that the call will timeout before a trunk becomes available. The following process is used to make this test:

— For each trunk route, a counter is maintained which reflects the current number of calls with the maximum queue priority of 3 queued against it. This includes all calls in OHQ, Ring Again, and those CBQ calls that are currently at priority 3 as well as any direct access calls in progress.

— Each trunk route has a threshold value which indicates the maximum number of priority 3 calls that can be queued against it before OHQ timeout becomes a high probability. Before a call is placed in the OBQ, the current queue count is compared with the threshold value for each eligible trunk route in the initial set of routes. If at least one of the trunk routes has a count which is less than or equal to the threshold value, the call is allowed to OHQ against all OHQ eligible routes.

Note: A maximum priority (0, 1, 2, or 3) and a starting priority (0, 1, 2, or 3) are assigned to each user through LD 87. Zero is the lowest priority while three is the highest. Calls are queued according to their starting priority and move to a higher queue (up to their maximum priority) as their promotion timer allows. Once calls reach their maximum priority, they wait for an available trunk in the I set. If the route advance timer (RADT) expires, they can also queue for the extended set routes.

Offer

If all eligibility and availability checks are successful, the call originator is given a distinctive OHQ offer tone (a 1 second burst of 440-Hz tone) when the call enters the OHQ. The call originator either accepts the OHQ offer by remaining off-hook or declines the offer by going on-hook.

OHQ calls are placed in a priority-ordered queue with all other calls waiting for trunks. OHQ calls are assigned the maximum priority (3), since other network facilities may be held while the call is queued. A timer with an initial value equal to the software-defined OHQ time limit is started to limit the duration of the OHQ. The OHQ time limit is service changeable within the range of 2 to 60 seconds.

The queue is examined whenever a trunk becomes idle in a trunk route on which one or more calls are queued. If a call is found which can be terminated on an idle trunk, the available trunk is seized, and the call terminated.

If the OHQ timer expires before the call can be terminated, the call is removed from the OHQ. At this time, the remaining eligible routes in the route list (the extended set) are examined, and the call is either terminated or given standard blocking treatment if no facilities are available. CBQ will not be offered at this point as OHQ was already offered. The ERWT is not given to calls which have been queued, even if terminated on expensive facilities.

OHQ can be offered to call originators located at an ESN node, ESN main, Conventional main or ETN switch. Also, as a call progresses through the network, OHQ can be offered to the call originator from any of the ESN nodes or ESN Mains that are used to process the call. For example, OHQ can be offered more than once for a given call.

Feature interactions

The OHQ feature has the following interactions with existing features:

Call modification

Station users are not allowed to activate call modification features (hold, call transfer, conference) while waiting in the OHQ. Switchhook flash used to activate features from 500/2500 telephones is ignored. Similarly, operation of set feature keys is ignored.

Camp-on, Call waiting

If the attendant extends a call to a telephone that is in the OHQ, the call-waiting tone is not offered to the telephone. If the attendant releases, the call is camped-on the OHQ telephone, but no warning tone is given. When the camp-on call is recalled to the attendant console, the attendant can repeat the camp-on procedure. Once the OHQ call is in an established state, the camp-on tone is provided.

Attendant functions

— The attendant cannot barge-in during trunk seizure for OHQ calls.

— If the attendant extends a network call for a telephone user and the call is offered OHQ, the attendant must inform the caller of the OHQ offer before releasing from the call.

— The attendant is not allowed to operate the release key or another loop key if the source call is in conference and the destination call is in the OHQ. Operation of the release destination key is permitted, however, and causes the OHQ call to be abandoned.

Coordinated Call-Back Queuing

The CCBQ feature enables stations at an ESN main to be offered CBQ when network calls are blocked at the serving ESN node. When facilities become available at the ESN node, the call originator at the ESN main is alerted by a callback from the node. This feature requires that the ESN main and associated ESN node be equipped with the Network Signaling feature.

Eligibility

When a telephone at an ESN main originates a network call through an ESN node, the NCOS of the call originator, call type, and whether or not the telephone is allowed access to the Ring Again feature is transmitted to the ESN node. If an authcode is entered at the ESN main prior to dialing a network call, the NCOS associated with the authcode is transmitted to the ESN node. When received by the node, this NCOS is used to determine CCBQ eligibility and is used for the duration of the call, unless further modified by the Authcode Conditionally Last feature.

The CBQ eligibility tests are performed. In addition, a check is made that the incoming trunk group from the ESN main is defined (at the ESN node) to permit CBQ, and that the call type allows CBQ. CCBQ is offered to the user at the ESN main if the eligibility tests are successful. If the tests are unsuccessful, standard call blocking is applied to the call.

As for stations at an ESN node, the call originator at an ESN main can invoke Ring Again upon receipt of ERWT if the originator's NCOS is defined at the ESN main as CBQ(a) eligible.

Offer

The CCBQ offer and acceptance sequences are identical to those for stations at the ESN node (see Call-Back Queuing). The optional recorded announcement and overflow tone are provided by the ESN node. In addition, after the recorded announcement is provided, the ESN node transmits a signal to the ESN main. This signal indicates that the call is in a state which allows Ring Again.

When the call originator at the ESN main activates Ring Again, the ESN main assigns a unique "queue identification" number to the call. This number is transmitted to the ESN node to indicate CCBQ acceptance. At the ESN main, the call is placed in a holding queue. At the ESN node, the call, together with the queue identification number, is placed into the trunk queue. The ESN main to ESN node tie trunk is released.

Callback

When an outgoing trunk is seized by the ESN node for a CCBQ call, slow outpulsing is started to hold the trunk while a callback is made to the call originator at the ESN main. The ESN node seizes an available tie trunk to the ESN main, and transmits the "queue identification" number of the call to the ESN main. The ESN main then initiates a callback to the call originator. Callback presentation to the call originator is as for standard Ring Again (see Call-Back Queuing).

> *Note:* If no tie trunks to the ESN main are idle, the outgoing trunk is released and can be offered to another call. The CCBQ call retains its position in the queue but is not offered another trunk until a tie trunk to the ESN main becomes available.

When the call originator at the ESN main accepts the CCBQ callback, answer supervision is sent from the ESN main to the ESN node. The ESN node completes the call and the digits are outpulsed at a normal rate.

If the call originator is equipped with a 500/2500 telephone and is engaged in a call when the ESN node initiates a CCBQ callback, a signal is transmitted from the ESN main to the ESN node. The ESN node releases the outgoing trunk and places the CCBQ call into a holding queue for 5 minutes. No attempt is made to seize another outgoing trunk for the call until the holding time expires. This process occurs only once.

If the originating telephone is still busy, the CCBQ is cancelled automatically at the ESN node. No indication is given to the call originator of the CCBQ cancellation. To prevent the CCBQ call from remaining indefinitely in the holding queue at the ESN main, the ESN main sets a time limit of 1 hour for CCBQ calls. When this time limit expires, the CCBQ call is cancelled automatically. CCBQ callback to a busy telephone is as for normal Ring Again.

The call originator at the ESN main can cancel the CCBQ call at any time; however, the ESN node is not aware of the cancellation until the CCBQ callback is attempted.

Feature interactions

The CCBQ feature interacts with the following features:

Initialize

If the Main initializes while calls are queued at the node, CCBQ callbacks from the node are not answered because the initialization has cleared the holding queue at the Main. The node treats these calls as callback-no-answer calls and cancels the CCBQ automatically. If the node initializes, CCBQ calls in the trunk queue are lost. The Main cannot detect this situation. To prevent calls from remaining indefinitely in the holding queue at the Main, the Main sets a time limit of 1 hour for CCBQ calls. If a callback from the node is not received within 1 hour, the Main cancels the CCBQ call automatically.

Attendant functions

Attendants at an Main are not offered CCBQ. Attendant barge-in on trunks involved in CCBQ operations results in cancellation of the CCBQ call.

AIOD and ANI

Automatic Identification of Outward Dial (AIOD) and Automatic Number Identification (ANI) facilities can be used to complete CCBQ calls from an ESN node. The outgoing toll call is billed to the access tie trunk rather than the telephone at the ESN main.

Coordinated Call-Back Queuing Against Main

The Coordinated Call-Back Queuing Against Main (CCBQAM) feature enables stations at nodes to be offered CBQ for network calls which are blocked at an Main. When facilities become available at the Main, the call originator at the node is alerted by a callback from the Main. CCBQAM otherwise functions identically to CCBQ at the node.

Call-Back Queuing to Conventional Mains

The CBQCM feature allows call originators at a Conventional main to access the CBQ feature at an ESN node.

Eligibility

When a telephone at a Conventional main originates a network call through an ESN node, the NCOS assigned to the incoming trunk group is used to determine the CBQCM eligibility. This NCOS, as well as the incoming trunk group, must be defined as CBQ eligible.

Offer

The CBQCM offer to the call originator at a Conventional main consists of an optional recorded announcement followed by special (interrupted) dial tone. (The announcement and tones are provided from the ESN node.) To accept the CBQCM offer, the call originator dials the extension number associated with the telephone being used for the call. When the last digit of the extension number is dialed, a confirmation tone (three 256-ms bursts of dial tone) is sent from the ESN node to the call originator. The call is placed in the CBQ at the ESN node when the call originator goes on hook.

The CBQCM offer can be refused by going on-hook any time before the last digit of the extension number is dialed, or by remaining off-hook for longer than 30 seconds after receipt of the confirmation tone. If the CBQCM is neither accepted nor rejected within 30 seconds, the caller is given overflow tone (from the ESN node) and the call is disconnected.

Callback

When an outgoing trunk becomes available at the ESN node, it is seized and slow outpulsing is started. The ESN node then seizes a tie trunk (see note) to the Conventional main and outpulses the extension number of the call originator. The call originator must answer the callback before slow outpulsing is completed, otherwise, the callback is cancelled and the outgoing trunk is released.

> *Note:* If no tie trunks are currently available to the Conventional main, the node releases the outgoing trunk. The CBQCM call retains its position in the queue but is not offered another outgoing trunk until a tie trunk to the Conventional main becomes available.

When the call originator answers the CBQCM callback, answer supervision must be transmitted from the Conventional main to the ESN node. Upon receipt of answer supervision from the Conventional main, the ESN node transmits a tone (three, 256-ms bursts of dial tone) to notify the call originator that the call is a CBQCM callback, and completes the call.

If the call originator's telephone is busy, or the originator does not answer when the callback is placed, the ESN node places the call in a suspended state for 5 minutes. After 5 minutes, another callback is attempted if the outgoing trunk is free. If the telephone which originated the call is still busy, or does not answer, the ESN node cancels the callback.

No provision is made for CBQCM cancellation by a call originator at a Conventional main. Once the CBQCM offer is accepted, the call remains in the queue until the ESN node initiates a callback.

Requirements

Station users at Conventional Mains cannot activate Ring Again to refuse expensive routes after the ERWT is given.

The ESN node seizes the same tie trunk group that was used to initiate CBQCM for the CBQCM callback. Thus, these trunk groups must be two-way (incoming/outgoing).

Conventional Mains must provide answer supervision on tie trunks connected to the ESN node. These switches must also permit transmission or repetition of telephone dial pulses for CBQCM operation. This feature cannot be used with systems that operate in senderized mode. Operation may require adjustment of the interdigit timeout on systems that employ simulated cut-through operation.

Multiple callback queues are allowed per trunk group for the Conventional main by dialing any digits (up to 7) based on the availability of SL-1 call registers.

Conventional Mains must not allow CBQCM callback calls to be modified by call transfer or call forward to an outside line. Call modifications like this can result in the tie trunk not being released at the end of the call.

Coordinated Dialing Plan

The Coordinated Dialing Plan (CDP) allows a customer with a number of local switches to coordinate the dialing plan of the stations at these switches. A telephone user can call any other telephone within the CDP group of switches by dialing a unique three- to seven-digit number assigned to the telephone.

If the switch is equipped with the DNXP package, the number assigned to each telephone can have up to ten digits.

A CDP can be arranged to provide a centralized public exchange network capability which channels access to and from the public network through a single switch within the CDP group.

The CDP software provides the translation and digit manipulation capability that is necessary to implement the Coordinated Dialing Plan. Calls dialed within the CDP format can be terminated locally after digit translation and digit deletion. Or, calls can be routed to a remote switch in the CDP group following digit translation, route selection, and digit deletion and/or insertion. Figure 7 illustrates how a Coordinated Dialing Plan might be implemented at two customer locations.

> *Note:* The maximum number of leading digits to be deleted from a Local Steering Code (LSC) is four. However, if the DNXP package is equipped, this number is increased to seven digits.

X11 Release 20 introduces Flexible Numbering Plan (FNP package 160) to the Global marketplace. FNP interacts with both CDP and Network Alternate Route Selection (NARS) to introduce new capabilities. For information regarding FNP refer to the *Flexible Numbering Plan* chapter in this document, and *Flexible Numbering Plan Description, operation, and administration* (553-2751-105).

The following table (Table 16) lists the minimum and maximum parameter settings for the various networking elements.

Table 16
Networking feature parameters

Parameter	Features equipped at switch		
	CDP	**BARS**	**NARS**
NCOS groups	0–99 (0–3)	0–99 (0–7)	0–99 (0–15)
Facility Restriction Levels	0–7	0–7	0–7
Digit manipulation tables	1–31	1–255	1–255 [1–999]
Route list blocks	0–32	0–127	0–255 [0–999]
Route list block entries	0–6 (0–2)	0–63 {0–31} (0–7)	0–63 {0–31} (0–7)
FCAS tables		1–127	1–255
FSNS tables			[1–255]
SDR blocks X11 release 5 and later X11 release 4 and earlier		256 32	512 256

Legend:

NCOS = Network Class of Service
FCAS = Free Calling Area Screening
FSNS = Free Special Number Screening
SDR = Supplemental Digit Restriction
Values in parenthesis () are for releases prior to X11 release 13.
Values in braces {} are for releases prior to X11 release 15.
Values in brackets [] apply if the Flexible Numbering Plan (FNP) package (160) is equipped.

Note 1: If the New Flexible Code Restriction (NFCR) feature (see *X11 Features and Services*) is equipped in conjunction with either BARS and/or CDP, the number of available NCOS groups is 8.

Note 2: If the Coordinated Dialing Plan (CDP), Basic Alternate Route Selection (BARS), and Network Alternate Route Selection (NARS) features are equipped in the same switch but for different customers, the highest parameter values apply to that switch; for example, if one

customer has CDP, another customer has NARS and another customer has BARS, the NARS parameters apply to the all customers.

Figure 7
Example of a Coordinated Dialing Plan

Location D

| 0 |
| 1 |
| 2XXXX |
| 3XXXX |
| 7 |
| 8 |
| 9 |

Tie trunks

Location E

| 0 |
| 1 |
| 43XXX |
| 52XXX |
| 7 |
| 8 |
| 9 |

0 = Attendant Directory Number
1 = Special Service Prefix
7 = Meridian 1 Trunk Access Code
8 = BARS/NARS Access Code
9 = Public Exchange Network Access Code

553-1577

Steering codes

Referring to Figure 7, users at Location D can call stations at Location E by dialing 43XXX or 52XXX. Similarly, users at Location E can call stations at Location D by dialing 2XXXX or 3XXXX. If a user at Location D dials 43XXX or 52XXX to reach a telephone at Location E, Location D uses the digits "43" or "52" as a DSC (Distant Steering Code) to select the trunk group to Location E. Similarly, if a user at Location E dials 2XXXX or 3XXXX to reach a telephone at Location D, Location E uses the digit "2" or "3" as a DSC.

The same format is used for calling local stations; for example, users at Location E dial 43XXX or 52XXX to reach local stations at Location E. In this case, the system interprets the digits "43" or "52" as a Local Steering Code (LSC) and deletes them from the dialed number in order to terminate the call locally.

Note: Where possible, four-digit extension numbers should be maintained as CDP DNs. As long as the first digit or digits of these extension numbers are unique at each location all or part of the extension number may be used as a steering code. There cannot be duplicate extension numbers at two locations on a CDP network.

If the switch at Location E is arranged to provide centralized access to the public exchange network, digit "9" at Location E is considered a Trunk Steering Code (TSC) for public exchange access. At Location D, digit "9" is a Trunk Steering Code which invokes digit manipulation to insert the required digits to route the call through Location E to the public exchange network. Similarly, users at Location D can call the attendant at Location E by simply dialing "0", if Location D does not assign digit "0" as the local attendant access code.

Steering codes can be composed of one, two, three, or four digits. If the DNXP package is equipped, the steering codes can have up to seven digits.

At each switch in the CDP group, the steering codes must be distinct (for example, the initial digits must be unique) from any assigned access codes. As Figure 7 shows, "0" is reserved as the attendant access code; "1" is reserved as the Special Service Prefix (SPRE); "7" is reserved as a trunk access code; "8" is reserved as a NARS access code; and "9" is reserved as the public exchange network access code. This means there are five digits remaining that can be used as the leading digits of steering codes (for example, "2," "3," "4," "5," and "6"). The CDP feature supports up to 32,000 steering codes if the Flexible Numbering Plan (FNP) package (160) is equipped, or 10,000 steering codes if FNP is not equipped.

Note: Prior to X11 Release 13, the CDP feature supports up to 5000 steering codes.

A CDP DN consists of an internal DN prefixed with the appropriate steering code. A typical CDP configuration is shown in Figure 7.

Associated documents

For more information regarding the CDP feature refer to *Coordinated Dialing Plan description* (553-2751-102).

Conventional switch access

If a conventional (CONV) switch, any type without the CDP software, is integrated as part of a CDP group (see Figure 8), the steering codes defined at a CDP switch to access the conventional switch may be repeated or absorbed (for example, deleted) by the CDP switch. The steering codes are repeated if the conventional switch is identified by more than one steering code; they are absorbed if all the numbers at the conventional switch begin with the same steering code.

Calls to a CDP switch from the conventional switch are made by dialing the desired CDP DN (for example, telephone C at the CONV switch dials 67000 to reach telephone B at switch CDP2). The CONV switch uses digit "6" as a trunk access code for the tie trunk route to switch CDP2. After tie trunk seizure, the CONV switch outpulses the remaining digits (7000) to CDP2. At CDP2, digit "6" is inserted on the incoming tie trunk from the CONV switch, and the call is completed to telephone B.

Local calls at the CONV switch are made by dialing only the internal DN (for example, 3500), rather than the CDP DN (for example, 53500), unless the CONV switch can be arranged to absorb digit "5", or employs a five-digit numbering plan.

As shown in Figure 8, switch CDP2 is arranged to provide centralized access to the public exchange network. For users at the CONV switch to access this capability, a separate tie trunk route must be provided to switch CDP2. This is because switch CDP2 is arranged to insert digit "6" on the incoming tie trunk route from the CONV switch used for CDP calls. For public exchange network calls, digit "9" must be inserted on the incoming tie trunk route from the CONV switch. Similarly, if users at the CONV switch are to be allowed access to the ESN capabilities (for example, NARS) at switch CDP2, another tie trunk route must be provided for this purpose.

A second alternative exists where one tie trunk route connects the conventional switch to the CDP equipped switch. Users dial an access code to this tie trunk group, then dial the necessary CDP digits to reach other switches, or the necessary BARS/NARS digits for network calls through the node. The tie trunk route at the CDP switch is not programmed to insert digits in this example.

CDP routing

Up to 128 route lists can be defined at a switch equipped with the CDP feature software. If CDP is equipped at an ESN node and the Flexible Numbering Plan (FNP) package (160) is equipped 1000 route lists can be defined. If CDP is equipped at an ESN node and the Flexible Numbering Plan (FNP) package (160) is not equipped 256 route lists can be defined. A route list is used to define the alternate route choices for CDP calls to a particular destination.

Route choices in a route list are called route list entries. There can be up to seven (0–6) route list entries associated with each route list. If a switch is equipped with the NARS software in addition to the CDP feature software, NARS route lists, a maximum of 1000 if the FNP package is also equipped, or 256 if the FNP package is not equipped, can be shared by both NARS and CDP calls.

> *Note:* Prior to X11 Release 13, up to 32 route lists (0–31) can be defined at a switch equipped with the CDP feature software. Also, there can be up to three (0–2) route list entries associated with each route list.

Route lists are associated with each "Distant Steering Code" and "Trunk Steering Code" that can be dialed at a CDP switch. Each code is defined in the CDP software, together with the route list number that must be accessed for call completion to the destination indicated by the steering code. The entries in the specified route list are then searched sequentially for an available and eligible trunk route. Local Steering Codes are not associated with route lists.

CDP digit manipulation

Route list entries can be associated with digit manipulation tables. There can be 32 (0–31) digit manipulation tables defined at a CDP switch. If CDP is equipped at an ESN node 1000 (0–999) tables can be defined if the FNP package is equipped, or 256 (0–255) tables can be defined if the FNP package is not equipped. Digit manipulation table "0" is used as an indication that no digit manipulation is required.

Each digit manipulation table (except "0") can be defined to delete a number (0 to 15) of leading digits of a dialed CDP number and to insert up to 24 different leading digits, including the asterisk (*) to indicate a dialing pause, where required.

CDP Time-of-Day schedules

Two (0–1) TOD schedules can be defined at a CDP switch. If CDP is equipped at an ESN node, eight (0–7) TOD schedules can be defined. Each route list entry is associated with a TOD schedule. When a route list entry is selected for a CDP call, the CDP software compares the current time-of-day with the TOD schedule assigned to the route list entry.

If the current time-of-day is within the interval defined by the TOD schedule, the route list entry is used for the call. If the current time-of-day is not within the interval defined by the TOD schedule or, if the TOD schedule is turned "OFF" (in software), the route list entry is not eligible for the call. TOD schedules can be selectively turned "ON" or turned "OFF" by the customer through service change.

Queuing

Queuing against local stations is provided by the standard Ring Again (RGA) feature. For calls directed to a remote CDP switch, Ring Again can be applied if all local outgoing trunk routes to the remote CDP switch are busy or blocked. Ring Again cannot be applied against busy or blocked stations/trunks at the remote CDP switch. Blocking tone is not provided until the full CDP number (or trunk steering code) is dialed.

Federal Communication Commission Equal Access Carrier Access Code Expansion impact

In May 1991, the Federal Communications Commission (FCC) mandated that Call Aggregators (CA) allow customers *Equal Access* to interexchange carriers. This capability is available with X11 release 17 and later. This allows callers to use interexchange carriers regardless of the CA's prescribed carrier. As a concession to CA's the FCC has allowed the optional restriction of direct dialed Equal Access toll calls.

Any call preceded by a Carrier Access Code (CAC) is considered to be an Equal Access call. The CAC consists of an Equal Access identifier and a Carrier Identification Code (CIC) which identifies the desired interexchange carrier for a given call. The FCC Equal Access CAC Expansion allows the Equal Access identifier to be expanded from two to three digits, and the CIC to be expanded from three to four digits. Table 17 gives examples of both the original and expanded CAC formats:

Table 17
Original and expanded CAC formats

CAC formats	Equal Access Identifier	Carrier Identification Code
Original	10	XXX
Expanded	101	XXXX

The expanded format is effective as of the first quarter 1995, both formats, original and expanded, will be allowed to coexist for approximately 18 months at which time the original format will be discontinued (fourth quarter 1996).

Along with the introduction of the expanded CAC the FCC Equal Access CAC Expansion feature also eliminates the Selective Carrier Restriction method capabilities, while retaining the General Carrier Restriction capabilities. This results in a single restriction method which will be referred to as Equal Access toll call restriction.

Dialing Plan considerations

To assist Network Dial Plan Administrators in planning for the CAC expansion the following tables show the formats supported and the time frames in which they are supported:

Table 18
CAC formats supported until December 31, 1994

Operator-assisted dialing to North American and International locations:
10CIC + 0
10CIC + 0 + NPA + NXX + XXXX
10CIC + 0 + NXX + XXXX
10CIC + 0 + SAC + NXX + XXXX
10CIC + 01 + CC + NN
Direct Distance Dial (DDD) dialing to North American and International locations:
10CIC + 1 + NPA + NXX + XXXX
10CIC + 1 + NXX + XXXX
10CIC + 011 + CC + NN
Where CIC may be any of the following, 000 to 099, 110 to 149, and 170 to 199. 100 to 109 and 150 to 169 are reserved.

Table 19
CAC formats supported from January 1, 1995 to May 31, 1996

Operator-assisted dialing to North American and International locations:
10CIC + 0
10CIC + 0 + NPA + NXX + XXXX
10CIC + 0 + NXX + XXXX
10CIC + 0 + SAC + NXX + XXXX
10CIC + 01 + CC + NN
101ECIC + 0
101ECIC + 0 + NPA + NXX + XXXX
101ECIC + 0 + NXX + XXXX
101ECIC + 0 + SAC + NXX + XXXX
101ECIC + 01 + CC + NN
Direct Distance Dial (DDD) dialing to North American and International locations:
10CIC + 1 + NPA + NXX + XXXX
10CIC + 1 + NXX + XXXX
10CIC + 011 + CC + NN
101ECIC + 1 + NPA + NXX + XXXX
101ECIC + 1 + NXX + XXXX
101ECIC + 011 + CC + NN
Where CIC may be any of the following, 000 to 099, 110 to 149, and 170 to 199 and ECIC may be 5000 to 6999.

Table 20
CAC formats supported from June 1, 1996 onward

Operator-assisted dialing to North American and International locations:
101XXXX + 0
101XXXX + 0 + NPA + NXX + XXXX
101XXXX + 0 + NXX + XXXX
101XXXX + 0 + SAC + NXX + XXXX
101XXXX + 01 + CC + NN
Direct Distance Dial (DDD) dialing to North American and International locations:
101XXXX + 1 + NPA + NXX + XXXX
101XXXX + 1 + NXX + XXXX
101XXXX + 011 + CC + NN

During the time when both original and expanded CAC formats are supported it should be noted that the original CICs will be supported by the expanded CAC format if "0" is dialed before the original CIC. Table 21 shows the interactions between CAC formats during the various time frames:

Table 21
CAC format interactions

Supported CAC formats	Dialing sequences	Example
Original only	10XXX + ...	10123 + 1 + NPA + NXX + XXXX
Original and Expanded	10XXX + ... 1010XXX + ...	10123 + 1 + NPA + NXX + XXXX 1010123 + 1 + NPA + NXX + XXXX
Expanded only	1010XXX + ...	1010123 + 1 + NPA + NXX + XXXX

Carrier Access Codes dialing sequences with special characters

The Meridian 1 recognizes two special characters in any dialing sequence. These characters are the * (star or asterisk) and # (number sign, pound, or octothorpe). The *, when detected in a dialing sequence, causes a pause in the outpulsing of digits, while the #, when detected in a dialing sequence, indicates end-of-dialing, i.e., no further digits are required to process the call.

Due to an interaction with Equal Access if the Meridian 1 is configured to restrict international toll calls, then direct dialed Equal Access operator calls (101XXXX + 0) can not be terminated with an #. If the Equal Access operator call is terminated with an # the call will be restricted. Table22 depicts this interaction:

Table 22
Octothorpe with Equal Access interaction

If	101XXX + 011 + CC + NN	**calls are restricted.**
Then	101XXX + 0 + #	**calls will also be restricted.**
But	101XXXX + 0	**will not be restricted.**

Configuring Equal Access within a Network

Equal Access toll restriction is intended for use on an outgoing route from a Meridian 1 to a Central Office. This feature is not intended for restriction of calls which terminate on a network node. Therefore, network signaling (ESN3, ESN5, or ETN) is not supported.

Within a network Equal Access toll calls should be restricted at the outgoing node (the node which is directly connected to the Central Office).

Feature interactions

AIOD and ANI

Calls made to the public exchange network when the AIOD or ANI feature is equipped will have either the internal DN recorded if the call originates at the CDP switch interfacing to the public network, or the trunk access code if the call originates at another CDP switch.

Attendant features

If a user at a local CDP switch calls the local attendant, the local user's internal DN (not the full CDP DN) is displayed.

If a user at a CDP switch calls an attendant at another CDP switch, the trunk access code and member number of the incoming trunk are displayed. The following attendant features are supported at the local CDP switch, but are not supported between CDP switches:

— automatic timed recall,

— barge-in, busy verify,

— camp-on, and

— interposition calling.

Call modification

Call modification, for example, call transfer, call forward, and conference, is allowed for CDP calls. When using these features, the user dials within the CDP format.

Call Detail Recording

The local internal DN (not the complete CDP DN) is recorded in the normal CDR manner. The maximum internal DN length remains at 4 digits; but if the DNXP package is equipped, the internal DN can have up to 7 digits. The full CDP DN is shown in the dialed number field.

Code Restriction

Code restriction is applied to calls made only from stations with a Toll Denied (TLD) class of service. Code Restriction or New Flexible Code Restriction (NFCR) can be applied on a trunk route basis to public exchange network trunk calls.

Collect Call Blocking True networking operation is not provided by this feature, however, it is possible to attach Collect Call Blocking capability to the Steering Codes (TSC, DSC) for use in a Coordinated Dialing Plan environment and outgoing routes for use in a non-CDP dialing plan, while tandeming.

Collect Call Blocking New classes of service and prompts are introduced to inhibit specific users from receiving collect DID and CO calls. When tandem calls are made, the source node determines the CCB treatment for all outgoing calls. For CDP routed calls, the CCBA prompt associated with the DSC or TSC is checked. For non-CDP routed calls (UDP, Access code, RAN, or Music Route), the CCBA prompt in the route data block is checked. The Meridian 1 will provide the CCB answer signal to the CO for all incoming DID and CO calls from routes with CCB enabled that are answered by CCB users. The CCB answer signal can only be sent in cases where answer supervision is provided by the Meridian 1. For CDP routed calls this will happen regardless of the class of service of the far end. If the call is collect the CO will disconnect it. The decision to send the CCB answer signal is made on the source node (the node closest to the CO) and is based on the CCB user hierarchy shown in Table 23 below. In either case, the DID/CO route must have Collect Call Blocking enabled.

Table 23
CCB User Hierarchy

CCB User Hierarchy
1 The setting of incoming routes CCB prompt.
2 The source (first) ACD queue's setting of the CCBA prompt.
3 The CCB option in the customer data block for NAS routing.
4 The CDP steering code's setting of the CCBA prompt.
5 The outgoing route's setting of the CCBA prompt.
6 The COS of the terminating set. If attendant answers the call, then the CCBA option in CDB.
7 The DISA data block's setting of CCBA

Common Control Switching Arrangement

A CDP number can be part of a CCSA dialing plan. Digit absorption and manipulation for CCSA calls is handled as usual by the switch. A CCSA call can terminate at a switch in a CDP group other than the switch which hosts the CCSA network. This operation is transparent to the originator of the CCSA call.

COS/TGAR treatment

For CDP calls, all Class of Service (COS) treatment remains the same as standard treatment with the exception of conditionally toll denied (CTD) and conditionally unrestricted (CUN) COS, which are treated as unrestricted (UNR). Users with an FR2 class of service can make local CDP calls, but cannot make CDP calls to distant switches. Trunk Group Access Restrictions (TGAR) are ignored for routing CDP calls.

Digit Display

— **Outgoing CDP Call** — The complete dialed CDP DN is displayed at the originating telephone.

— **Incoming CDP Call** — The trunk access code and member number of the incoming trunk route is displayed.

— **Internal CDP Call —** At the originating telephone, the complete dialed CDP DN is displayed. If the call hunts or is picked up by another telephone, the internal DN of the answering telephone is displayed. At the terminating telephone, the internal DN of the originating telephone is displayed.

Direct Inward Dialing

Because a CDP DN can be up to 7 digits long, the capability of inserting up to 6 leading digits on DID trunks is provided.

End-to-End Signaling

End-to-End signaling is allowed for CDP calls.

Hunting

Hunting across different switches in a CDP group is not supported. Standard hunting can be applied to local CDP calls.

Interchangeable Numbering Plan Area codes

Due to the fact that Interchangeable Numbering Plan Area (NPA) codes plan removes the requirement of the second digit in an NPA being zero (0) or one (1) the Toll Denied (TLD) class of service is no longer a reliable method of toll denying sets. To reliably toll deny sets the Code Restriction or New Flexible Code Restriction (NFCR) feature must be used.

Message center

The message center capability is not supported across CDP switches. However, locally it operates as normal.

NARS

The CDP feature can be implemented at a switch equipped with the NARS software feature. If such is the case, the following considerations apply:

— Steering codes for CDP calls must be distinct from the assigned NARS access codes.

— CDP numbers can be integrated with the ESN UDP; for example, a five-digit CDP number can be the same as the last five digits of a seven-digit UDP number.

— NARS/BARS route lists, digit manipulation tables, and TOD schedules can be shared by CDP calls. (CDP route lists must be numbered 0–31.)

— Users eligible for the OHQ and CBQ features, can use them when placing CDP calls.

— Free Calling Area Screening (FCAS) does not apply to CDP calls.

Flexible Numbering Plan

Flexible Numbering Plan (FNP) package 160 was introduced to the International marketplace as part of the X11 with Supplementary Features Group E (Phase 5) release.

FNP accommodates Global Numbering Plan requirements by modifying the Electronic Switched Network (ESN) dialing plan. The dialing plans are divided into two areas:

—   On-net dialing — which deals with all the possible dialing situations required when dialing to a station located within the Local (private) Network, and

—   Off-net dialing — which deals with all the possible dialing situations required when dialing to a station that is not part of the Local Network (typically the Public Numbering Plan).

FNP was enhanced in the Group F (Phase 6Biv) release to include the ability of inhibiting the time out handling process for ESN Basic Alternate Route Selection (BARS) and Network Alternate Route Selection (NARS) Special Numbers (SPN) and Coordinated Dialing Plan (CDP) Trunk Steering Codes (TSC). The enhancement ensures that all digits are collected prior to seizing a trunk. This enhancement meets Chinese requirements.

Network Alternate Route Selection (NARS) package 58 is a prerequisite for FNP.

With X11 Release 20 FNP is introduced to the Global marketplace.

FNP interacts with both NARS and Coordinated Dialing Plan (CDP) to introduce:

— Universal Numbering Plan (UNP),

— Transferrable Directory Numbers (TNDN),

— Group Dialling Plan (GDP),

— Arbitrary length DNs on a node, and

— Free Special Number Screening (FSNS).

On-net dialing

The Flexible Numbering Plan (FNP) feature allows any station in the network to be represented by a flexible number of digits up to a maximum of ten.

FNP allows the length of Location Codes (LOC) to vary from node to node, as well, the total number of digits dialed to get to a station can differ for different stations.

FNP allows flexible length DNs throughout the network, i.e., the number of digits that make up a DN can vary for different stations. An existing four digit network may want to go to five or six digit numbers when adding new switches, while keeping the existing four digit plan as is.

When Uniform Dialing Plan (UDP) is used, stations on the same switch can skip the node identification digits. The on-net LOC are represented by three- to seven-digit codes, while the total number of digits dialed can be from three to ten digits. To use the UDP, a station user dials the Location Code of the desired node, then the DN of the station at that node. The digits dialed to get to a station are the same from any switch in the network.

With Flexible Numbering Plan (FNP), any stations on any switches are represented by a unique one to ten digit number. Moreover, DNs of different lengths can coexist on the same node. Termination of all codes is attempted when the system times out, when Inhibit Time Out Handling (ITOH) is disabled, even if the expected number of digits is not dialed. When ITOH is enabled, termination of a SPN is attempted when all expected digits are received, the number of expected digits is defined by the response to the Flexible Length (FLEN) prompt in LD 90.

When Coordinated Dialing Plan (CDP) is used, stations on any switch are

represented by unique three to ten digit numbers (since release 13). A station on one switch can call a station at another switch within the CDP group by dialing the unique three to ten digit number without access codes and associated optional pauses for dial tone. With existing features, the number of digits dialed to a particular node (NCDP) must be the same for all stations on that node. If fewer digits than NCDP are dialed, the system times out and gives overflow tone. With Flexible Numbering Plan (FNP), any stations on any switches are represented by a unique one digit to ten digits number. Moreover, DNs of different lengths can coexist on the same node. Termination is attempted when the system times out, even if the expected number of digits is not dialed.

When the Transferable DN (TNDN) scheme is used, a user can move from one location to another while retaining their DN. The TNDN scheme is supported on a one to seven digit Coordinated Dialing Plan.

Off-net dialing

Off-net dialing deals with dialing digits to reach a location which is not part of the local network, typically a public exchange station, but also includes stations which are part of another private network.

Flexible numbering is the use of inconsistent dialing patterns which exist in international locations. In North America the dialing plans are fixed length, NXX + XXXX or NPA + NXX + XXXX and ESN dialing plan formats are designed to respond to these consistent dialing patterns. Since this is not the case internationally, Flexible Numbering Plan (FNP) allows users to dial numbers of varying lengths to terminate at a destination. Flexibility of the number of digits which can be dialed is achieved by using SPNs.

An Alternate Remote Routing Number (ARRN) capability is also introduced for SPNs under the Supplemental Digit Restriction or Recognition (SDRR) table.

End-of-dial timing

All NARS end-of-dial timing procedures apply to FNP along with the FNP unique Flexible Length (FLEN) processing. If the user dials the number of digits as defined by the response to the FLEN prompt, then the software considers dialing as being complete and analyzes the digits for call processing purposes. If the Inhibit Time Out Handler (ITOH) procedures are active and the response to FLEN is a value other than zero "0", then if NIT expires or

the user dials # prior to the number of digits input in response to the FLEN prompt are dialed, no attempt is made to complete the call.

ESN feature interactions

ESN features operate the same way they did prior to the introduction of FNP if FLEN is set to zero. When used along with ISDN, FNP supports features which are currently supported jointly by ESN and ISDN.

Feature operation and implementation

For further details regarding the operation and implementation of a Flexible Numbering Plan refer to *Flexible Numbering Plan Description, operation, and administration* (553-2751-105).

Network traffic measurements

The NTRF feature provides traffic measurement data related to network performance and network traffic. The NTRF feature can be equipped at ESN nodes and ESN Mains. Using this data allows the network manager to assess the effectiveness of the network and to identify specific areas of network operation where improvements are needed.

The network traffic measurements accumulated at an switch equipped with the NARS (ESN node), BARS (ESN main), or CDP feature encompass the following areas of operation (in addition to regular traffic measurements):

— Network Class of Service (NCOS),

— Routing,

— Off-Hook Queuing (OHQ),

— Call-Back Queuing (CBQ),

— Coordinated Call-Back Queuing (CCBQ),

— Call-Back Queuing to Conventional Mains (CBQCM), and

— Incoming Trunk Groups.

Routing traffic measurements

A route list is a list of outgoing alternate trunk routes to a specific location from an switch.

Trunk routes in a route list are termed route list entries. The number of route lists/entries that can be defined at an switch depends on the features equipped at that switch. Table 24 lists the parameters for the different features and feature combinations. The values shown in parentheses are for X11 Release 13 and greater.

Legend for Table 24:

NCOS = Network Class of Service

FCAS = Free Calling Area Screening

SDR   = Supplemental Digit Restriction

Table 24
Summary of networking feature parameters

Parameter	BARS	NARS	CDP	CDP with BARS	CDP with NARS
NCOS Groups	0–99 (0–7)	0–99 (0–15)	0–99 (0–3)	0–99 (0–7)	0–99 (0–15)
Facility Restriction Levels	0–7	0–7	0–7	0–7	0–7
Digit Manipulation Tables	1–255	1–255	1–31	1–255	1–255
Route Lists	0–127	0–255	0–31 (0–127)	0–127	0–255
Route List Entries	0–31 (0–7)	0–31 (0–7)	0–6 (0–2)	0–31 (0–7)	0–31 (0–7)
FCAS Tables	1–127	1–255	–	1–127	1–255
SDR Tables	0–255	0–511	–	0–255	0–511
Steering Codes	– –	– –	1–10,000 (1–5,000)	1–10,000 (1–5,000)	1–5000

Note 1: If the NARS and BARS features are equipped in the same switch but for different customers, the highest parameter values apply to that switch; for example, if one customer has NARS and another customer has BARS, the NARS parameters apply to the BARS customer.

Note 2: If the New Flexible Code Restriction (NFCR) feature is equipped, the number of available NCOS groups is 8, see *X11 Features and Services*. With X11 Release 13 and later, this number is expanded to 100.

Note 3: NSIG provides 16 NCOS groups.

Note 4: Parameters in parenthesis are for releases prior to X11 Release 13.

The TFN001 routing measurements provide data related to route list utilization. The measurements show how often a route list was accessed, which entries in the list were used, and whether the call was successful in completing a selection or connection. Routing traffic measurements are available at ESN node and ESN main switches.

The routing traffic measurements contain the following statistics for each defined route list.

— **Route list requests** This measurement identifies the total number of call attempts for which the called destination translations identified this route list to attempt call completion.

— **Route list requests served without delay** This measurement reflects the total number of network calls which were routed without encountering blocking or queuing.

— **Expensive route acceptances** This measurement identifies the number of calls which were allowed to complete over an expensive trunk route after the Expensive Route Warning Tone (ERWT) was given.

— **Route list requests standard blocking** This measurement identifies the number of call attempts which could not be served because a route or queuing process was not available to a user. The blocked call may have been routed to overflow tone, a recorded announcement, or the attendant.

— **Route list entry usage count** This measurement identifies the number of calls which were routed successfully over a particular route (entry) in a route list. A count is maintained for each route list entry.

OHQ measurements

Traffic measurements for Off-Hook Queuing (OHQ) are associated with each route list and identify the utilization of the OHQ feature. The OHQ measurements are included with the routing traffic measurements (TFN001), and contain the following statistics for each route list.

— **Quantity of calls placed in OHQ** This measurement identifies the number of calls which attempted to use a route in the route list. But because facilities were not immediately available, the call was permitted to remain off-hook to wait for facilities.

— **Average time in OHQ** This measurement identifies the average duration that calls remained in the OHQ until a route became available. The value (expressed in units of 0.1 second) represents the average time in the queue. Calls which timed out in the queue before a route was selected are also included in the average.

— **Quantity of calls abandoned from OHQ** This measurement identifies the number of calls which were placed in the OHQ but were abandoned. For example, the caller went on-hook before a route became available or the time limit was reached.

CBQ measurements

Traffic measurements for CBQ are associated with each route list and identify the utilization of the feature. The CBQ measurements are included with the routing traffic measurements (TFN001) and contain the following statistics (for each route list).

— **Quantity of CBQ calls** This measurement identifies the number of calls which were offered CBQ and accepted the offer.

— **Average time in CBQ** This measurement identifies the average duration (in units of 0.1 second) calls remained in the CBQ. Calls which were cancelled and calls which were served are included in this measurement.

— **Quantity of CBQ offerings** This measurement is a count of the number of calls which were offered CBQ, regardless if the offer was accepted or not.

— **Quantity of CBQ user cancellations** This measurement identifies the number of calls which were removed from the CBQ on the call originator's request. For example, cancellation of the Ring Again feature.

— **Routing traffic report output format** The routing traffic measurements are output for each route list as shown in .

Table 25
TFN001 routing format

System ID		TFN001						
Customer number								
RLST	xxx	route list requests	route list requests served without delay	expensive route acceptance	route list requests standard blocking	not defined	not defined	
	RT		route list entry use	route list entry use	route list entry use	route list entry use	route list entry use	route list entry use	route list entry use
		SL1TD calls	SL1TD calls	SL1TD calls	SL1TD calls	SL1TD calls	SL1TD calls	
	OHQ	OHQ calls	time in OHQ	abandoned calls				
	CBQ	CBQ calls	average time in CBQ	CBQ offerings		CBQ user cancel		
Example								
0434		TFN001						
000								
RLST	000	00345	00344	00012	00000	00000	00000	
	RT		00000	00000	00000	00000	00000	00000	00000
		00000	00000	00000	00000	00000	00000	00000
		00000	00000	00000	00000	00000	00000	00000
		00000	00000	00000	00000	00000	00000	00000
		00000	00000	00000	00000	00000	00000	00000
		00000	00000	00000	00000	00000	00000	00000
		00000	00000	00000	00000	00000	00000	00000
		00000	00000	00000	00000	00000	00000	00000
	OHQ	00000	00000	00000				
	CBQ	00000	00000	00000	00000			

Note 1: OHQ and/or CBQ information is printed only if the feature is equipped and activated.

Note 2: The two fields not defined always show zeroes (0).

NCOS measurements

The TFN002 NCOS measurements are shown in .

Traffic measurements are collected for each defined NCOS group to indicate the grade of service, in terms of blocking and queuing delay, being provided by the system. If a grade of service is determined by the communications manager to be inappropriate for users in a particular NCOS group, then the communications manager can either reassign the users to another NCOS group, redefine the characteristics of the existing NCOS group, or change the routing parameters. NCOS measurements are available at ESN node and ESN main switches.

The TFN002 NCOS measurements contain the following statistics for each defined NCOS group:

— **Quantity of calls attempted**   This measurement identifies the total number of call attempts generated by users in an NCOS group.

— **Routing requests served without delay**   This measurement identifies the number of call attempts which were routed without encountering blocking or queuing.

— **Expensive route acceptance**   This is a count of the number of callers who accepted an expensive route to complete a call.

— **Network Call Standard Blocking**   This measurement identifies the number of call attempts which could not be completed because a route or queuing process was not available to a user. The blocked call may have been routed to overflow tone, a recorded announcement, or the attendant.

— **Quantity of calls refusing expensive routes**   This measurement identifies the number of calls which were given ERWT and elected not to use the expensive route.

— **Quantity of calls placed in OHQ**   This measurement identifies the number of calls that were placed in the OHQ.

— **Average time in OHQ**   This measurement identifies the average duration that calls remained in the OHQ until a route became available. The value (in units of 0.1 second) represents the average time that calls were in the queue. Calls which timed out in the queue before a route was selected are also included in the average.

— **Quantity of CBQ calls** This measurement identifies the number of calls which were offered CBQ and accepted the offer.

— **Average time in CBQ** This measurement identifies the average time that calls waited in the CBQ for a route to become available. It includes calls which requested a cancellation, calls which were served, and direct Ring Again against trunks. The average time is expressed in units of 0.1 second.

Table 26
TFN002 NCOS report

Format							
System ID	TFN002						
Customer number							
NCOS	network class of service group	calls attempted	routing requests served without delay	expensive route acceptances	network call standard blocking	not defined	calls refusing expensive routes
	OHQ	OHQ calls	average time in OHQ				
	CBQ	CBQ calls	average time in CBQ				
Example							
0423	TFN002						
000							
NCOS	000	00207	00197	00000	00001	00000	00000
	OHQ	00007	00237				
	CBQ	00000	00000				
Note 1: OHQ and/or CBQ information is printed only if feature is equipped and activated.							
Note 2: Note 2: The field that is not defined always shows all zeroes (0).							

Incoming trunk group measurements

The incoming trunk group measurements (TFN003) are output as shown in Table 27.

The TFN003 Incoming Trunk Group Measurements provide an indication of the incremental traffic that was imposed on incoming trunk groups by the network queuing features. Data are provided for each incoming or two-way trunk group that is offered OHQ, CCBQ, or CBQCM. These measurements are available at ESN nodes.

The following measurements are accumulated for each incoming (or two-way) trunk group:

— **Quantity of calls placed in OHQ**   This measurement identifies the number of incoming trunk calls that were placed in the OHQ for possible connection to another trunk group.

— **Average time in OHQ**   This measurement reflects the average time (in units of 0.1 second) that calls waited in the OHQ for a trunk to become available. The average time includes those calls that were removed from the OHQ by caller abandonment, or were removed from the queue after expiration of the OHQ time limit.

— **Quantity of incoming calls offered CCBQ or CBQCM**   This measurement identifies the number of incoming trunk calls that were blocked at the ESN node, and the user was given the option of accepting an ESN node initiated callback when facilities become available. The measurement relates to use of the CBQ feature by users at an ESN main (Coordinated Call-Back Queuing) or Conventional main (Call-Back Queuing to Conventional Mains).

— **Quantity of calls accepting CCBQ or CBQCM**   This measurement identifies the number of incoming trunk calls that were blocked at the ESN node, were offered CBQ, and accepted the offer. The count relates to CBQ acceptances by users at an ESN main or Conventional main.

— **Average time in CBQ**   This measurement (expressed in units of 0.1 second) reflects the average time that users at an ESN main or Conventional main remained in the CBQ (at the ESN node) for a facility to become available.

Note 1: When a CCBQ callback is offered to a busy station at an ESN main, the call is removed from the queue for 5 minutes, then reinserted in the queue. This process occurs only once. The additional queuing time is added to the average time. The 5-minute suspension time is not included in the average time, nor is it reinsertion into the queue pegged as another CBQ call.

Note 2: When a CBQCM callback is offered to a station at a Conventional main that is busy or fails to answer the callback, the call is removed from the queue and reinserted into the queue as specified in Note 1.

— **Quantity of calls blocked in callback** This measurement identifies the number of CBQ callbacks (CCBQ or CBQCM) initiated by the ESN node that could not be completed because an outgoing trunk group (to the ESN main or Conventional main) was not available.

— **Callback Attempts No Answer and cancellation** This measurement identifies the number of callback attempts that were not successful because the caller failed to answer the callback. CBQ callbacks to a station at an ESN main that has previously cancelled CBQ are treated as Callback Attempts No Answer.

Table 27
TFN003 Incoming Trunk Group

Format					
System ID		TFN003			
Customer number					
TRKG	incoming trunk group				
	OHQ	calls placed in OHQ	average time in OHQ		
	CBQ	incoming calls offered CBQ, CCBQ, CBQCM	calls accepting CBQ, CCBQ, CBQCM	average time in CBQ, CCBQ, CBQCM	blocked CBQ, CCBQ, CBQCM callbacks	callback attempts not answered or cancelled
Example					
0423	TFN003				
000					
TRKG	003				
	OHG	00006	00263		
	CBQ	00000	00000	00000	00000	00000

OHQ threshold violation measurement

The output format for this threshold measurement is shown in Table 28.

The OHQ overflow threshold measurement (TFN101) provides an indication that more than the expected number of users are timing out in the OHQ. This means that OHQ is offered and accepted, but a trunk does not become available before the service-changeable OHQ time limit expires. This could result from trunks being out of service, an incorrectly defined OHQ time limit, or temporary traffic overload.

Table 28
OHQ threshold violation measurement

Format		
System ID	TFN101	
Customer number		
OHQT timed out OHQ calls	threshold	
Example		
0423TFN101		
000		
OHQT 00333	00000	

Traffic measurement options

New traffic measurement options are introduced with the NTRF feature.

These options are set and/or queried through use of the Traffic Control program (LD 2) in the normal manner. For more information, see *Traffic measurement formats and output* (553-2001-450). The options are:

— to generate Routing Measurements (TFN001)

— to generate NCOS Measurements (TFN002)

— to generate Incoming Trunk Group Measurements (TFN003)

List of terms

AC

Access Codes

AIOD

Automatic Identification of Outward Dial

ANI

Automatic Number Identification

AUB

Authcode Data Block

AUT

Authcode Table

BARS

Basic Alternate Route Selection

BAUT

Basic Authorization Code

Bellcore

The organization which oversees and administers the North American Numbering Plan (NANP).

CA

Call Aggregators — (as defined by FCC Docket 90-313) are persons who, in the course of their operations, make telephones available to the public or to transient users of its premises for interstate telephone calls using a provider of operator services.

Aggregators, as defined by the FCC, include the following:

— Hotels and motels

— Hospitals

— Universities

— Airports

— Gas Stations

— Pay Telephone Owners

CAC

Carrier Access Code, used by Equal Access feature. Code dialed by the user which is made up of the Equal Access identifier and the Carrier Identification Code.

CIC

Carrier Identification Code, used by Equal Access feature.

CAS

Central Attendant Service

CBQ

Call-Back Queuing

CBQ(i)

initial CBQ option

CBQ(a)

extended CBQ option

CCBQ

Coordinated Call-Back Queuing

CCBQAM

Coordinated Call-Back Queuing Against Main

CCBQ CM

Coordinated Call-Back Queuing to Conventional main

CCSA

Common Control Switching Arrangement

CDP

Coordinated Dialing Plan

CDR

Call Detail Recording

CFF

Call Forwarding-forwarding party's COS

CFO

Call Forwarding-originating party's COS

CO

Central Office

CONV

Conventional (switch)

DDD

Direct Distance Dialing

DISA

Direct Inward System Access

DMI

Digit Manipulation Index

DN

Directory Number

DNXP

DN Expansion

DSC

Distance Steering Code

DTMF

Dual Tone Multi-Frequency

EOD

End-of-Dialing

ERWT

Expensive Route Warning Tone

ESN

Electronic Switched Network

FCAS

Free Calling Area Screening

FCC

Federal Communications Commission

FCI

Free Calling Index

FRL

Facility Restriction Level

HLOC

Home Location Code

HNPA

Home Numbering Plan Area (code)

ITEI

Incoming Trunk Exclusion Index

ITGE

Incoming Trunk Group Exclusion

LDN

Listed Directory Number

LOC

Location Code

LPK

Loop Key

LSC

Local Steering Code

NANP

North American Numbering Plan

NARS

Network Alternate Route Selection

NAUT

Network Authorization Code

NCOS

Network Class of Service

NCTL

Network Control

NPA

Numbering Plan Area(code)

NPX

North American Numbering Plan NPA format for Pre Interchangeable
Numbering Plan Area codes where:

N = any digit between two (2) and nine (9),

P = digit zero (0) or one (1), and

X = any digit between zero (0) and nine (9).

NSC

Network Speed Call

NSIG

Network Signaling

NTRF

Network Traffic (measurement)

NXFER

Network Transfer

NXX

North American Numbering Plan Local Exchange format and North
American Numbering Plan NPA format for Interchangeable Numbering Plan
Area codes where:

N = any digit between two (2) and nine (9), and

X = any digit between zero (0) and nine (9).

OHQ

Off-Hook Queuing

RDB

Route Data Block

RGA

Ring Again

RLB

Route List Block

RLT

Release Link Trunk

RTC

Routing Control

SAT

Satellite Link Control

SDRR

Supplemental Digit Restriction/Recognition

SPN

Special Number

SPRE

Special Service Prefix

SSC

System Speed Call

SSP

Special Service Prefix

STD

Standard (signaling)

TCM

Traveling Class Mark

TCOS

Traveling Class of Service

TFC

Traffic Control

TFN

Network Traffic

TGAR

Trunk Group Access Restrictions

TLD

Toll Denied

TOD

Time of Day

TSC

Trunk Steering Code

TTTN

Tandem Tie Trunk Network

UDP

Uniform Dialing Plan

XFER

Call Transfer

Meridian 1
Electronic Switched Network
Description

N⊘RTEL
NORTHERN TELECOM