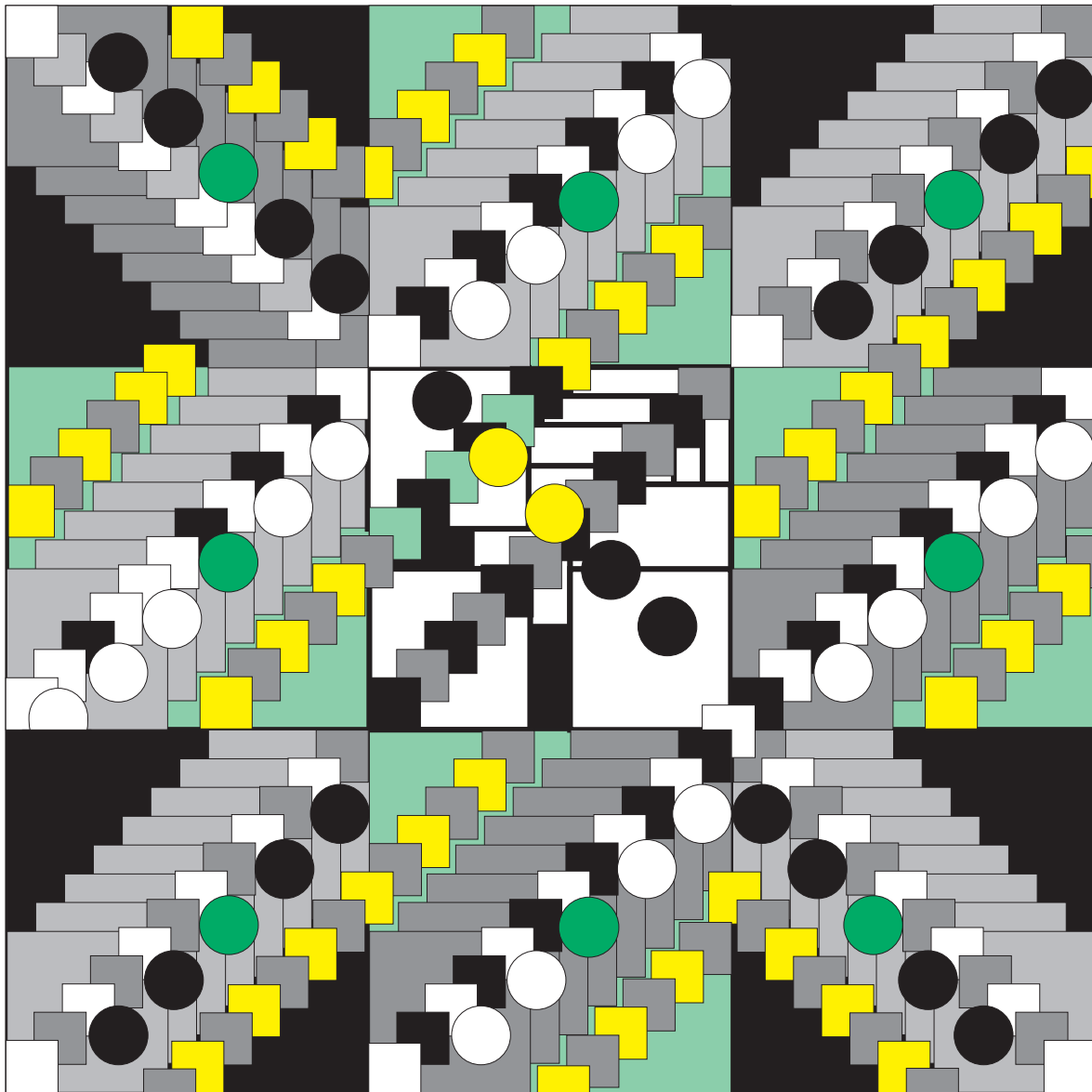


2220 Nways BroadBand Switch
Models 300, 500, and 501



Planning Series CES Interface Specifications



2220 Nways BroadBand Switch
Models 300, 500, and 501



Planning Series CES Interface Specifications

Note

Before using the information given in this booklet, be sure to read the general information and notices provided in the *2220 Nways BroadBand Switch Physical Lines Interface Specifications, External Cable References*, GA33-0379.

Fifth Edition (June 1998)

This edition applies to the following IBM licensed programs:

- Nways Switch Control Program Version 2 Release 2 (V2R2)
- Nways 2220 Switch Manager for AIX Version 1 replaces Nways Enterprise Manager Release 3.

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About This Document

Who Should Use This Document

Use this document if you are responsible for:

- Planning the installation of a network using IBM 2220 Nways BroadBand Switches (Nways Switches).
- Installing and configuring the network.

Purpose of This Document

This document describes the:

- Functions provided by IBM Networking BroadBand Services (NBBS) architecture on circuit emulation services (CES) interfaces of Nways Switches.
- Special features for bandwidth utilization, optimization, and automatic rerouting of connections.

How This Document Is Organized

The document is organized as follows:

- “Chapter 1. Nways Switch and Circuit Emulation Services” on page 1 gives an introduction to the CES access services provided by the Nways Switch.
- “Chapter 2. Configuring CES Resources” on page 11 provides recommendations for configuring CES resources.
- “Chapter 3. More Information on CES Options” on page 17 describes certain CES options.
- A Glossary is provided at the end.

Where To Find More Information

This document is a supplement to the *2220 Nways BroadBand Switch Planning Guide*, GA33-0293. For a complete list of customer information manuals, refer to “Bibliography” on page 37.

What’s New in This Book

The following functions are new or have changed in the Nways Switch Control Program since the last edition of this book:

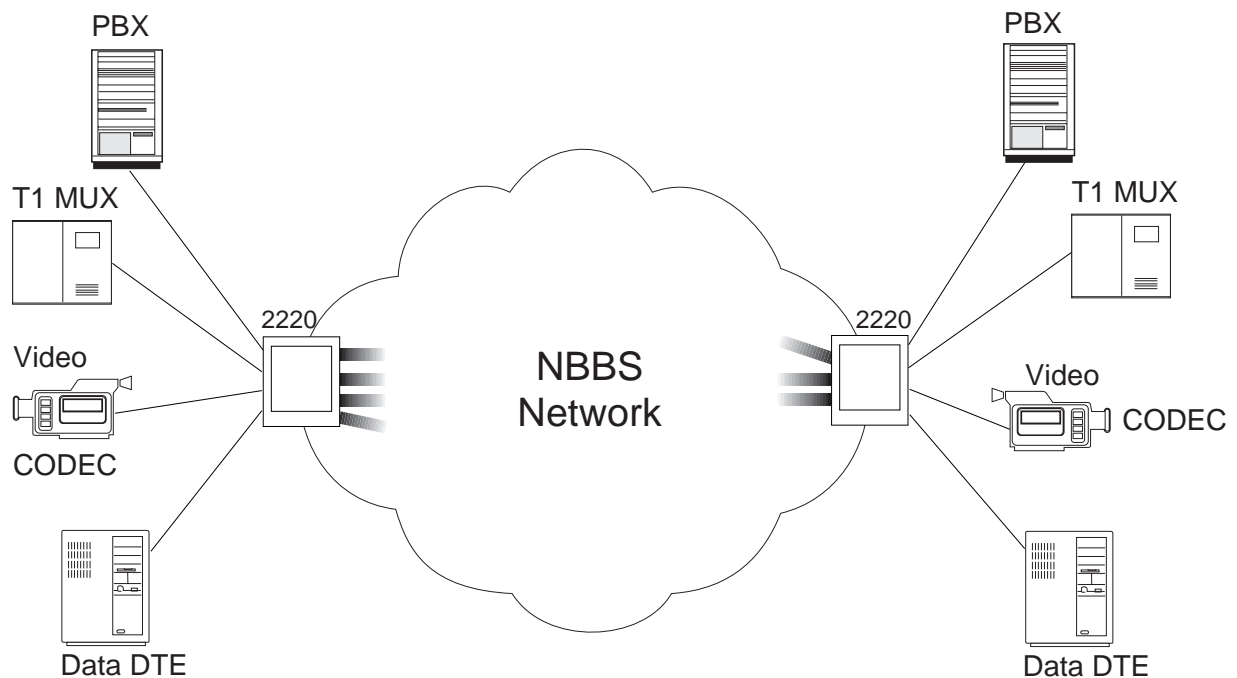
- Non-disruptive path switching (NDPS) is enhanced with parallel NBBS trunks that ensure continued network availability in case of trunk failure.

Chapter 1. Nways Switch and Circuit Emulation Services

This document describes how the IBM 2220 Nways BroadBand Switch (*Nways Switch*) supports the circuit emulation services (CES) protocol.

The CES protocol carries data and voice at constant bit rate (CBR) in real-time. This traffic can be pulse code modulation (PCM) voice, video, fax, or synchronous data such as binary synchronous communication (BSC) or airline control/serial link architecture.

The Nways Switch supports CES in real-time over permanent virtual circuits (PVCs). Figure 1 shows the various types of CES traffic supported by Nways Switches communicating over a Networking BroadBand Services (NBBS) network.



Legend:

CODEC

Coder/decoder

DTE

Data terminal equipment

MUX

Multiplexer

PBX

Private branch exchange

Figure 1. CES Traffic Supported by NBBS Network

CES Modes

In relation with channel usage, traffic type, and voice compression, the Nways Switch supports five CES modes of operation which are summarized in Table 1.

Table 1. CES Modes of Operation

CES Mode	Channels	Traffic	Voice Compression
Clear channel data	No	Data	No
Data on channels	Yes	Data	No
Clear channel voice	No	Voice	No
Voice without compression on channels	Yes	Voice	No
Voice with compression on channels	Yes	Voice	Yes

Clear channel data

No channels are configured. The bandwidth is reserved in relation with the peak bit rate. The maximum end-to-end delay is 200 ms by default. Circuit emulation class 2 (CE2) is the default.

Data on channels

Channels are configured using 64 kbps time slots. Bandwidth is reserved depending on the aggregate peak bit rate of each channel. The maximum end-to-end delay is 200 ms by default. Circuit emulation class 2 (CE2) is the default.

Clear channel voice

No channels are configured. Bandwidth is reserved depending on the configured peak bit rate. The maximum end-to-end delay is 200 ms by default. For information on how to select circuit emulation class 1 or 2 (CE1 or CE2), see “Without Voice Compression” on page 20.

Voice without compression on channels

Channels are configured using 64 kbps time slots. Bandwidth is reserved depending on the aggregate peak bit rate of each channel. If the CES potential connection is defined as *dynamic*, you must configure mono-slot channels and select the On External Event option.

Voice with compression on channels

Channels are configured using 64 kbps time slots. Voice compression introduces a delay which requires an echo canceller. This type of connection applies only to private voice networks. You must configure circuit emulation class 2.

Voice processing functions are available to PCM voice traffic transferred on 64 kbps channels. They are voice compression, fax demodulation, compression law conversion, echo cancellation, silence removal, and idle signal removal (for details, see “Voice Server Functions” on page 5).

PBX Signaling Modes

Voice traffic from private branch exchanges (PBXs) is transported in the following signaling modes:

- Transparent mode
- Channel associated signaling (CAS) permanent mode
- Channel associated signaling (CAS) dynamic mode.

Transparent Mode

In transparent mode, a channel transports voice and signaling transparently over a full or fractional T1 or E1 line. The Nways Switch supports two transparent modes: clear channel and common channel signaling.

Clear Channel (Unstructured)

The Nways Switch supports clear channel as specified in the ITU-T standard G.703 for unstructured transmission. Clear channel is supported on T1, E1, J1, and JJ20 TTC lines.

Common Channel Signaling

Common channel signaling (CCS) mode is supported on T1 and E1 PBX lines. Signaling is passed transparently by the 2220 network using any channel selected. This mode supports up to 24 channels (time slots) on T1 lines and 31 channels on E1 lines (one channel is used for signaling). It provides a permanent logical link between two PBXs, which can be mapped to one or more NBBS connections. Connections are configured depending on channel usage as follows:

Mono-slot channels

One connection exists per 64 kbps time slot. This mode supports voice server functions. The signaling channel is passed transparently without compression.

Clear channel

One connection handles all the time slots. No voice server functions are available in this mode.

Multi-slot channels

Multiple connections exist, each of them handling one channel made of one or more time slots. No voice server functions are available in this mode.

In transparent mode, all channels on a given CES port must go to the same destination.

Figure 2 on page 4 is an example of connection in CCS transparent mode.

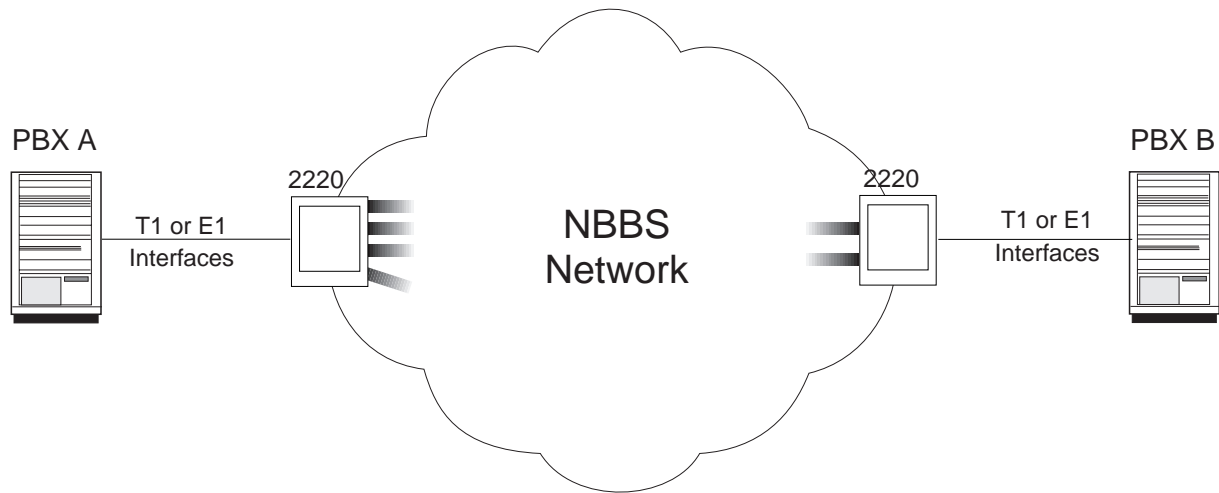


Figure 2. CCS Transparent Connection

Channel Associated Signaling

Channel associated signaling (CAS) mode allows a single PBX link to communicate with several other PBXs. The signaling information corresponding to a given slot is carried through the 2220 network. Signaling information is extracted at the 2220 network entry and delivered to the destination port. No specific configuration is needed for this type of signaling.

CAS mode can be either:

Permanent

Connections between the PBXs are permanently activated. Voice server functions are available only on mono-slot connections. You must configure multi-slot connections in permanent mode.

Dynamic

This mode (called *On External Event* in the configuration programs) saves bandwidth by using connections only when needed. When an off-hook (or seize) signal is detected, the connection is established. In the same fashion, when an on-hook signal is detected, the connection is broken and the corresponding bandwidth is released.

Dynamic connections are available **only** on mono-slot connections. Voice server functions are available on this type of connections.

Figure 3 on page 5 shows an example of connection in CAS permanent mode.

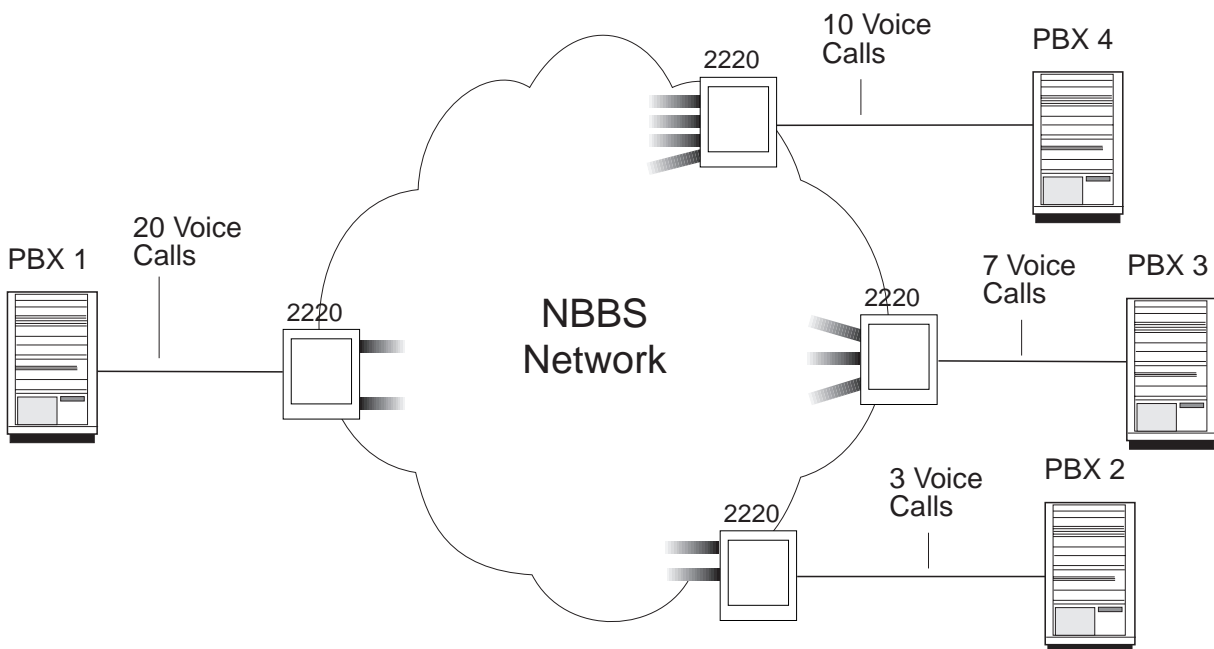


Figure 3. CAS Permanent Connection

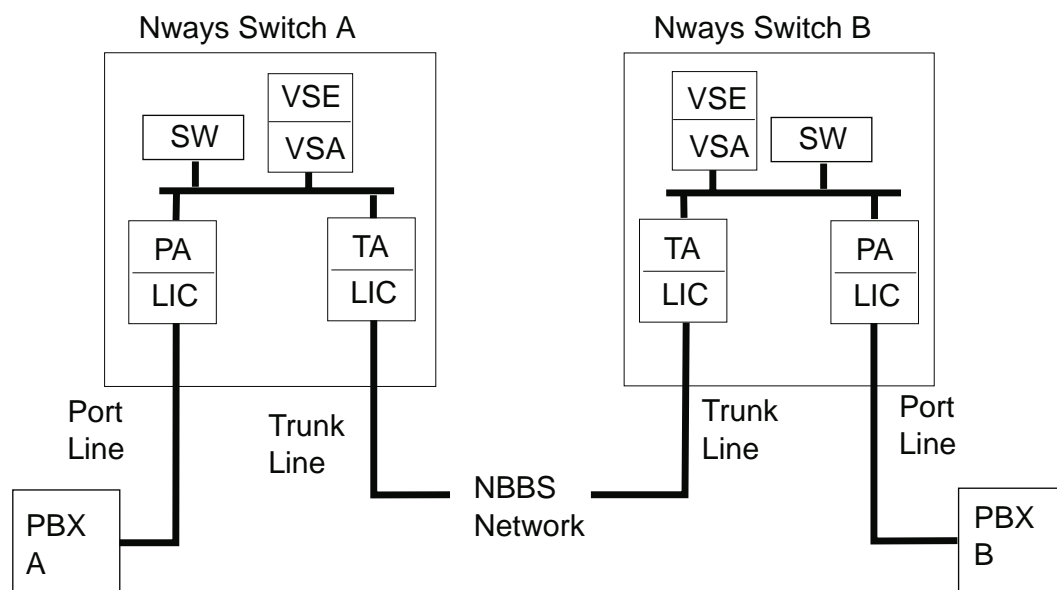
For details on the available QoSs, see “QoS Options” on page 15.

Voice Server Functions

A voice server adapter (VSA), possibly with an associated voice server extension (VSE) provides the following functions to CES voice connections operating in pulse code modulation (PCM) on 64 kbps channels:

- Voice compression
- Fax demodulation
- Compression law conversion
- Echo cancellation
- Silence removal
- Idle signal removal.

Figure 4 on page 6 shows how VSAs and VSEs work on both ends of a voice connection. During a voice call from PBX A to PBX B, voice signals from PBX A are compressed by a VSA or VSE in Nways Switch A. After transmission over the 2220 network, they are decompressed by another VSA or VSE in Nways Switch B. The process is symmetrical for voice signals from PBX B to PBX A.



Legend:

- LIC** Line interface coupler
- PA** Port adapter
- PBX** Private branch exchange
- SW** Switch module
- TA** Trunk adapter
- VSA** Voice server adapter
- VSE** Voice server extension

Figure 4. Voice Call

Voice Compression

Voice compression is performed by a VSA or VSE using one of the following algorithms:

- *Group special mobile (GSM)*. A 64 kbps connection is reduced so that only 12.8 kbps carries the same capacity. On the remote Nways Switch, a VSA or VSE decompresses the voice.
- *Adaptive differential pulse code modulation (ADPCM)*. The 64 kbps bandwidth is reduced to 32 kbps. With this type of compression, up to six successive encoding and decoding processes are accepted with no degradation of voice quality.

GSM and ADPCM compression modes are supported on the same Nways Switch, but not on the same voice server. One type of voice compression is assigned per VSA or VSE. You select voice compression is selected when you configure CES potential connections.

Fax Demodulation

GSM voice compression is turned off when a fax is detected on the connection. To save bandwidth, the fax signal is demodulated and transported at 12.8 kbps. In ADPCM, faxes are transported as compressed voice.

Compression Law Conversion

A-law and μ -law are compression laws used for PCM voice. A-law is used in Europe while μ -law is used in the U.S. Conversion is done by a VSA or VSE when the compression law is different at each end of a CES voice connection.

You configure one of the compression laws for each Nways Switch of the network. Compression law conversion is independent of the voice compression mode (GSM or ADPCM).

In GSM and ADPCM, to activate compression law conversion, you must specify an additional voice function (such as voice compression) when configuring CES potential connections.

Echo Cancellation

Because a VSA or VSE induces a propagation delay, voice connections using analog to digital converters need echo cancellation when they pass through a VSA or VSE. For pure digital transmission, echo cancellation is not required.

Echo cancellation can be done by an external echo canceller or by a VSA or VSE.

- You specify external echo cancellation when configuring E1, T1, or J1 port line attachments. The function requires no VSA or VSE.
- You specify internal echo cancellation when configuring CES potential connections. The function requires a VSA or VSE.

Echo cancellation applies to both the GSM- and ADPCM-compressed voice. In ADPCM, you cannot configure echo cancellation alone; you must configure both voice compression and echo cancellation.

Silence Removal

On voice connections, silence removal can be performed by a VSA or VSE. When a 64 kbps channel is used with voice compression and silence removal, its equivalent capacity is reduced to 10 kbps. On the remote Nways Switch, a VSA or VSE regenerates silences.

Silence removal is specified when configuring CES potential connections and applies to both the GSM- and ADPCM-compressed voice. In ADPCM, you cannot configure silence removal alone; you must configure both voice compression and silence removal.

Idle Signal Removal

To free a maximum bandwidth, idle signal removal is performed each time a CES voice connection passes through a VSA or VSE. When an Nways Switch receives the same idle character from a PBX for more than 60 ms, it stops packet

transmission and forwards the idle pattern to the Nways Switch on the remote end of the connection. On the remote Nways Switch, a VSA or VSE regenerates the idle characters.

Note: There is no need to define the idle character to be played back, since NBBS transfers the appropriate pattern from one side of the network to the other side each time the function is activated.

The saved trunk bandwidth is available for non-reserved traffic. This process also decreases transmission delay and the bit error rate for non-real time traffic and for NBBS control information. The process is transparent to the PBX protocol and is particularly efficient in common channel signaling (CCS) where potential connections are permanently set up.

When you configure CES potential connections with GSM or ADPCM compression, to activate idle signal removal, you must specify an additional voice function (such as echo cancellation, voice compression, or silence removal).

Physical Lines

Table 2 lists the type of lines supported by CES and the associated line interface couplers (LICs).

Table 2. Physical Lines Supported by CES

Line Attachments		T1	E1	J1	JJ20 TTC	V.24, V.35, X.21	X.21, V.36, V.35
LIC Type		LIC514, 544	LIC515, 516, 545, 546, 567	LIC514, 544	LIC517	LIC511	LIC522
Transport Mode	Transparent Clear Channel	Yes (ITU-T G.703)	Yes (ITU-T G.703)	Yes (ITU-T G.703)	Yes (ITU-T G.703)	Yes	Yes
	Transparent CCS	Yes	Yes	No	No	No	No
	CAS Permanent or Dynamic	Yes	Yes (No for LIC567)	No	Yes	No	No
Traffic Type	PCM Voice (64 kbps)	Yes	Yes	Yes	Yes	No	No
	Fax or Modem on PCM Voice Band	Yes	Yes	Yes	Yes	No	No
	Constant Bit Rate (CBR) Data or Video	Yes	Yes	Yes	Yes	Yes	Yes

Each of the CES lines is a *port line*. It attaches a CES device or private branch exchange to an Nways Switch and is a port to the 2220 network. CES port lines transport only CES traffic.

For cabling information, see the *2220 Nways BroadBand Switch Physical Lines Interface Specifications, External Cable References, GA33-0379*.

Channels

On E1, T1, or J1 line interfaces, you may define each 64 kbps slot as a dedicated CES link. For instance, using a LIC515 with four E1 interfaces, you may define up to 124 (31x4) CES links.

Note: *kbps* means 1000 bits per second.

It is also possible to define a CES link based on several 64 kbps slots (for example, 256 kbps). This is called *bonding*. The slots can be contiguous or not.

The maximum number of connections is defined at adapter level, not at port level. Despite the number of ports defined on an adapter, the maximum number of connections that an adapter can handle at the same time remains the same. In CES, only one connection is supported per logical port.

CES Logical Ports

CES logical ports (layer 2 of the OSI reference model) are called *CES ports*. They are generated by the Nways Switch Control Program to provide CES access services to physical CES port lines. A CES port sets up and maintains predefined CES connections.

CES Connections

In NBBS architecture, CES connections (called *CES potential connections*) are predefined between two CES devices attached to the network. CES connections are point-to-point and bidirectional. They operate in real-time over permanent virtual circuits (PVCs).

Chapter 2. Configuring CES Resources

This chapter provides recommendations for configuring CES resources.

Nways Switch Configuration Programs

CES resources (line attachments, logical ports, and potential connections) 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 Enterprise Manager) from a network management station.

For information on configuration parameters, see the online help. For guidelines on how to configure HDLC resources, refer to the *Nways Switch Configuration Overview* supplied with the NCT2.

Configuring Line Attachments

Signaling Type

When using common channel signaling (CCS), you configure the line attachment with Signaling Type as CCS.

Frame Formats

Table 3 on page 12 gives a summary of the framing characteristics for voice connections depending on the interface type.

Table 3. Frame Formats

Line Type	Framing	CAS	CCS
E1	G.704 superframe	<ul style="list-style-type: none"> Time slot 16 is reserved for signaling. A, B, C, and D bits are supported. 	No dedicated time slot for signaling. TS16 is generally used, but is not mandatory.
T1	D4 superframe	<p>A multiframe contains 12 frames made of 24 8-bit slots and:</p> <ul style="list-style-type: none"> No frame is reserved for signaling. A and B bits are supported by using the eight bit in frame 6 (bit A) and in frame 12 (bit B). 	No dedicated time slot for signaling. TS24 is generally used, but is not mandatory.
	D5 extended superframe	<p>A multiframe contains 24 frames made of 24 8-bit slots and:</p> <ul style="list-style-type: none"> No frame is reserved for signaling. A, B, C, and D bits are supported by using the eight bit in frames 6 (bit A), 12 (bit B), 18 (bit C), and 24 (bit D). 	

Configuring CES Ports

In an 2220 network, you configure one CES port for each CES physical line. Using the 64 kbps time slots, you can create channels on port lines that work in time division multiplexing (E1, T1, or J1). You can create a channel for each time slot or group of time slots, and you configure one CES port on each channel.

The following physical interfaces support multiple CES ports:

- E1 line with LIC types 515, 516, 545, 546, and 567
- T1 and J1 with LIC types 514 and 544.

Before creating CES connections, you must create CES ports on both Nways Switches at the end-points of the connection. On one end, the port serves as *connection initiator*. On the other end, the port serves as *connection completer*. A connection is always activated from the initiator logical port.

Some of the CES port parameters to configure are as follows:

- CES port name
- Attached resource identification
- Line attachment location (rack, slot, position, and channel, if any)
- Connection initiator, completer, or both

- Administrative state (locked or unlocked)
- Maximum bandwidth available (default value: line speed).

Configuring CES Potential Connections

You configure one permanent CES potential connection for each CES port configured as connection initiator. It is possible to define several non-permanent connections on the same CES port, but only one connection is active at a time. On port lines with channels, you configure one permanent connection per channel.

Some of the CES potential connection parameters to configure are as follows:

- Connection name
- Identification of initiator device (Nways Switch, port, and resource)
- Identification of completer device (Nways Switch, port, and resource)
- Quality of service (QoS) for both directions (see “QoS Options” on page 15 for details)
- Peak bit rate (defaulted to the line speed)
- Traffic type: data or voice
- For voice traffic, use of echo canceller and voice server functions
- Connection activation mode: permanent or none, on external event or none (see “Activating Connections” on page 17 for details)
- Accounting selection and bandwidth sensitivity over which accounting information is recorded.

Configuring Voice Connections

If you use voice server functions (voice compression, echo cancellation, or silence removal) on a CES potential connection, conform to the following restrictions:

1. CES connections using voice server functions must operate on mono-slot (64 kbps) channels (one connection per time slot).
2. The quality of service must include the VOICE and CE2 options.
3. If the link fails, when the NDPS option is selected the connection is not rerouted but terminated, then immediately restarted.
4. When a voice connection uses CAS dynamic, the NDPS option must not be selected.
5. Depending on the number of VSAs and VSEs installed in your Nways Switch, you can assign voice server functions to only a limited number of voice connections (for details, see “Required VSAs and VSEs”).

Required VSAs and VSEs

VSAs and VSEs have a limited number of voice slots and therefore provide voice server functions to a limited number of voice connections. If all voice slots are busy, voice signals are transmitted without being processed (for example, without voice compression or without echo cancellation).

To determine the number of available voice slots in your Nways Switch for the CES voice connections that you are going to configure, proceed as follows:

1. Calculate the number of available voice slots as explained in “Available Voice Slots” on page 14.

2. Using Table 5, determine the number of voice slots required by each voice connection.
3. Add the voice slots required by your voice connections.
4. Compare the number of available voice slots to the number of required voice slots.
5. If there are not enough voice slots, you decide whether or not to order additional VSAs or VSEs.

Available Voice Slots

Voice modules VSA, VSE1, and VSE2 are built with digital service processors (DSPs) that have:

- Five voice slots when configured for GSM compression
- Four voice slots when configured for ADPCM compression.

Table 4 gives the maximum number of voice slots available for a VSA, a VSA with a VSE1, or a VSA with a VSE2.

Table 4. Voice Slots Available in VSAs and VSEs

Voice Modules	Number of DSPs	GSM Slots	ADPCM Slots
VSA only	4	20 (4x5)	16 (4x4)
VSA and VSE1	16	80 (16x5)	64 (16x4)
VSA and VSE2	28	140 (28x5)	112 (28x4)

Required Voice Slots

Table 5 gives the number of voice slots required by a voice function or a mix of voice functions. This table applies to GSM and ADPCM voice compression.

Table 5. Voice Slots Required By Voice Functions

Voice Server Functions	Required Voice Slots
Compression law conversion	0 (in GSM and ADPCM, an additional voice function must be selected)
Idle signal removal	
Echo cancellation	1 (in ADPCM, voice compression must also be selected)
Silence removal	
Voice compression	1
Echo cancellation + silence removal	1
Voice compression + silence removal	1
Voice compression + echo cancellation	2 (are assigned to two voice slots of the same digital voice processor)
Voice compression + echo cancellation + silence removal	

Symmetrical Voice Connections

CES voice connections can be activated by an external event occurring on the physical port line on either side of the connection. To have a voice connection operated symmetrically, configure the CES ports on each end-point Nways Switch as connection initiator **and** connection completer. Also, configure a similar CES potential connection on each side.

QoS Options

Depending on the type of traffic and the way you want the connection to be managed by the 2220 network, you assign a quality of service (QoS) to each CES potential connection. The following QoS options define the characteristics of a potential connection:

- Non-disruptive path switching
- Circuit emulation class 1
- Circuit emulation class 2
- High priority.

Non-Disruptive Path Switching (NDPS)

Non-disruptive path switching (NDPS) ensures that when a link fails in the 2220 network or if the current path is lacking resources, connections with the NDPS option are rerouted to another path (when available) or to a parallel trunk. The Nways Switch that is the connection initiator reroutes the connections. When the NDPS option is not selected, connections are terminated and re-established by the Retry mechanism only when the path is available. For more information, see “Non-Disruptive Path Switching” on page 18.

Restriction: Non-disruptive path switching (NDPS) is not supported in CAS dynamic mode.

Circuit Emulation Class 1 (CE1)

Circuit emulation class 1 (CE1) is a logical queue in each transit Nways Switch. It is used to manage the cell and packet transmission for real-time applications requiring very low delay and jitter. CE1 provides lowest delay and jitter and minimizes the end-to-end delay. However, CE1 requires more bandwidth than CE2.

Circuit Emulation Class 2 (CE2)

Circuit emulation class 2 (CE2) is another logical queue that is used for real-time applications that can support slightly more delay and jitter than CE1. CE2 requires less bandwidth than CE1 but increases the end-to-end delay.

High Priority (HPRI)

If a path fails, it is possible that bandwidth will no longer exist to support all the established connections. If high priority has been selected for a connection, *bandwidth preemption* ensures that the connection is given first access to the available bandwidth. Other connections get bandwidth only if it is available.

Bandwidth preemption applies when one of the following events occurs:

- Connections are activated.
- A link fails.
- Connections with the NDPS option are rerouted.

For more information, see also “Bandwidth Preemption” on page 19.

Using Predefined QoSs

Nways Switch configuration programs provide predefined QoSs that you can assign to CES connections for the following traffic types:

- CES voice
- CES data.

QoS for CES Voice Traffic

Table 6 shows the predefined QoS options for CES voice traffic. Their names begin with QOSCESVOICE. You can assign the CE1 or CE2 option to the CES voice traffic.

Table 6. Predefined QoS for CES Voice Traffic

QoS Name	Circuit Emulation Class 1 (CE1)	Circuit Emulation Class 2 (CE2)	Non-Disruptive Path Switching (NDPS)	High Priority (HPRI)
QOSCESVOICECE1	X			
QOSCESVOICECE2		X		
QOSCESVOICECE1NDPS	X		X	
QOSCESVOICECE2NDPS		X	X	
QOSCESVOICECE1HPRI	X			X
QOSCESVOICECE2HPRI		X		X
QOSCESVOICECE1NDPSHPRI	X		X	X
QOSCESVOICECE2NDPSHPRI		X	X	X

QoS for CES Data Traffic

Table 7 shows the predefined QoS options for CES data traffic. Their names begin with QOSCESDATA. Circuit emulation class 2 (CE2) is selected by default.

Table 7. Predefined QoS for CES Data Traffic

QoS Name	Circuit Emulation Class 2 (CE2)	Non-Disruptive Path Switching (NDPS)	High Priority (HPRI)
QOSCESDATA	X		
QOSCESDATANDPS	X	X	
QOSCESDATAHPRI	X		X
QOSCESDATANDPSHPRI	X	X	X

Chapter 3. More Information on CES Options

Default QoS Options

Table 8 displays the default settings in the Nways Switch Control Program for certain CES options used in CES traffic.

Table 8. CES QoS: System Defaults

QoS Option	CES Data	CES Voice
Bandwidth adjustment (ADJ)	No	No
Bandwidth keeping (KEEP)	Not applicable	Not applicable
Logical queues	Circuit emulation class 2 (CE2)	Circuit emulation class 1 or 2 (CE1 or CE2)
End-to-end delay	200 ms	2 ms to 150 ms
Maximum number of hops	10	10

When a connection is established, the Path Selection function minimizes the number of hops and the trunk load to guarantee the required end-to-end delay.

Activating Connections

When you configure a CES potential connection, you may specify the following modes for activating the connection:

- Permanent activation or none
- Activation on external event or none.

Permanent Mode

Activating a connection means starting its set up over the network. The required Nways Switch resources (adapter, line interface coupler, and line attachments) must be available, the line must be unlocked, and the remote equipment must be ready. Otherwise, the connection set up will fail.

In an 2220 network, the Nways Switch that is the connection initiator activates the connection as follows depending on the Permanent Mode option:

- When you select Permanent Mode, the connection is activated when the Nways Switch resources, the line, and the remote equipment are ready.
- When you *do not* select Permanent Mode, the connection is activated only when a Start Connection command is received from the network operator through the Nways 2220 Switch Manager. As in Permanent mode, the Nways Switch resources, the line, and the remote equipment must be ready.

On External Event (PBX CAS)

On External Event is an option that you may select when you configure CES voice connections. For lines using CAS dynamic, you specify the On External Event option. For CAS permanent mode, you *do not* select the option.

Restriction: non-disruptive path switching (NDPS) is not supported in CAS dynamic mode.

In CAS dynamic (On External Event specified), the Permanent Mode option has the following results:

- If Permanent Mode is specified, the CAS dynamic environment is prepared when the Nways Switch resources and the line interface are ready (for example, busy back status removed). The connection is activated when a PBX calling signal is received.
- If Permanent Mode is not specified, the CAS dynamic environment is prepared only when a Start Connection command is received from the network operator through the Nways 2220 Switch Manager. As in Permanent Mode, a PBX calling signal is awaited to activate the connection.

On V.24, V.35, or X.21 lines, the On External Event option is ignored because only the modem leads are looked after to know if the line interface is ready. No further signal is awaited.

Configuring Echo-Canceller

The maximum end-to-end delay for CES voice traffic depends on the following characteristics:

- Type of telephone network (public or private)
- Presence of an echo canceller.

Table 9 gives the maximum end-to-end delays for CES voice connections without or with echo canceller.

Table 9. CES Voice: Maximum End-To-End Delays

Telephone Network	Without Echo Canceller	With Echo Canceller
Public	2 ms	27 ms
Private	25 ms	150 ms

Non-Disruptive Path Switching

Non-disruptive path switching (NDPS) is a function that restores a connection over another network path if the current trunk fails or if there is insufficient bandwidth when bandwidth adaptation is performed.

When a trunk fails or when bandwidth adaptation cannot be successfully performed, the connections with the NDPS attribute are rerouted (when possible). The rerouting order depends on connection priority: high-priority (HPRI), circuit emulation class 1 (CE1), and circuit emulation class 2 (CE2). At the same priority level, the connection with the widest bandwidth is rerouted first. If necessary, low-priority connections are preempted on the trunk used for rerouting (see "Bandwidth Preemption" on page 19).

When a trunk with a parallel trunk configuration fails, the bandwidth used by the connections of the parallel trunk is reduced to its initial value so that the parallel trunk can transport the connections of the failing trunk.

When many connections require NDPS at the same time, a wide amount of traffic control is created in the 2220 network. This can result in long rerouting delays. (For more information on selecting a QoS with the NDPS option, see “Non-Disruptive Path Switching (NDPS)” on page 15.)

Restrictions

The following restrictions apply to the NDPS option with CES voice traffic:

1. If a link fails and the NDPS option is included in the QoS of a CES voice connection using a voice server function (see “Voice Server Functions” on page 5), the connection is not rerouted but is terminated and immediately restarted. Depending on the delay required to restart the connection, any calls in progress may be interrupted and the end user may need to re-dial. For CES connections without voice compression, NDPS operates normally: the connection is rerouted and is not terminated.
2. When a port line such as E1 or T1 is configured with the unstructured (G.703) frame format, if an NDPS recovery occurs, the PBX or TDM equipment may take a long time (up to one minute) to recover synchronization.
3. NDPS is not supported for voice connections in CAS dynamic. In case of trunk failure, the end user must immediately re-dial to re-establish the connection. For this reason, the NDPS option must not be selected in the QoS of a CAS dynamic connection.

Bandwidth Preemption

Bandwidth preemption is a function that stops a low priority connection so that a higher priority connection can use its resources. Bandwidth preemption is used:

- At connection setup
- On link failure.

Because bandwidth adaptation is not available for CES connections, there is no preemption on bandwidth request. For more information on selecting a QoS with bandwidth preemption, see “High Priority (HPRI)” on page 15.

At Connection Setup

Preemption at connection setup is performed as follows:

1. A low-priority connection, without the non-disruptive path selection (NDPS) option in its quality of service, is established.
2. A request occurs to establish a new connection with a higher priority and there is not enough trunk capacity to support both connections at the same time.
3. The high-priority connection is established.
4. The low-priority connection is terminated and its resources (bandwidth and label) are released.

If the low-priority connection has the NDPS option, it is immediately rerouted with its initial bandwidth. The connection is not terminated.

If the new connection has the same priority as an established connection, and if there is not enough bandwidth available, the new connection is rejected.

After Link Failure

Preemption after link failure is performed as follows:

1. A low-priority connection without NDPS is established on a trunk. A connection with a higher priority is also established on the trunk.
2. The bandwidth capacity of the trunk becomes insufficient.
3. The high-priority connection is rerouted.
4. The low-priority connection is terminated and its resources are released.
If the low-priority connection has the NDPS option, it is immediately rerouted with its initial mean bit rate. The connection is not terminated.

If there is not enough bandwidth available to reroute the high-priority connection, even when the low-priority connections are preempted, the high-priority connection is terminated and the low-priority connections are kept.

Optimizing CES Voice Connections

Optimizing CES voice connections requires choosing the best combination of:

- Number (N) of 64 kbps time slots assigned to a channel.
- Packeting delay (time needed to fill a packet)
- Bandwidth
- Packet length.

Increasing the number of time slots allocated to a channel (or connection) decreases packeting delay because less time is lost waiting for the time slots to become available again. However, more time is spent filling the packets. Increasing packet length decreases bandwidth needed, but increases the packeting delay.

Without Voice Compression

Table 10 shows the parameters for T1, E1, and J1 lines depending on the number of time slots. It will help you to select a circuit emulation class (CE1 or CE2) depending on the number of time slots (N) and packeting delay. The parameters are calculated as follows:

- Packet size (bytes) = payload + 6 (header length)
- Bandwidth per time slot (kbps) = $64 \times \text{packet size} \div \text{payload}$
- Packeting delay (ms) = $0.125 \times \text{payload} \div N$

Also, the total bandwidth for a connection is $N \times \text{bandwidth per time slot}$.

Table 10. Packet Length, Delay, and Bandwidth on T1, E1, and J1 Lines

Number of Time Slots (N)	Circuit Emulation Class 1 (CE1)			Circuit Emulation Class 2 (CE2)		
	Payload (Bytes)	Bandwidth per Time Slot (kbps)	Packeting Delay (ms)	Payload (Bytes)	Bandwidth per Time Slot (kbps)	Packeting Delay (ms)
1	16	88	2.0	80	69	10
2	16	88	1.0	80	69	5
3	24	80	1.0	72	69	3.0

Table 10. Packet Length, Delay, and Bandwidth on T1, E1, and J1 Lines (continued)

Number of Time Slots (N)	Circuit Emulation Class 1 (CE1)			Circuit Emulation Class 2 (CE2)		
	Payload (Bytes)	Bandwidth per Time Slot (kbps)	Packeting Delay (ms)	Payload (Bytes)	Bandwidth per Time Slot (kbps)	Packeting Delay (ms)
4	32	76	1.0	80	69	2.5
5	20	83	0.5	80	69	2.0
6	24	80	0.5	80	69	1.5
7	28	78	0.5	112	67	2.0
8	32	78	0.5	128	67	2.0
9	36	75	0.5	126	67	1.75
10	40	74	0.5	120	67	1.5
11	44	73	0.5	88	69	1.0
12	48	72	0.5	120	67	1.25
13	52	71	0.5	104	68	1.0
14	56	71	0.5	112	67	1.0
15	60	70	0.5	120	67	1.0
16	64	70	0.5	80	69	0.625
17	68	70	0.5	68	70	0.5
18	72	69	0.5	72	69	0.5
19	76	69	0.5	76	69	0.5
20	80	69	0.5	80	69	0.5
21	84	69	0.5	84	69	0.5
22	88	68	0.5	88	68	0.5
23	92	68	0.5	92	68	0.5
24	96	68	0.5	120	67	0.625
25	100	68	0.5	100	68	0.5
26	104	68	0.5	104	68	0.5
27	108	68	0.5	108	68	0.5
28	112	67	0.5	112	67	0.5
29	116	67	0.5	116	67	0.5
30	120	67	0.5	120	67	0.5
31	124	67	0.5	124	67	0.5
32	128	67	0.5	128	67	0.5

For example, for a connection with six time slots (N=6) a bandwidth of 80 kbps per time slot is reserved in CE1, while a bandwidth of 69 kbps is reserved in CE2.

With GSM Voice Compression

GSM compressed voice is always in circuit emulation class 2 (CE2). Also you must configure the connections on mono-slot channels.

Table 11. Bandwidth, Packet Length, and Delays with Voice Compression

Voice Function	Bandwidth per Time Slot (kbps)	Packet Length (bytes)	Packeting + Depacketing delays (ms)
Silence Removal (see note)	R=67 M=30 b=0.5 s T1 63 kbps T3 54 kbps	160	55
Voice Compression	15.2	32	55
Voice Compression and Silence removal (see note)	R=15.2 M=30 b=0.5 s T1 12.3 kbps T3 9.6 kbps	32	55
No Compression (Fax or Modem)	67	160	55
Legend:			
R	Peak bit rate (kbps)		
M	Mean bit rate (kbps)		
b	Mean burstiness (seconds)		
Note: The bandwidth reserved with silence removal is a conservative amount and is higher than the average bandwidth used. The additional difference is available for reserved traffic in excess and for non-reserved traffic.			

V.24, V.35, V.36, and X.21 Lines

For connections between clear channel interfaces (V.24, V.35, V.36, and X.21) or between clear channel interfaces and TDM interfaces (T1 and E1), you select circuit emulation class 2 (CE2).

64 kbps ≤ Access Rate ≤ 2048 kbps

The traffic parameters are as follows:

- Number of time slots (N) = access rate ÷ 64000 (rounded to the higher integer)
- Payload length is given by Table 10 on page 20.

For example, for:

Access rate = 64 kbps

N equals 1 and payload is 80 bytes

Access rate = 112 kbps

N equals 2 and payload is 80 bytes

Access rate = 2048 kbps

N equals 32 and payload is 128 bytes.

- Bandwidth = access rate × (payload + 6) ÷ payload.
- Packeting delay = (payload × 8) ÷ access rate.

Access Rate < 64 kbps

For connections between clear channel interfaces (V.24, V.35, V.36, and X.21):

- Number of time slots (N) = 1
- Payload = (access rate ÷ 1000) + 16 (rounded to the lower multiple of 4)

For example, for:

Access rate = 2.4 kbps

 Payload is 16 bytes

Access rate = 46 kbps

 Payload is 60 bytes

- Bandwidth reserved = access rate × (payload + 6) ÷ payload.
- Packeting delay = (payload × 8) ÷ access rate.

Maximum Number of Voice Connections

The following tables give the number of 64 kbps connections possible depending on the type of trunk and the QoS.

Table 12. Number of Connections for Different Trunk Types

Trunk Type	64 kbps Connections	
	CE1	CE2
T3	417	532
E3	296	378
E2	76	97
J2	59	75
V.35/V.36/X.21 - 2.048 kbps	14	25
V.35/V.36/X.21 - 1.536 kbps	9	18
V.35/V.36/X.21 - 1.024 kbps	4	12
V.35/V.36/X.21 - 512 kbps	1	6
E1 (31 x 64 kbps)	14	24
T1 with AMI (24 x 56 kbps)	8	16
T1 with B8ZS (24 x 64 kbps)	9	18

Table 13. Number of Connections for Fractional E1 or T1 Trunks

Fractional E1 or T1	64 kbps Connections	
	CE1	CE2
3 x 64 kbps	0	2
4 x 64 kbps	0	3
5 x 64 kbps	1	3
6 x 64 kbps	1	4
8 x 64 kbps	1	6
9 x 64 kbps	1	7
10 x 64 kbps	1	7
11 x 64 kbps	1	8
12 x 64 kbps	2	9
13 x 64 kbps	3	10
14 x 64 kbps	3	11
15 x 64 kbps	4	11
16 x 64 kbps	4	12
17 x 64 kbps	5	13
18 x 64 kbps	6	14
20 x 64 kbps	7	15
21 x 64 kbps	7	16
22 x 64 kbps	8	17
25 x 64 kbps	10	19
26 x 64 kbps	11	20
28 x 64 kbps	12	22
30 x 64 kbps	13	23

Table 14. Number of Connections for Fractional T1 Trunks (with AMI)

Fractional T1 with AMI	64 kbps Connections	
	CE1	CE2
10 x 56 kbps	0	6
11 x 56 kbps	0	7
12 x 56 kbps	1	8
13 x 56 kbps	1	8
14 x 56 kbps	2	9
15 x 56 kbps	3	10
16 x 56 kbps	4	11
17 x 56 kbps	4	11
18 x 56 kbps	4	12
19 x 56 kbps	5	13
20 x 56 kbps	5	13
21 x 56 kbps	6	14
22 x 56 kbps	6	15
23 x 56 kbps	7	15

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.

2220 NSM. 2220 Nways Switch Manager

AAL. ATM adaptation layer.

ABR. Availability bit rate. A best effort service with a minimum bit rate and a maximum cell loss value.

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. An application 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.

ATMA_n. ATM adapter type n (module).

ATM adaptation layer (AAL). In ATM devices, a set of protocols that adapt non-ATM devices 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 or trunk 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 local area networks. 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.

BS. Bearer services.

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 a 2220 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 a 2220 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 access 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 TDM digital transmission service at 2.048 Mbps.

E3 standard. A European standard for TDM 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.

IMU. Inverse multiplexing unit

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 connections between calling ISDN terminal equipments and called terminal equipments attached through other Nways Switches.

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. Also called cell delay variation (CDV).

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 a 2220 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, FR, 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 a 2220 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 (see 2220 Nways Switch 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 2220 Nways Switch 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 2220 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. (See 2220 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 2220 Switch Manager (2220 Switch Manager). An IBM licensed program that runs under NetView for AIX to manage the 2220 Nways Switch operation and configuration from a network management station. It replaces the Nways Enterprise Manager (NEM) which is no longer available.

Nways BroadBand Switch. Synonym for 2220 Nways BroadBand Switch.

Nways Enterprise Manager (NEM). An IBM licensed program that was used under NetView for AIX in a network management station to manage Nways Switches, routers, and bridges in a 2220 network (see 2220 Nways Switch Manager).

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) and stores the centralized configuration database of the NBBS network. An OS/2 station can be used as a remote user 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 adapters of the 2220 Nways Switch. It includes a CMIP agent to work with the 2220 Switch Manager.

Nways 2220 Switch Manager for AIX. (See Nways 2220 Switch Manager)

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 remote user 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 user premises to an Nways Switch and serves as a port to the 2220 network. Port lines 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 a 2220 network between two HDLC, CES, or frame-relay devices.

PPP. Point-to-point protocol.

PRA. Primary Rate Access.

private branch exchange (PBX). A switching system located on a user premises that relays inside lines (extensions) and provides access to the public telephone network.

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 a 2220 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.

remote user 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.

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. An application 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 TDM digital transmission service with a basic rate of 1.544 Mbps. Also called DS-1.

T3 standard. A TDM digital transmission service with a basic rate of 44.736 Mbps. A T3 line can transport up to 28 T1 circuits. Also called DS-3.

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 a 2220 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. A best effort service with no quality commitment.

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.

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 connections between calling X.25 subscribers and called subscribers attached to other Nways Switches.

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.

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This section lists prerequisite and related publications.

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