2220 Nways BroadBand Switch
Models 300, 500, and 501

Planning Series
ISDN Interface Specifications

IBM

Planning Series
ISDN Interface Specifications

┌─ **Note!** ───┐

Before using the information provided in this book, read the general information and notices contained in the *2220 Nways BroadBand Switch Physical Lines Interface Specifications*, GA33-0379.

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About this Book

The following sections describe the audience, purpose, and organization of this book.

Who Should Use this Book?

Use this book if you are in charge of:

- Planning the installation of a network including IBM 2220 Nways Broadband Switches

- Installing and configuring such a network.

Purpose of this Book

This book provides:

- General information about Euro-ISDN, INS-Net, and QSIG.

- A short introduction to the ISDN network functions supported by the Nways Switch.

- A brief description of ISDN configuration parameters.

How this Book Is Organized

- For an introduction to the Nways Switch ISDN and QSIG support, read Chapter 1, Nways Switch and Integrated Services Digital Network.

- For more information about ISDN network functions, read Chapter 2, Nways Switch Network Functions.

- For a brief description of ISDN configuration parameters, read Chapter 3, Configuring ISDN Resources.

- A glossary is provided at the end of the book.

Where to Find More Information

This book is a supplement to the *2220 Nways BroadBand Switch Planning Guide*. For a complete list of the customer information manuals, refer to the "Bibliography" on page X-11.

Chapter 1. Nways Switch and Integrated Services Digital Network

The IBM 2220 Nways Broadband Switch (also called Nways Switch) provides ISDN and QSIG support. This book describes the logical interface of the:

- Integrated services digital network (ISDN), including:
  - Euro-ISDN
  - INS-Net (ISDN Japan)
- Q signaling (QSIG) access agent.

Provided by the Nways Switch Control Program Version 2 Release 1 running in the 2220 Nways BroadBand Switch.

The Nways Switch connects to ISDN equipment based on:

- European telecommunication standard (ETS) Euro-ISDN standards for public and private telephone networks
- European computers manufacturers association (ECMA) Q signaling (QSIG) standards for private branch exchanges (PBX).

The Nways Switch also connects to INS-Net equipment based on the telecommunication technology committee (TTC) standard for public and private telephone networks.

The Euro-ISDN and QSIG port access services of the Nways Switch use a primary rate access (30B+D) on E1 and (23B+D) on T1 physical interfaces to build private networks with integrated services.

The INS-Net port access services of the Nways Switch use a primary rate access (23B+D) on J1 physical interfaces to build private networks with integrated servcies.

Refer to the *2220 Nways BroadBand Switch Physical Lines Interface Specifications*, GA33-0379 for details about the physical interface (layer 1) of the corresponding lines.

Introduction

ISDN describes and specifies a digital user interface for a digital communications network. It does not specify the internal operations of the communications network. It specifies only the interfaces and the services that it provides.

This section explains the ISDN and QSIG terminology defined in **reference models**.

ISDN Reference Model

Figure 1-1 on page 1-2 shows the ISDN reference model.

Figure 1-1. ISDN Reference Model

The ISDN reference model defines the following reference points:

- **U reference point**: The two-wire interface between the user premises and the ISDN.

  Note: In Europe, this interface is not accessible to the user.

- **T reference point**: The four-wire public user network interface (UNI).

- **S reference point**: The private UNI interface, using the same protocol as the T interface. It can be considered as an extension of an ISDN private branch exchange (PBX).

- **Q reference point**: The standardized four-wire interface between two PBXs. It uses a balanced protocol and provides supplementary services, mainly for voice communications.

- **Network termination 1 (NT1)**: A digital modem that converts the two-wire U interface into the four-wire T interface.

  Note: In Europe, this equipment is generally installed by the carrier on the user premises.

- **Network termination 2 (NT2)**: A functional view of the private network switches (typically one or more interconnected PBXs).

The following abbreviations are used:

- **TE**: Terminal equipment at the user premises
- **PBX**: Private branch exchange
- **CPE**: Customer premises equipment
- **SPE**: Supplier premises equipment.

QSIG Reference Model

Q Signaling (QSIG) is a European standard based on ISDN technology. It uses outband signaling known as common channel signaling (CCS). It defines a Q interface on tie-lines between PBXs (for private networks).

Figure 1-2 on page 1-3 shows the QSIG reference model, which is an ISDN simplified reference model.

Figure   1-2. QSIG Reference Model

The T, S, and Q reference points are the ones defined in the ISDN reference model.

The following additional abbreviations are used in the QSIG reference model:

- **TE**: Terminal equipment at the user premises
- **PTNX**: Private telecommunications network exchange.

QSIG PTNX Reference Model

The QSIG standard defines different functions for the private telecommunications network exchanges (PTNX) within a network. Figure 1-3 shows the QSIG PTNX reference model.

Figure   1-3. QSIG PTNX Reference Model

The T, S, and Q reference points are those defined in the ISDN model.

The following additional abbreviations are used in the QSIG PTNX reference model:

- **TE**: Terminal equipment at the user premises.
- **PTNX**: Private telecommunications network exchange.
- **End-PTNX**: A PTNX with extensions directly connected to it. This PTNX:

- Is called the originating PTNX when a call is originated from one of the extensions.

- Is called the destination PTNX when it receives a call to one of the extensions.

- **Transit-PTNX**: A PTNX that receives calls from, or forwards calls to, other PTNXs within a network. Transit-PTNXs are used to build large networks with tie-lines such as E1.

- **Gateway-PTNX**: A PTNX that interfaces between a QSIG private network and a non-QSIG network. In particular, a gateway-PTNX must map Q signaling into non-Q signaling. Depending on the type of network interconnected, it may provide supplementary end-to-end services.

ISDN Basic Rate Interface

The ISDN basic rate interface (BRI) uses the same twisted pair (subscriber loop) as is currently used for a telephone. This single pair of wires carries two (64 kbps) B channels and one (16 kbps) D channel (1 kbps=1000 bites per second).

A B channel is 64 kbps in both directions simultaneously (duplex). When a user places a call for voice or data, a continuous path is allocated to the call until either party hangs up (clears the call).

The D channel is not an end-to-end clear channel like the B channels. The D channel carries data in short packets and is primarily used for signaling between the user and the network. When the user dials a number, the requested number is carried as a packet on the D channel. Depending on the network, the D channel can also be used for sending limited amounts of data from one end user to another through the network without using the high capacity B channels.

Note: The Nways Switch does not provide the ISDN basic rate.

ISDN Primary Rate Interface

The ISDN primary rate interface (PRI) uses two pairs of wires (subscriber loops), one for each direction.

- In Europe, the transmission rate used is 2 Mbps (1 Mbps=1000 000 bits per second). This results in the availability of 30 B channels (64 kbps) plus one D channel (64 kbps).

- In the U.S. and in Japan, the transmission rate used is 1.544 Mbps. This results in the availability of 23 B channels (64 kbps) plus one D channel (64 kbps).

Nways Switch ISDN Offering

Logical Interface

Table 1-1 and Table 1-2 on page 1-6 list the characteristics of the Nways Switch Euro-ISDN, INS-Net and QSIG logical Interface.

Table 1-1. Characteristics of the Nways Switch Euro-ISDN and INS-Net Logical Interface

Characteristics	DCE or DTE INS-Net Port	DCE or DTE Euro-ISDN Port
LIC Type	514 and 544 (100 ohms)	515 and 545 (E1 75 ohms)
		516, 546, and 567 (E1 120 ohms)
Framing	ITU-T G.703 and G.706	
Payload	Primary rate access (23B+D)	Primary rate access (30B+D)
Numbering Plans	Unknown	E.164
		Private numbering plan (PNP)
		Unknown
Access Type	Public network access	
	Private network access	
	Private subscriber access	
Standards	TTC JT-I431 for layer 1	ETS-300 011 for layer 1
	TTC JT-Q921 for layer 2	ETS-300 102-1 for layer 3
	TTC JT-Q931 for layer 3 (see the note below)	ETS-300 102-2 for layer 3
		ETS-300 125 (ITU-T Q.920 and Q.921) for layer 2
		ETS-300 170
		ETS-300 171
		ETS-300 172
		ETS-300 239
Note:		
• TTC JT-I431 is based on ITU-T I.431 for layer 1 with a maximum speed of 1.544 Mbps		
• TTC JT-Q921 is based on ITU-T Q.921 for layer 2		
• TTC JT-Q931 is based on ITU-T Q.931 for layer 3		

Table 1-2. Characteristics of the Nways Switch QSIG Logical Interface

Characteristics	DCE QSIG Port on E1 Lines	DCE QSIG Port on T1 Lines
LIC Type	515 and 545 (E1 75 ohms) 516, 546, and 567 (E1 120 ohms)	514 and 544 (100 ohms)
Framing	ITU-T G.703 and G.706	
Payload	Primary rate access (30B + D)	Primary rate access (23B + D)
Numbering Plans	E.164 and private numbering plan (PNP)	
Access Type	Private network access Private subscriber access	
Standards	ETS-300 011 for layer 1 ECMA 141 for layer 2 ECMA 143 for layer 3 ECMA 165 for the generic function protocol	ITU-T I.431 for layer 1 ECMA 141 for layer 2 ECMA 143 for layer 3 ECMA 165 for the generic function protocol

Figure 1-4 shows how the Nways Switch connects to an ISDN or QSIG environment.

Figure 1-4. Nways Switch ISDN Environment

The Nways Switch complies with standards listed in Table 1-1 on page 1-5 for:

- Access to an ISDN public network through a T2 interface (A)
- Access to a Euro-ISDN private network through an S2 interface (B)
- Access to a QSIG private network through a Q interface (C).

Euro-ISDN Port

Euro-ISDN port access services connect ISDN equipment to an Nways Switch port using a primary rate access (30B+D). This attachment is based on the European telecommunication standards (ETS) listed in Table 1-1 on page 1-5.

When attaching to a PBX, the Nways Switch acts as an Euro-ISDN DCE using the NT2 interface. When attaching to a public or private Euro-ISDN network, the Nways Switch acts as a DTE using the NT1 interface (provided by the carrier).

The Euro-ISDN protocol requires a low-speed adapter type 3 (LSA3) and a line interface coupler (LIC) of the following type:

- 515, 516, or 567 (four E1 lines)
- 545 or 546 (eight E1 lines).

The LIC type 567 is designed for public telephone networks where approval is required from the telephone authorities.

Euro-ISDN Private Network

Figure 1-5 shows an example of a Euro-ISDN private network based on Nways Switches. The Nways Switch provides the T interface network-side protocol. Each T interface is identified by a subscriber number which belongs to a private numbering plan (PNP) or an E.164 numbering plan.

Figure 1-5. Euro-ISDN Private Network

The Nways Switch supports:

- Direct dialing-in (DDI) used by a PBX to select an extension.

- Hierarchical numbering plan: in a large network, a user can dial a truncated number for a local call. In this case, the Nways Switch can complete the number.

- Calling party number: the Nways Switch can provide a calling party number in the CALL SETUP to securely identify the caller.

- Open or closed numbering plans.

Notes:

1. A numbering plan is open if the length of the numbers follows certain predetermined rules. (For example, the E.164 international ISDN numbering plan is open).

2. A numbering plan is closed if the length of the numbers is variable.

- Implicit or explicit numbering plans.

   Notes:

   1. A numbering plan is implicit if it contains escape codes or prefixes. Implicit plans are still used by some PBXs.

   2. A numbering plan is explicit if it does not use prefixes.

The Nways Switch does not support in-band tone generation.

ISDN DSS1: Access to a Public Network

The Nways Switch provides:

- The T interface protocol (NT2) on the user side. Every T interface is identified in the public ISDN network by a E.164 subscriber number.

- The S interface protocol on the network side. Every S interface is identified in the NBBS address space by private numbers, which must be mapped to DDI in the public ISDN address space.

Figure 1-6 shows an example of access to a public network based on Nways Switches.

Figure 1-6. ISDN DSS1: Access to a Public Network

The Nways Switch supports:

- Open or closed E.164 numbering plans

- Implicit or explicit numbering plans

- On-net to off-net (1) calls (private to public)

- Off-net to on-net (2) calls (public to private)

- On-net to on-net (3) calls (private to private).

Note: The Nways Switch does not support in-band tone generation.

INS-Net Port

INS-Net is the ISDN service provided by NTT in Japan.

The ISDN port access services connect INS-Net equipment to an Nways Switch port using a primary interface access (23B+D). This attachment is based on the telecommunication technology committee (TTC) standards listed in Table 1-1 on page 1-5.

When attaching a PBX, the Nways Switch acts as an INS-Net DCE with the NT2 interface. When attaching to a public or private INS-Net network, the Nways Switch acts as a DTE with the NT1 interface (provided by the carrier).

The INS-Net protocol requires a low-speed adapter type 3 (LSA3) and a LIC type 514 (four J1 lines) or 544 (eight J1 lines).

ISDN support in Japan is available on J1 lines with the following characteristics:

- A J1 line supports 24 channels instead of 32 channels on an E1 line.
- Signaling is transported over the D channel (channel number 24 instead of channel number 16).

QSIG Port on E1 and T1 Lines

Q signaling (QSIG) is an ECMA standard used with the ISDN protocol. It is based on the ECMA standards listed in Table 1-2 on page 1-6.

The QSIG port attachment of the Nways Switch use a primary rate access (30B+D on E1 and 23B+D on T1 physical interfaces) to build private networks with integrated services. QSIG ports are fully interoperable with ISDN ports.

The Nways Switch with the Q signaling transit function acts as a DCE and provides private branch exchanges (PBXs), connected at the Q reference point. NBBS services are provided between these access points. The Nways Switch acts either as a transit or gateway PBX.

The following signaling modes are provided:

- Basic call
- Call-related generic functional transport (GFT)
- Call-independent GFT.

QSIG on E1 lines requires the same hardware features as Euro-ISDN, and QSIG on T1 lines requires the same hardware features as INS-Net. Refer to Table 1-2 on page 1-6.

QSIG Transit Network

Figure 1-7 on page 1-10 shows an example of a QSIG transit network based on Nways Switches. The switches provide the Q interface balanced-protocol. A *Q interface* is a tie-line that gives access to a range of extension numbers. Therefore, a QSIG port is identified by a range of private numbers in the Nways Switch address space. The phone number examples in Figure 1-7 on page 1-10 identify PBX extensions, not Nways Switch QSIG ports.

Figure 1-7. QSIG Transit Network

The Nways Switches support:

- Open or closed private numbering plans

- Implicit or explicit numbering plans.

QSIG Gateway

The QSIG gateway function maps the Q and T interfaces. The Nways Switch provides:

- The T interface protocol on the user side. Every T interface is identified in the public ISDN network by an E.164 subscriber number.

- The S interface protocol on the network side. Every S interface is identified in the NBBS address space by private numbers, which must be mapped to DDI in the public ISDN address space.

Figure 1-8 shows an example of a QSIG gateway function based on Nways Switches.

Figure 1-8. QSIG Gateway

The Nways Switch supports:

- Open or closed E.164 numbering plans

- Implicit or explicit numbering plans

- On-net to off-net (1) calls

- Off-net to on-net (2) calls

- On-net to on-net (3) calls.

The Nways Switch does not support in-band tone generation.

Multivendor Environment

Figure 1-9 shows a typical multivendor environment.

The Nways Switch supports:

- Basic calls from vendor A to vendor B, as well as QSIG supplementary services (1)

- Basic calls from vendor B to vendor B, as well as QSIG supplementary services and proprietary supplementary services encapsulated in the QSIG generic protocol (2).

Figure 1-9. Multivendor Environment

Chapter 2. Nways Switch Network Functions

The Nways Switch supports the ISDN network functions described in this section.

Numbering Plans

E.164 and private numbering plan (PNP) are supported. E.164 is supported for both network and subscriber access (private and public).

Call configuration is made simple through:

- The single local declaration of ISDN numbers within a predefined range
- The prefix (wildcard) list used to quickly define publicly accessible areas
- The numbering plan tables which allow for simple number changes (for example, adding or suppressing a digit)
- The open and closed private numbering plan.

The NBBS architecture supplies automatic discovery of the network topology and directory numbers.

Call Processing Functions

Types of Accesses

The Nways Switch provides three types of ISDN or QSIG access shown in Figure 2-1:

- Private subscriber access (1) through a range of numbers (E.164 or PNP)
- Public network access (2) through wildcards (E.164)
- Private network access (3) through wildcards (E.164 or PNP).

Figure 2-1. Types of ISDN or QSIG Access

Types of Calls

The Nways Switch supports three types of calls:

- On-net to on-net (1) calls (E.164 or PNP)

- On-net to off-net (2) calls with the lowest routing cost. Every access to the public network is customized with the number range of the region. The directory services dynamically find the best access to the public network.

- Off-net to on-net (3) calls with the possibility of one to five DDI digits.

Figure 2-2 shows the different types of calls supported by the Nways Switch.

Figure 2-2. Types of ISDN or QSIG Calls

Line Bundling

This Nways Switch function provides a hunt group mechanism that allows one ISDN number to be shared by several ISDN terminals. Line bundling is available for port lines connected to the same LSA3 adapter and that share the same address range. Line bundling is transparent to the telephone end user and applies to every type of access, namely:

- Private or public subscriber access

- Access to private or public networks.

Figure 2-3 on page 2-3 shows an example of line bundling.

Figure 2-3. Line Bundling

Virtual Private Network

With the virtual private network (VPN) function, service providers can build several virtual networks, thereby sharing the same physical network among different customers.

Figure 2-4 shows an example of a virtual private network.

Figure 2-4. Virtual Private Network

PBX numbering plans are not modified and this function is transparent to the end-user. Virtual private networks are configured in the NBBS network using virtual private identifications.

Network Clustering

NBBS network clustering allows you to define prefixes for direct access to an area. Clusters are connected through private network access. Network clustering is compatible with the VPN function defined in "Virtual Private Network" and it supports:

- Line bundling

- QSIG and Euro-ISDN

- PNP and E.164 numbers.

Figure 2-5. Network Clustering

Supplementary Services

Figure 2-6. Supplementary Services

The Nways Switch supports the following ISDN and QSIG supplementary services (A, B, and C in Figure 2-6):

- Direct dialing-in (DDI): enables a public subscriber to directly call a private subscriber without operator intervention.

- Calling line identification presentation (CLIP): gives the calling party identification to the called party.

- Calling line identification restriction (CLIR): prevents giving of the calling party identification to the called party.

- Connected line identification presentation (COLP): gives the connected party identification to the calling party.

- Connected line identification restriction (COLR): prevents giving of the connected party identification to the calling party.

- Subaddressing (SUB): allows a supplementary address field to be used after an ISDN address.

- User-user signaling level 1 (UUS1): allows a user to exchange information over the D channel (not available for QSIG).

- Transit counter (QSIG only).

The Nways Switch supports and transparently transports (C in Figure 2-6):

- The QSIG generic functional protocol (GFP)
- PBX proprietary protocols encapsulated in GFP
- All standard QSIG supplementary services.

Bearer Services

In order to optimize the use of network resources, the Nways Switch dynamically selects one of the bearer service profiles that you have configured, on a call per-call-basis, depending on the destination number and bearer capability.

Figure   2-7. Bearer Services

Dynamic selection of a profile applies to voice and data. The traffic is transported as PTM packets over the NBBS network on 64 kbps channels using the CES (with voice server functions) or the HDLC protocol (with idle character removal). This permits having, for example, non-compressed voice for a call transmitted over the public network.

DPNSS Support

In UK, the Nways Switch can connect to digital private network signaling system (DPNSS) PBXs through DPNSS/QSIG converters. This equipment converts DPNSS frames to ISDN basic calls. It supports most of the DPNSS supplementary services encapsulated in the QSIG generic protocol.

Figure   2-8. DPNSS Support

For more information about this converter, contact your IBM marketing representative.

Chapter 3. Configuring ISDN Resources

This section provides information about ISDN resource configuration.

Figure 3-1 shows a general view of the configuration.

Figure   3-1. ISDN Configuration

The Euro-ISDN/QSIG protocol requires a low-speed adapter type 3 (LSA3) and a line interface coupler (LIC) to connect to up to eight E1 or T1 lines. The INS-Net protocol requires a low-speed adapter type 3 (LSA3) and a line interface coupler (LIC) to connect up to eight J1 lines.

The configuration is based on the:

- *Bearer service profiles (BSP)*: Specify the ISDN traffic characteristics on a an NBBS connection. Must be configured first.

- *Numbering plan table (NPT)*: Specifies the characteristics of the numbering used. An NPT can be shared by several ISDN or QSIG accesses.

- *ISDN network interface (INI)*: Specifies the parameters for layers 1, 2, and 3. There is one INI per ISDN or QSIG (E1) access.

Configuration Tools

ISDN resources are configured using either:

- Nways Switch Configuration Tool Version 2 (NCT2) from a dedicated configuration station running under OS/2 or AIX

- Nways Switch Manager (component of the Nways Switch Enterprise Manager) from a network management station.

See the online help for a detailed description of the configuration parameters and the online Nways Switch Configuration Overview, distributed with the NCT2, for configuration principles.

Bearer Service Profile

An ISDN bearer service profile (BSP) is a set of parameters that defines a type of ISDN traffic (speech, audio, data, or video). One BSP is associated with each ISDN numbering plan table.

Following are the ISDN bearer service profile (BSP) parameters:

- Bearer service profile name: up to 32 characters

- Data bearer service: clear channel or HDLC/IR (idle removal)

- Quality of service (QoS) choice for data traffic (clear channel or HDLC/IR)

- Voice treatment, if required: GSM or ADPCM voice compression and silence removal

- Echo cancellation

- Negociable services

- QoS choice for voice traffic (compressed or non-compessed).

More about BSP Parameters...

The SETUP message includes the called party number and the bearer capability. The BSP has been selected by the source numbering plan table (NPT) according to the called number. The BSP:

- Selects the QoS for the NBBS connection.

- Selects the service required to transport data on the B channels.

- Selects a profile according to bearer setup capabilities.

Table 3-1 shows the possible options of the BSP configuration according to bearer capability.

Table 3-1. Bearer Service Profile Configuration Options				
Bearer Capability	**Circuit Emulation**	**Voice Processing**	**HDLC / Idle Removal**	**QoS**
Speech	Yes	GSM, echo cancellation	No	RT1 or RT2
Audio 3.1 Khz	Yes	GSM, echo cancellation	No	RT1 or RT2
Data	Yes	No	Yes	RT2 or NRT
Audio 7 Khz	Yes	No	No	RT1 or RT2
Videoconference	Yes	No	No	RT1 or RT2

Quality of Service

The Quality of Service (QoS) is selected according to the type of traffic and the way you want the connection to be handled by the NBBS network. This section applies to the predefined QoSs.

The choice of a QoS depends on the type of traffic and the characteristics of the connection:

- For HDLC traffic, refer to *2220 Nways BroadBand Switch HDLC Interface Specifications*, GA33-0375
- For frame-relay, traffic refer to *2220 Nways BroadBand Switch Frame Relay Interface Specifications*, GA33-0374
- For CES (voice) traffic, refer to *2220 Nways BroadBand Switch CES Interface Specifications*, GA33-0376

ISDN Numbering Plan Table Parameters

An ISDN *numbering plan table* (NPT) is a set of parameters, organized in source NPT and destination NPT, that defines a type of called ISDN number. A numbering plan table is associated with each ISDN network interface.

ISDN numbering plan table (NPT) must be configured after ISDN bearer service profiles. Following are the NPT parameters:

- Numbering plan table name: up to 32 characters
- source numbering plan table:
  - Name of the associated bearer service profile (selected from the list of configured BSPs)
  - Called number: prefix, numbering plan identifier, and type of number (displayed by the NCT2)
  - Called number: number of digits to accumulate (value selected in the range 0-20)
  - Number alteration rules: number of digits to strip-off, additional prefix, numbering plan identifier, and type of number
- Destination numbering plan table:
  - Called number: prefix, numbering plan identifier, and type of number (displayed by the NCT2)
  - Number alteration rules: number of digits to strip-off, additional prefix, numbering plan identifier, and type of number

More about NPT Parameters...

The numbering plan table (NPT) can be shared by several ISDN or QSIG accesses.

ISDN Number Structure

ISDN number structure is defined in the following ways:

- In the E.164 numbering plan, a **country code** and an **area code** precede the **local number**.
- In a private numbering plan (PNP), a **level 2 region code** and a **level 1 region code** precede the local number.

ISDN number encoding can be **implicit** or **explicit** depending on the PBX dialing type.

Table 3-2 on page 3-4 shows an example of a number for each type of numbering plan when using explicit encoding. In this case, the numbering plan identification (NPI) and the type of number (TON) depends on the type of call.

Table 3-2. Examples of ISDN Numbers (Explicit Encoding)		
Numbering Plan Id	**Type of Number**	**Examples of Numbers**
E.164	International	33 4 92 11 4000
E.164	National	4 92 11 4000
PNP	Level 1	36 4000
PNP	Local	4000

Table 3-3 shows an example of a number for each type of numbering plan when using implicit encoding. In this case, prefixes precede the number and the NPI and TON are unknown.

Table 3-3. Examples of ISDN Numbers (Implicit Encoding)		
Numbering Plan Id	**Type of Number**	**Examples of Numbers**
Unknown	Unknown	00 33 4 92 11 4000
Unknown	Unknown	0 4 92 11 4000
Unknown	Unknown	9 36 4000
Unknown	Unknown	4000

Figure 3-2 shows the automatic region gateway function, also called explicit numbering.

Figure 3-2. Explicit Numbering

- The 2220 uses the E.164 country code (or area code) or the PNP level 2 and level 1 region codes.

- The source 2220 completes the called or calling numbers to the E.164 international or PNP level 2 numbers.

- The destination 2220 removes the codes from the numbers.

Example of extension 1234 calling extension 5555:

- The source PBX sends a SETUP(7 53 5555) message to the source 2220. The level 2 and level 1 region codes precede the extension.

- The source 2220 sends to the destination 2220 a SETUP(7 53 5555, 4 36 1234) message including the calling number and the called number.

- The destination 2220 removes the destination region code and sends to the destination PBX a SETUP(5555, 4 36 1234) message including the called extension and the calling number.

Source NPT

The source NPT:

- Specifies the called number process on the incoming call side.

- Adds or removes prefixes.

- Determines the numbering plan (E.164 or PNP).

- Changes the number type (unknown, level 2, level 1, local, national, international). The resulting number is used to route the call to the destination 2220 and to query the NBBS directory services.

- Selects the bearer service profile (BSP).

Table 3-4 shows an example of a source NPT. In the example for the called number 948, the NPI and TON are unknown. The source NPT first changes the number to 948 1234. It then removes a digit (9), adds a prefix (4), sets the new NPI to PNP, sets the new TON to level 2, and selects the bearer service profile B.

Table 3-4. Source NPT							
Called Number Matching Criteria			**Called Number Modification Rules**				
Number	**NPI**	**TON**	**Added Prefix**	**Strip Off Digits**	**New NPI**	**New TON**	**BSP**
936	Any	Any	4	1	PNP	Level 2	A
948	Any	Any	4	1	PNP	Level 2	B
210492	Any	Any	33	3	E.164	International	C

Destination NPT

The destination NPT:

- Adds or removes prefixes.

- Changes the numbering plan (E.164 or PNP).

- Changes the number type (unknown, level 2, level 1, local, national, international). The resulting number is forwarded to the destination PBX and adapts the called number to the PBX numbering format.

Table 3-5 on page 3-6 shows an example of a destination NPT. In the example, for the called number 448, the destination NPT receives the SETUP(448 1234) message. The NPI is PNP and the TON is level 2. Therefore, the destination NPT does not change the NPI and the TON.

Table 3-5. Destination NPT						
Called Number Matching Criteria			Called Number Modification Rules			
Number	NPI	TON	Added Prefix	Strip Off	New NPI	New TON
436	PNP	Any		0	Unknown	Unknown
448	PNP	Level 2		0	Unchanged	Unchanged
33492	E.164	Any	0	2	E.164	National

ISDN Network Interface Parameters

An *ISDN network interface* is a logical Nways Switch resource generated by the Control Program to provide access services to a physical ISDN port line (or channel on an E1 or a T1 line). An ISDN network interface sets up and maintains the connections between its attached ISDN terminal equipment and the destination terminal equipment.

ISDN network interfaces must be configured after the bearer service profiles and numbering plan tables. Configure one ISDN network interface per physical ISDN/QSIG port line. Following are the network interface parameters:

- Network interface name: up to 32 characters

- Line attachment location: rack, slot, and position on the LIC

- ISDN parameters:

    - Protocol
    - Access to public subscriber, private subscriber, public network, or private network
    - Layer 2 protocol role: network or user
    - Layer 3 protocol role: network-side or user-side

- Initial administrative state (locked or unlocked) and line automatic restart

- Numbering plan table name (selected from the list of configured NPTs)

- Public numbers (E.164): country code, area code, DDI range, explicit numbering

- Private numbers: level 2 region code, level 1 region code, DDI range, nearest public network access, explicit numbering

- Resources: up to 64 local resources defined by a type and an identifier.

For each ISDN network interface, advanced options can be configured with the following parameters:

- Access to public subscriber, private subscriber, public network, or private network (displayed by the NCT2)

- Virtual private network (VPN): selection of multi-VPN on private access and definition of VPN prefix

- Maximum number of hops in the range 2-31

- Accounting selection

- Least cost routing selection

- Selection of calling line identification services: presentation (CLIP) and restriction (CLIR)
- Selection of connected line identification services: presentation (COLP) and restriction (COLR).

If required, a channel usage table can be displayed. It is used to select a usage for each channel: incoming, outgoing, birectional (default choice), and not available. Channel 0 is reserved for synchronization. Channel 16 or 24 is reserved for signaling.

More about ISDN Network Advanced Options...

This section describes the parameters related to the network:

Access Type

Can be private subscriber, private network, or public network.

Local Number

According to the access type (see Figure 3-3), you must define:

- Number range (1) for private subscriber access (E.164 or PNP)
- Wildcards for public (2) or private (3) network accesses.

Figure 3-3. Types of ISDN/QSIG Access

Line Bundling

Line bundling allows you to define the same number range on different lines connected to the same adapter. Refer to "Line Bundling" on page 2-2 for details.

Figure 3-4 on page 3-8 shows an example of line bundling.

Figure   3-4. Line Bundling

Number of Hops

Used for QSIG protocol to determine the maximum number of hops for a connection. An NBBS network typically counts for two hops (one for the entry, one for exit). For example, if you have three NBBS networks connected, for six hops are counted.

Connection Accountable

Defines whether or not you want accounting for a given connection.

Calling Line Id Restriction (CLIR) and Calling Line Identification Presentation (CLIP)

The calling number is passed to the destination 2220 if it is presented to the source 2220 and if CLIR is set to NO. If CLIP is selected, the destination 2220 sends the calling number to the destination PBX. Figure 3-5 shows an example of these parameters.

Figure   3-5. CLIP, CLIR, COLP, and COLR Parameters

Connected Line Identification Restriction (COLR) and Connected Line Identification Presentation (COLP)

If COLR is selected, the destination 2220 sends back the number of the connected station to the source 2220. If COLP is selected, the source 2220 returns the number of the connected station to the source PBX. Refer to Figure 3-5.

Virtual Private Network (VPN)

The prefixes configured for each ISDN network interface must be defined. Figure 3-5 shows an example of VPNs. Refer to "Virtual Private Network" on page 2-3 for details.

Figure   3-6. Virtual Private Network

Glossary

The following are the abbreviations and technical terms used in the 2220 Nways Switch library.

2220. The IBM 2220 Nways BroadBand Switch (also called Nways Switch) is a fast packet switch enabling high-speed communications over a broadband network. It implements the functions of the IBM Networking BroadBand Services (NBBS) architecture.

2220-300. 2220 Nways Switch Model 300.

2220-500. 2220 Nways Switch Model 500.

2220-501. 2220 Nways Switch Model 501.

AAL. ATM adaptation layer.

ABR. Availability bit rate.

ac. Alternating current.

access services. Functions that are performed by a port adapter of the IBM 2220 Nways BroadBand Switch to:

- Support the attachment of external user devices through port lines
- Prepare user data packets
- Control the input traffic on port lines
- Manage line protocols.

active remote connector (ARC). A connector that supplies the electrical and physical interfaces between a line interface coupler type 511 (LIC511) in an Nways Switch subrack and data circuit-terminating equipment (DCE) or data terminal equipment (DTE). ARCs are housed in line connection boxes (LCBs).

adapter. An Nways Switch module that can be used, depending on its hardware type and the code that it runs, as:

    Control point adapter

    Port adapter

    Trunk adapter

    Voice server adapter.

A trunk or port adapter is associated with a line interface coupler (LIC). A voice server adapter can be associated with a voice server extension (VSE).

ADPCM. Adaptive differential pulse code modulation.

AIS. Alarm indicator signal.

AIX. Advanced Interactive Executive.

alarm and power control (APC). In an Nways Switch, a module that connects the NAS, reports alarms, and controls the power supplies.

Alert Manager. A component of the Nways Enterprise Manager that processes the SNA alerts received from IBM 3746s operating in IP mode.

AMI. Alternate mark inversion.

ANSI. American National Standards Institute.

APC. Alarm and power control (module).

AR. Access rate.

ARC. Active remote connector.

asynchronous transfer mode (ATM). A high-speed, connection-oriented switching and multiplexing protocol that transmits different types of traffic (voice, video, and data) simultaneously.

ATM. Asynchronous transfer mode.

ATMAn. ATM adapter type n (module).

ATM adaptation layer (AAL). In ATM devices, a programming interface that provides common functions for connecting non-ATM equipment to an ATM network. There are several classes of ATM adaptation layers which represent the main traffic types (for example, data, voice, and video).

ATM network interface. A logical resource generated by the Nways Switch Control Program to provide access services to a physical ATM port line. An ATM network interface sets up and maintains predefined ATM virtual connections.

AT&T. American Telephone & Telegraph (Company).

B8ZS. Bipolar eight-zero substitution.

Bc. Burst committed.

Be. Burst in excess.

bearer service profile (BSP). A set of parameters that defines a type of ISDN traffic (speech, audio, data, or video). One BSP is associated with each ISDN numbering plan table.

BECN. Backward explicit congestion notification.

B-ICI. Broadband inter-carrier interface.

BMI. Byte multiplexer interface.

BNC. Bayonet Niell-Concelman.

bps. Bit per second.

bridge. A functional unit that interconnects two LANs that use the same logical link control protocol but may use a different medium access control protocols. A bridge works at the data link level (layer 2) of the OSI reference model.

broadband network. A network that uses a large frequency band to transport different kinds of traffic (such as coded voice, video, and data) at the same time.

BSC. Binary synchronous communication.

BSP. Bearer service profile.

BT. Burst tolerance.

bursty. Refers to transmission at variable bit rate where the time between data transmissions is not always the same.

CAC. Connection admission control.

CAS. Channel associated signaling.

CBR. Constant bit rate.

CCS. (1) Common channel signaling (2) Change control server (also called CC server).

CDB. Configuration database.

CDV. Cell delay variation.

CDVT. Cell delay variation tolerance.

cell loss priority (CLP). A priority bit in the ATM cell header. When set, it indicates that the cell can be discarded during traffic congestion.

centralized configuration database. A database prepared with the Nways Switch Configuration Tool Version 2 (NCT2) on a configuration station. It stores the parameters of an NBBS network.

CES. Circuit emulation services.

change control server (CCS or CC server). A station that runs the IBM NetView Distribution Manager for AIX to store the Nways Switch Control Program and to manage code changes.

CIR. Committed information rate.

circuit emulation services (CES). An access service that emulates a leased line. It transports information

with a constant bit rate at the source and destination. The traffic can be PCM voice, video, fax, multimedia, or real-time synchronous data (such as BSC).

CLIP. Calling line identification presentation.

CLIR. Calling line identification restriction.

CLK. Clock (module).

CLKRD. Clock redrive (module).

clock module (CLK). A module of the 2220 Model 300 or 500 that transmits clock signals to the line interface couplers (LICs). It is optional and can have a backup.

clock redrive (CLKRD). A module of the 2220 Model 501 that drives the signals from the Model 500 clock module to the adapters of the Model 501. The clock redrive is optional and can have a backup.

clock references. In an Nways Switch, the software function that controls the transmission of clock signals to the LICs where they are used for bit synchronization.

CLP. Cell loss priority.

CMIP. Common management information protocol.

CMIS. Common management information services.

CMOT. CMIP over TCP/IP.

CNM. Communication network management.

code file. A named set of records stored as a unit in a change control server. An Nways Switch code file can include data or internal code.

COLP. Connected line identification presentation.

COLR. Connected line identification restriction.

configuration station. See Nways Switch configuration station.

control point (CP). In an Nways Switch, a logical resource that provides network control functions. It can have a backup.

CP. Control point.

CPA. Control point adapter (module).

CPE. Customer premises equipment.

CP spanning tree. In an NBBS network, a distribution tree that connects the Nways Switch control points through trunk lines.

The CP spanning tree supplies a very fast and efficient way to multicast control messages such as network topology data.

CRC. Cyclic redundancy check.

CSU. Channel acccess unit.

CTD. Cell transfer delay.

data circuit-terminating equipment (DCE). An equipment installed on a user premises that provides all the functions required to establish, maintain, and terminate a connection, and to do the signal conversion and coding between a data terminal equipment (DTE) and a line. A DCE can be separate piece of equipment or part of other equipment.

data terminal equipment (DTE). That part of a data station that serves as data source, data sink, or both, and provides the data communication control function depending on the type of protocol used.

dB. Decibel.

dBm. Decibel based on 1 milliwatt.

DC48. Dc power input type -48V

dc. Direct current.

DCD. Dc distribution (module).

DCE. Data circuit-terminating equipment.

DDI. Direct dialing-in.

DE. Discard eligibility.

decibel (dB). (1) One tenth of a bel. (2) A unit that expresses the ratio of two power levels on a logarithmic scale. (3) A unit for measuring relative power. The number of decibels is 10 times the logarithm (base 10) of the ratio of the measured power levels; if the measured levels are voltages (across the same or equal resistance), the number of decibels is 20 times the log of the ratio.

decibel based on 1 milliwatt (dBm). A unit of absolute power measurement that is scaled such that 0 dBm equals 1 milliwatt.

dialog box. On the screen of a station, an area with entry fields and push buttons. (Also called dialog.)

DLCI. Data link connection identifier.

DNPT. Destination numbering plan table.

DSP. Digital service processor.

DSU. Data service unit.

DTE. Data terminal equipment.

DTMF. Dual-tone modulation frequency.

DTR. Data terminal ready.

dummy module. In an Nways Switch, a cover inserted in the place of a module to ensure correct air cooling inside a logic subrack. During normal operation, the dummy modules must not be removed.

E1 standard. A European standard for digital transmission service at 2.048 Mbps.

E3 standard. A European standard for digital transmission service at 34.368 Mbps. An E3 line can transport up to 16 E1 circuits.

E&M. Earth & mark.

ECMA. European Computers Manufacturers Association.

EIA. Electronics Industries Association.

equivalent capacity. The minimum amount of bandwidth needed by a connection to ensure that the packet loss ratio is below a specified threshold.

ESF. Extended status flags.

ETS. European telecommunication standard.

FANB. Fan box.

FAT. File allocation table.

fax. Document received from a facsimile machine. Synonym for telecopy.

FCS. Frame check sequence.

FDDI. Fiber Distributed Data Interface.

FE1. Fractional E1.

FECN. Forward explicit congestion notification.

FEP. Front-end processor.

fiber. Synonym for optical fiber.

fiber budget. The optical power loss as result of the number of connections in the optical fiber link subtracted from the working budget. The loss as a result of connections includes connector loss and splice loss. The fiber budget is expressed in decibels.

Fiber Distributed Data Interface (FDDI). A U.S. standard for 100 Mbps token-ring LANs using optical fiber cables over distances of several kilometers.

fiber optic cable. Synonym for optical fiber.

FR. Frame relay.

FRAD. Frame-relay access device.

frame relay (FR). A connection-oriented protocol to transport data frames over a fast packet-network with guaranteed end-to-end quality of service.

FRFH. Frame-relay frame handler.

front-end processor (FEP). A processor, such as the IBM 3745, 3746 Model 900 or 950, or 3174, that relieves a main frame from communication control tasks.

FRTE. Frame-relay terminal equipment.

FRU. Field replaceable unit.

FT1. Fractional T1.

FTP. File transfer protocol.

Gbps. Gigabit per second (10 to the power of 9 bits per second).

GCRA. Generic cell rate algorithm.

GFP. Generic function protocol.

GFT. Generic function transport.

GSM. Group special mobile.

GUI. Graphical user interface.

HDB3. High-density bipolar 3.

HDLC. High-level data link control.

high-level data link control (HDLC). A data network protocol.

hot pluggable. Refers to a hardware component that can be installed or removed without disturbing the operation of any other resource that is not connected to, or dependent, on this component.

HPFS. High-performance file system.

HPRI. High priority.

HSAn. High-speed adapter type n (module).

HSDS. High-speed digital services.

HSSI. High-speed serial interface.

hub (intelligent). A wiring concentrator, such as the IBM 8260, that supplies bridging and routing functions for LANs with different cables and protocols.

hunt group. See X.25 hunt group.

IDNX. Integrated Digital Network Exchange.

IE. Information element.

ILMI. Interim local management interface.

Integrated Digital Network Exchange (IDNX). A processor integrating voice, data, and image applications. It also manages transmission resources and connects to multiplexers and network management support systems. It permits integration of equipment from different vendors.

integrated services digital network (ISDN). A digital end-to-end public or private network that supports multiple services including, but not limited to, voice and data.

IP. Internet Protocol.

IP gateway adapter. In an Nways Switch, a port adapter that routes the IP control between the NAS and the network management station.

ISDN. Integrated services digital network.

ISDN network interface. A logical resource generated by the Nways Switch Control Program to provide access services to a physical ISDN or QSIG port line. An ISDN network interface sets up and maintains the connections between its attached ISDN terminal equipment and the destination terminal equipment.

ISO. International Organization for Standardization.

isochronous. Refers to transmission at a constant bit rate where there is a clock relationship between source and destination. The bit rates are the same on the destination and source.

ITU-T. International Telecommunication Union - Telecommunication (replaces CCITT).

jitter. Undesirable variations in the transmission delay of a digital signal.

KB. Kilobyte (storage capacity, 1024 bytes).

kbps. Kilobit per second (1000 bits per second).

LAN. Local area network.

LAPB. Link access procedure for B-channel.

LAPD. Link access procedure for D-channel.

LCB.   Line connection box.

LCBB.   Line connection box, base (LCEB and LCPB).

LCBE.   Line connection box, expansion (LCEE and LCPE).

LCEB.   Line connection enclosure, base.

LCEE.   Line connection enclosure, expansion.

LCPB.   Line connection power, base.

LCPE.   Line connection power, expansion.

LCR.   Least cost routing.

LED.   Light-emitting diode.

LICn.   Line interface coupler type n (module).

line.   In an NBBS network, any physical medium, such as a telephone wire, microwave beam, or optical fiber, that transmits information. A line can be a trunk line or a port line.

line connection box (LCB).   A metallic box that:

- Multiplexes up to 15 low-speed lines. There can be up to four LCBs per LIC type 511 for a total of 60 lines (two LCBs and 30 lines per LIC connector).

- Reduces cable lengths between Nways Switch and DCE or DTE locations.

An LCB fits in a standard 19-inch rack. Each one houses up to 15 active remote connectors (ARCs).

line interface coupler (LIC).   In an Nways Switch, a module that physically attaches trunk or port lines. Each line interface coupler is associated with a trunk or port adapter, and supports specific line interfaces.

LIV.   Link integrity verification.

LMI.   Local management interface.

local area network (LAN).   A computer network located on a user premises in a limited geographical area.

logical port.   (Also called NBBS port.) A logical resource generated by the Nways Switch Control Program to provide access services to a physical port line (or channel of a TDM port line) using HDLC, frame relay, or CES protocol. A logical port sets up and maintains its predefined connections.

logical trunk.   (Also called NBBS trunk.) A logical resource generated by the Nways Switch Control Program to provide transport services to a physical trunk line (or channel of a TDM trunk line). A logical

trunk is mainly responsible for optimizing bandwidth and maintaining the CP spanning tree.

LSAn.   Low-speed adapter type n (module).

MA/SR.   Multi-access/sub-rate.

management access.   Refers to an Nways Switch that connects a network management station or a change control server to an NBBS network through its service bus, which is a dedicated Ethernet LAN.

MB.   Megabyte (storage capacity, 1 048 576 bytes).

Mbps.   Megabit per second (10 to the power of 6 bits per second).

MBS.   Maximum burst size.

MLT.   Multiple logical trunks.

module.   In an Nways Switch, a hardware unit plugged in a slot of the logic subrack. It houses, for example, an adapter, a line interface coupler, or a voice server extension. All modules are hot pluggable.

ms.   Millisecond (1/1000 second).

NAS.   Nways Switch administration station.

NBBS.   Networking BroadBand Services (architecture).

NBBS architecture.   See Networking BroadBand Services.

NBBS connection.   See potential connection and virtual connection.

NBBS network.   A network built with IBM 2220 Nways BroadBand Switches and conforming to the IBM Networking BroadBand Services (NBBS) architecture.

NBBS port.   See logical port.

NBBS trunk.   See logical trunk.

NCT2.   Nways Switch Configuration Tool Version 2.

NDPS.   Non-disruptive path switching.

NEM.   Nways Enterprise Manager.

network control.   Functions that are performed by an Nways Switch control point to:

- Allocate and control the Nways Switch resources

- Provide topology and directory services

- Select routes

- Control congestion.

network management station (NMS). A station that runs IBM NetView for AIX and the Nways Enterprise Manager. It is used to manage network topology, accounting, performance, configuration, and error reporting.

network node interface (NNI). An interface between nodes in a communication network.

Network Support Center (NSC). A location from which IBM remotely supports NBBS networks.

Networking BroadBand Services (NBBS). An IBM architecture for high-speed networking that complements ATM standards and provides access services, transport services, and network control to user traffic.

NIC. Network Information Center.

NMS. Network management station.

NNI. Network node interface.

NPT. Numbering plan table.

NR. Non-reserved.

NRT. Non-real-time.

NRZI. Non-return-to-zero inverted recording.

NRZ-1. Non-return-to-zero change-on-ones recording.

NSAP. Network service address point.

NSC. Network Support Center.

NSM. Nways Switch Manager.

NVDM. NetView Distribution Manager for AIX.

NTT. Nippon Telegraph & Telephone (Corporation).

numbering plan table (NPT). A set of parameters, organized in origin NPT and destination NPT, that defines a type of called ISDN numbers. A numbering plan table is associated with each ISDN network interface.

Nways BroadBand Switch. Synonym for 2220 Nways BroadBand Switch.

Nways Enterprise Manager (NEM). The IBM licensed program that runs under NetView for AIX in a network management station to manage Nways Switches, routers, and bridges in an NBBS network.

Nways Switch. Synonym for 2220 Nways BroadBand Switch.

Nways Switch administration station (NAS). A station attached to each 2220 to run the Control Program, and control and service the Nways Switch locally.

Nways Switch configuration station. A mandatory OS/2 or AIX station that runs a stand-alone version of the Nways Switch Configuration Tool Version 2 (NCT2). It stores the centralized configuration database of the NBBS network and can be connected as a user remote console.

Nways Switch Configuration Tool Version 2 (NCT2). A component of the Nways Switch Control Program that is used to configure physical and logical resources. It is also used in stand-alone version under OS/2 or AIX .

Nways Switch Control Program. The IBM licensed program that runs in the NAS and in adapters of the 2220 Nways Switch. It includes a CMIP agent to work with the Nways Switch Manager.

Nways Switch Manager (NSM). A component of the Nways Enterprise Manager that manages the 2220 Nways Switch operation and configuration from a network management station.

Nways Switch Resource Control. A component of the Nways Switch Control Program. It is used from the NAS of an Nways Switch or from a user remote console to control resources and configuration files.

OAM. Operation, administration, and maintenance.

OC3. Optical carrier level 3.

ONPT. Origin numbering plan table.

operation, administration, and maintenance (OAM). A group of functions coded in specific ATM cells to handle alarms and loopback tests on ATM connections.

optical fiber. In fiber optics technology, a wave guide that propagates optical signals from light-generating transmitters to light-detecting receivers.

OSI. Open systems interconnection.

packet loss ratio. The probability that a packet will not reach its destination or not reach it in a specified time. It is obtained by dividing the number of packets lost in transmission by the total number transmitted.

packet transfer mode (PTM). The native transfer mode of the NBBS architecture. PTM divides the traffic into packets of variable length.

PBX. Private branch exchange.

PCM. Pulse code modulation.

PCR.   Peak cell rate.

PDH.   Plesiochronous digital hierarchy.

permanent virtual circuit (PVC).   A virtual circuit that has a logical channel permanently assigned to it at each item of data terminal equipment. It is activated by a program or by a network operator request.

plesiochronous.   Refers to transmission at a nominal bit rate where the source and destination are controlled by different clocks. The bit rates are nearly the same.

PLP.   Packet layer protocol.

PNP.   Private numbering plan.

port.   See logical port.

port adapter.   In an Nways Switch, a module that provides access services to one or more port lines. Each port adapter is associated with a line interface coupler (LIC).

port line.   A communication line that connects a device on a user premises to an Nways Switch. Thus, it is a port to the NBBS network. Port lines can have different protocols and interfaces.

position.   When configuring an Nways Switch, the position parameter indicates the line attachment number on the LIC module (1 to 8, depending on the LIC type).

potential connection.   A predefined connection through an NBBS network between two HDLC, CES, or frame-relay devices.

PPP.   Point-to-point protocol.

private branch exchange (PBX).   A switching system located on a user premises that consolidates a number of inside lines (extensions) into a smaller number of outside lines.

PRS.   Primary reference source.

PSDN.   Packet switched data network.

PSN.   Public switched network.

PSTN.   Public switched telephone network.

PTF.   Program temporary fix.

PTM.   Packet transfer mode.

PTNX.   Private telecommunications network exchange.

pulse code modulation (PCM).   A standard adopted for the digitalization of analog voice signals. In PCM, voice is sampled at a rate of 8 kHz and each sample is coded in an 8-bit frame.

PVC.   Permanent virtual circuit.

Q signaling (QSIG).   An international standard for signaling procedures in private telecommunication networks. It applies to the PBX-to-Nways Switch interface, which is called the Q reference point.

QoS.   Quality of service.

QSIG.   Q signaling.

quality of service (QoS).   In an NBBS network, a set of parameters that guarantees the characteristics of a connection, mainly its end-to-end delay, delay variation, and packet loss tolerance.

RABM.   Router and Bridge Manager.

rack.   A metallic structure, with a standard 19-inch width, that houses the hardware elements of an Nways Switch, that is, logic subrack with modules, fan boxes, and power units.

When configuring an Nways Switch, the rack parameter indicates the 2220 Model (rack A is the Model 300 or 500, and rack B is the Model 501).

RDI.   Remote defect indication.

real-time processing.   Refers to the manipulations of data that are required, or generated, by certain process while the process is in operation. Usually, the results influence the process and, perhaps, related processes.

resource.   In an Nways Switch, a hardware element or a logical entity created by the Control Program. Adapters, modules, and line attachments are examples of physical resources. Control points, logical trunks, logical ports, and network interfaces are examples of logical resources.

resource profile.   A record of the characteristics of an Nways Switch resource. It includes (for example) the part number or module name, the change level, and the name and phone number of the person to contact when a problem occurs.

RETAIN.   Remote Technical Assistance Information Network

RIP.   Route Information Protocol.

router.   An attaching device that connects two LAN segments of the same or different architectures. It can also be connected to a wide area network. A router works at the network level (layer 3) of the OSI reference model by determining the best paths for network traffic flows.

Router And Bridge Manager.   A component of the Nways Enterprise Manager that provides distributed

management for routers such as the IBM 2210 or 2216, bridges such as the IBM 8229, and communication controllers such as the IBM 3746 in IP mode.

RS. Recommended specification.

RSF. Remote support facility.

RSN. Receive sequence number.

RT. Real-time.

RVX. RS/EIA-232, V.24/V.35, X.21.

s. Second.

SCR. Sustainable cell rate.

SDH. Synchronous digital hierarchy.

SDLC. Synchronous data link control.

SDT. Structured data transfer.

serial line internet protocol (SLIP). A TCP/IP protocol used on a point-to-point connection between two IP hosts over a serial line (for example, an RS/EIA-232 connection to a modem over a telephone line).

SLA. Serial link architecture.

SLIP. Serial line internet protocol.

slot. When configuring an Nways Switch, the slot parameter indicates the module location (1 to 12) in the logic subrack.

SNA. Systems Network Architecture.

SNMP. Simple Network Management Protocol.

SONET. Synchronous optical network.

spanning tree. See CP spanning tree.

SRC. System reference code.

SSN. Send sequence number.

station. A microcomputer that is connected to a host or a network and at which a user can run applications.

STM-1. Synchronous transport module type 1.

STS-3c. Synchronous transport signal type 3 concatenated.

SUB. Subaddress.

subrack. A metallic structure installed in an Nways Switch rack. A logic subrack holds modules. A power subrack holds power supply components.

SVC. Switched virtual circuit.

SW. Switch (module).

switch module (SW). A module of the 2220 Model 300 or 500 that interconnects the adapters through an ATM cell switch. It can have a backup.

switch redrive (SWRD). A module of the 2220 Model 501 that drives the signals from the switch module in the Model 500 to the adapters of the Model 501. It can have a backup.

SWRD. switch redrive (module)

switched virtual circuit (SVC). A connection set up from a calling address to a called address following a call establishment protocol. It is released when a clear request signal is received.

synchronous digital hierarchy (SDH). A international recommendation for the internal operation of carrier optical networks.

synchronous optical network (SONET). A U.S. standard for transmitting digital information over optical interfaces. It is closely related to the international recommendation for synchronous digital hierarchy (SDH).

T1 standard. A digital transmission service with a basic rate of 1.544 Mbps.

T3 standard. A digital transmission service with a basic rate of 44.736 Mbps. A T3 line can transport up to 28 T1 circuits.

TCPA. Trunk and control point adapter.

TCP/IP. Transmission Control Protocol/ Internet Protocol.

TDM. Time division multiplexing.

TE. Terminal equipment.

Telnet. In TCP/IP, an application protocol that allows a user at one site to access a remote system as if the display station were locally attached. Telnet uses the Transmission Control Protocol (TCP) as the underlying protocol.

time division multiplexing (TDM). The process of breaking the bandwidth on a communication line into a number of channels, possibly of different size.

TME. Tivoli Management Environment.

TMN. Telecommunication Management Network.

TPA. Trunk or port adapter.

Transmission Control Protocol/ Internet Protocol (TCP/IP). A set of communication protocols that support peer-to-peer connections over both local and wide area networks.

transport services. Functions that are performed by a trunk adapter of an Nways Switch to:

- Support the attachment of trunk lines
- Maximize bandwidth utilization
- Guarantee the quality of service of a connection
- Transfer packets between Nways Switches
- Manage logical queues and schedule transmission.

trunk. See logical trunk.

trunk adapter. In an Nways Switch, a module that provides transport services to one or more trunk lines. Each trunk adapter is associated with a line interface coupler (LIC).

trunk line. In an NBBS network, a high-speed line connecting two Nways Switches. It can be, for example, a copper cable, optical fiber, or radio wave guide and can be leased from telecommunication companies.

UBR. Unspecified bit rate.

UNI. User network interface.

UPC. Usage parameter control.

URL. Uniform resource locator.

user network interface (UNI). A standardized interface between a user and a communication network.

user remote console. A station running OS/2, TCP/IP, and Nways Switch Resource Control. It can be connected to the NAS of an Nways Switch to remotely control and service it.

UTC. Universal time, coordinated.

UUS. User-user signaling.

VBR. Variable bit rate.

VC. Virtual channel.

VCC. Virtual channel connection.

VCI. Virtual channel identifier.

VCN. Virtual circuit number.

virtual channel (VC). In ATM, a unidirectional route between two ATM devices. Virtual channels always come in pairs, one in each direction. They follow virtual paths.

virtual channel connection (VCC). In ATM, a unidirectional connection established over a virtual channel. Virtual channel connections always come in pairs, one VCC in each direction.

virtual channel identifier (VCI). In ATM, the unique numeric tag that identifies every channel. It is defined by a 16-bit field in the ATM cell header.

virtual connection. In frame relay, the return path of an FR potential connection.

virtual path (VP). In ATM, a group of virtual channels that are switched together as one unit. (Also called VC service.)

virtual path connection (VPC). In ATM, a connection established over a virtual path. Virtual path connections always come in pairs, one VPC in each direction. (Also called VP service.)

virtual path identifier (VPI). In ATM, an 8-bit field in the ATM cell header that indicates the virtual path over which the cell is to be routed.

voice server adapter (VSA). In an Nways Switch, a module that supplies additional voice functions to voice connections operating in pulse code modulation at 64 kbps. It can attach a voice server extension (VSE).

voice server extension (VSE). In an Nways Switch, a module associated with a voice server adapter (VSA) to supply voice functions to an extended number of PCM voice connections.

VP. Virtual path.

VPC. Virtual path connection.

VPD. Vital product data.

VPI. Virtual path identifier.

VPN. Virtual private network.

VSA. Voice server adapter (module).

VSEn. Voice server extension type n (module).

WAN. Wide area network.

wide area network (WAN). A network that provides communication services to a large geographic area. It can use or provide public communication facilities.

window. On the screen of a station, an area with a title bar, a menu bar, and scroll bars.

X.25 hunt group. A group of X.25 network interfaces associated with one common subscriber address. If an interface is busy, the connection searches (hunts) for the other interfaces of the group until a free one is found.

X.25 network interface. A logical resource generated by the Nways Switch Control Program to provide access services to a physical X.25 port line. An X.25 network interface sets up and maintains the connections between its attached X.25 subscribers and the destination subscribers.

X.25 Recommendation. An international standard for the interface between data terminal equipments and packet-switched networks.

X.25 subscriber. An X.25 end-user connected to an X.25 network interface through a DTE. A subscriber is defined by an address and a logical name.

Bibliography

This section lists prerequisite and related publications.

Nways Switch Publications

- *2220 Nways BroadBand Switch At a Glance, an Overview*, GA33-0292
- *2220 Nways BroadBand Switch Planning Guide*, GA33-0293
- *2220 Nways BroadBand Switch Physical Lines Interface Specifications*, GA33-0379
- *2220 Nways BroadBand Switch Frame Relay Interface Specifications*, GA33-0374
- *2220 Nways BroadBand Switch HDLC Interface Specifications*, GA33-0375
- *2220 Nways BroadBand Switch CES Interface Specifications*, GA33-0376
- *2220 Nways BroadBand Switch ATM Interface Specifications*, GA33-0378
- *2220 Nways BroadBand Switch X.25 Interface Specifications*, GA33-0413
- *2220 Nways BroadBand Switch ISDN Interface Specifications*, GA33-0447
- *Nways Switch Configuration Overview*, online documentation[1]
- *How to use the NAS*, online tutorial[1]

Nways Enterprise Manager Publications

- *IBM Nways Enterprise Manager Installation Guide*, SH11-3086
- *IBM Nways Enterprise Manager: Managing the Accounting and Performance Monitoring*, GA33-0366
- *IBM Nways Enterprise Manager User's Guide*, online manual[2]

TME 10 NetView for AIX Version 5 Publications

- *NetView for AIX Installation and Configuration*, SC31-8163
- *NetView for AIX V4R1 User's Guide*, SC31-8158

TMN 2.2 Publications

- *TMN 2.2 General Information*, GT01-0458
- *TMN 2.2 Agent User's Guide* SC31-8157

TME 10 Software Distribution Publications

- *Software Distribution for AIX Concepts*, GH19-4161
- *Software Distribution for AIX Getting Started*, GH19-4162
- *Software Distribution for AIX User's Guide*, GH19-4163
- *Software Distribution for AIX Installation and Customization*, GH19-4164

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[1] Online documentation delivered with the 2220 Nways Switch Control Program.

[2] Online documentation delivered with the Nways Enterprise Manager product.

- *NetView Distribution Management Agent/2 User's Guide*, SH19-4084

OSI System Management Standards for CMIP

OSI Management Framework and Overview

- *OSI Basic Reference Model Part 4: Management Framework* ISO 7498-4
- *Systems Management Overview* ISO 10040

CMIP/CMIS

- *Common Management Information Service Definition* ISO 9595

Systems-Management Functions

- *Part 1: Object Management Function*, ISO 10164-1
- *Part 2: State Management Function*, ISO 10164-2
- *Part 3: Attributes for Representing Relationships* ISO 10164-3
- *Part 4: Alarm Reporting Function*, ISO 10164-4
- *Part 5: Event Report Management Function*, ISO 10164-5
- *Part 9: Objects and Attributes for Access Control* ISO 10164-9
- *Accounting Management*, SC 21 N 4971
- *OSI Software Management*, SC 21 N 6040
- *General Relationship Model*, SC 21 N 6041
- *Performance Management*, SC 21 N 6306

Management Information Model

- *Part 1: Management Information Model*, ISO 10165-1
- *Part 2: Definition of Management Information*, ISO 10165-2
- *Part 5: Generic Managed Information*, ISO 10165-5

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2220 Nways BroadBand Switch
Models 300, 500, and 501
Planning Series
ISDN Interface Specifications

Publication No. GA33-0447-01

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