Qwest Corporation Technical Publication

Integrated T-1 Service

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Technical Publication

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NOTICE

Technical Publication 77397, *Qwest Integrated T-1* provides information about Digital Switched Service and the various ways which it can be integrated with other combinations of Qwest voice and data services on Integrated T-1 (IT1) service. The IT1 interface to the customer is a Digital Signal Level 1 (DS1) Channel at 1.544 Mbit/s transmission rate. Pub 77397 is intended to be used with Technical Publication 77375, *1.544 Mb/s Channel Interfaces.*

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CONTENTS

CONTENTS (Continued)

CONTENTS

Line #	Issue	Issue Date (mm-yyyy)	Change			Reason/Level	CR or Notice #
			Chapter Number	Chapter Name	Update Activity		
1	C	06-2003	1	Introduction	▪ Editorial changes ▪ Reason for reissue: addition of Fractional FR NC Codes	Product life cycle/Level 3	⑨
2	C	06-2003	2	Overview of QWEST Integrated T-1	▪ Editorial Changes ▪ Redrew the drawing 2-3 & 2-4 to show the components clearly ▪ Added CPE box in Fig 2-4 ▪ Deleted bullet points to show the changes in the service applications.	Product life cycle/Level 3	
3	C	06-2003	3	Network Channel/Network Channel Interface Codes	▪ Editorial changes to in formatting	Product life cycle/Level 3	
4	C	06-2003	4	Options Available on QWEST Integrated T-1 Service	▪ Editorial changes in format ▪ Deleted the NC/NCI codes associated with grandfathered Shared Ring Service (SRS)	Product life cycle/Level 3	
5	C	06-2003	5	Services Offered on QWEST IT1	▪ Editorial changes in format and verbiage ▪ Added verbiage to clarify the 56 vs. 64kbps per channel option ▪ Replace the contents of table 5-2 to show the NC codes for Fractional Frame Relay service. ▪	Product life cycle/Level 3	
6	C	06-2003	6	Definitions	▪ Editorial changes in format ▪ Deleted irrelevant definitions	Product life cycle/Level 3	
7	C	06-2003	6	References	▪ Changes in the issue and dates of references ▪ Changed the FCC document ordering information.	Product life cycle/Level 3	

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1.   Introduction

1.1   General

Technical Publication 77397 *Qwest Integrated T-1* provides information about Integrated T-1 (IT1) Service and the various ways which it can be optioned with a combination of Qwest voice and data services. The Integrated T-1 interface to the customer is a Digital Signal Level 1 (DS1) Channel at a 1.544 Mbit/s transmission rate. PUB 77397 is intended to be used with Technical Publications 77375, *1.544 Mbit/s Channel Interfaces,* and 77200 *Qwest DS1 Service and Qwest DS1 Rate Synchronization Service.*

1.2   Reason for Reissue

This Technical Publication is reissued to include the NC codes for fractional Frame Relay Dedicated Data Service.

1.3   Scope

This publication describes the Integrated T-1 Service and defines different available options when ordering Integrated T-1. The publication also provides the Network Channel (NC) and Network Channel Interface (NCI) codes and their definitions associated with IT1 options. The document also includes other services that can be integrated with IT1 and the NC and NCI code combinations to assist customers in ordering the service(s).

1.4   Document Organization

This publication is organized as follows:

Chapter 1   **Introduction** - provides the purpose and general information about this document.

Chapter 2   **Overview of Qwest Integrated T-1** - describes the service and its architecture.

Chapter 3   **Network Channel/Network Channel Interface Codes** - illustrates compatible NC and NCI code combination tables for ordering the services described in the chapter.

Chapter 4   **Options Available on Qwest Integrated T-1 Service** - provide a general explanation and architecture for IT1 Service.

Chapter 5   **Services Offered on Qwest IT1** - illustrates brief discussion of services offered with IT1 and compatible NC and NCI code combination tables for ordering the services described in the chapter.

Chapter 6   **Definitions**

Chapter 7   **References**

CONTENTS

2.   Overview of Qwest Integrated T-1

This chapter provides an overview of Qwest Private Line Transport Integrated T-1 (IT1) service. IT1 Service is a high capacity, high performance information channel designed to perform multiple functions. It is a dedicated, end-to-end digital transport service designed for full duplex, point-to-point transmission at 1.544 Mbit/s. It consists of 24 Digital Signal Level 0 (DS0) channels (64kb/s each) which can be utilized to provide different services.

IT1 Service offers digital transport within Qwest's territory. The Qwest network links the population centers of this vast geographic region together to provide virtually unlimited service to subscribers wherever they reside or do business. This service can offer increased value to subscribers because it provides security, reliability, protection, and rate stability.

A description of the Network Interface (NI) may assist the reader to understand IT1 design. It is the point of demarcation on the end-user's (EU) premises at which Qwest's responsibility for the provision of service ends. Figure 2-1 gives a pictorial representation of the Network Interface.
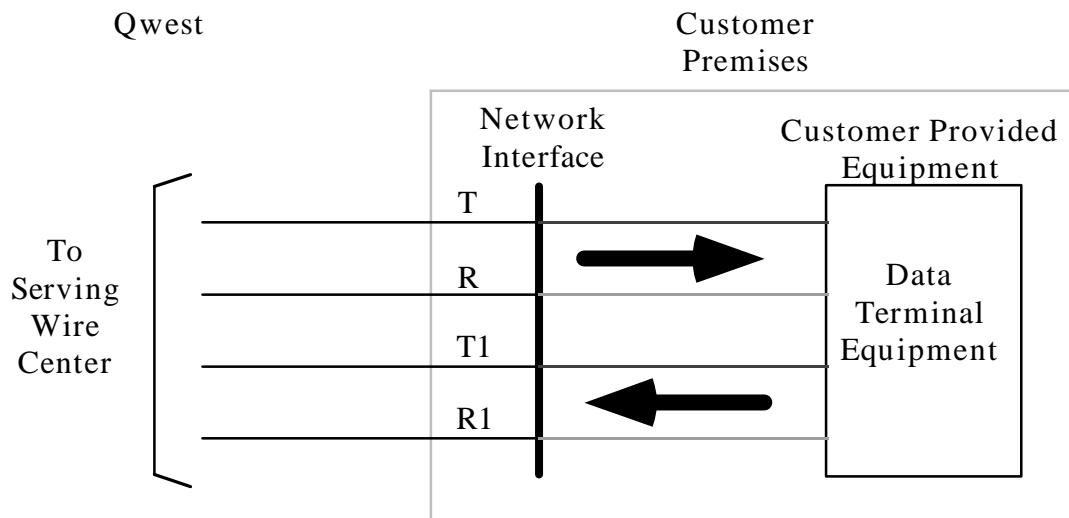

Figure 2-1 Network Interface of Integrated T-1

2.1   Service Description

Integrated T-1 is a two point digital intrastate/intralata dedicated service which utilizes Digital Signal 1 (DS1) facilities. DS1 provides a channel that transmits a digital signal at

the rate of 1.544 Mbit/s between the customer premises and Qwest's Wire Center. This DS1 channel at the Network Interface is also referred to as a Digital High Capacity Channel. The service allows customers to "channelize" the DS1 into twenty-four channels using their Customer Provided Equipment (CPE). The CPE for example may include a Private Branch Exchange (PBX), D4 type channel bank, CODEC equipment or a router. Figure 2-2 describes the general IT1 design.

Customers who own a Multiplexer may purchase IT1 that will include from one to twenty-four voice and data channels. These channels can be utilized for different services at the customer's discretion.

A combination of up to 24 channels are used to transport voice, and/or data applications such as Advanced Voice Channel, Basic Voice Channel, Basic ISDN 2B+D (SLS), Basic Dedicated Digital Data Channel, and Frame Relay Dedicated Digital Data Channel. A description of these services is given in Chapter 5.

These channels can be used to provide facilities for modem pools, file transfer, distance learning applications, imaging, LAN/WAN interconnections, video arrangements, and voice/data multiplexing on a single DS1 facility.

The voice and data services available and Network Channel/Network Channel Interface (NC/NCI) codes for ordering are discussed in Chapter 5.
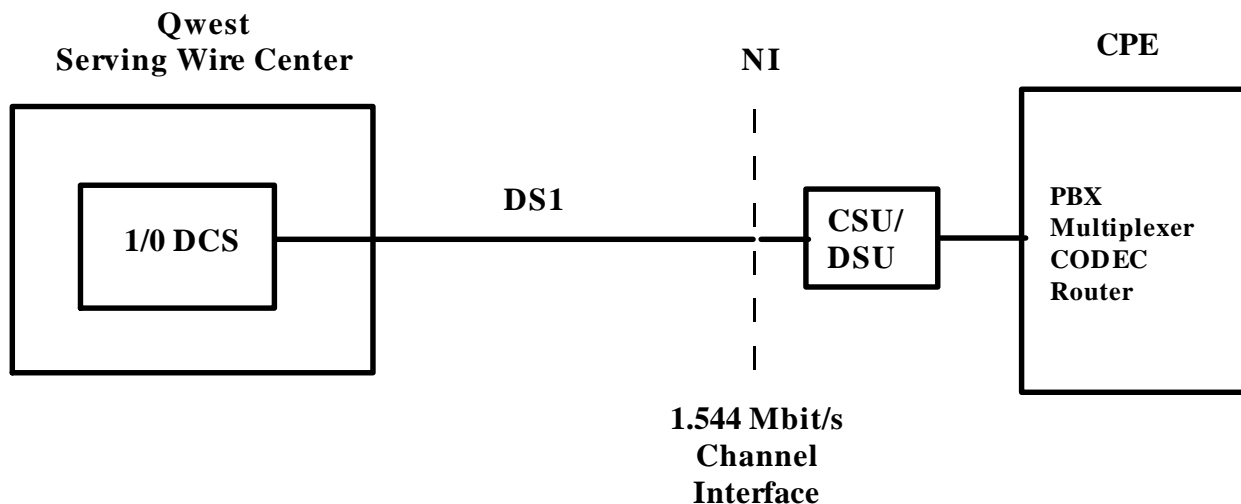
Figure 2-2 General Integrated T-1 Design

2.2   Network Architecture

The customer specifies the number of voice and data channels required for different services (e.g., Advanced Voice Channel, Basic Voice Channel, Basic Dedicated Digital Data Channel, Frame Relay Dedicated Digital Data Channel, Basic ISDN 2B+D (SLS), etc.) A 1/0 Digital Cross-Connect System (DCS) machine or a channel bank is used to route the above services to the respective switching or IOF equipment.

The architecture used to provide service to the customer is at Qwest's discretion and is dependent on the facilities available at the Central Office (CO). The network architectures, which use the 1/0 DCS solution, are shown in Figure 2-3. In locations where it is not possible to provide IT1 through a 1/0 DCS, the service will be provisioned via channel banks as shown in Figure 2-4.
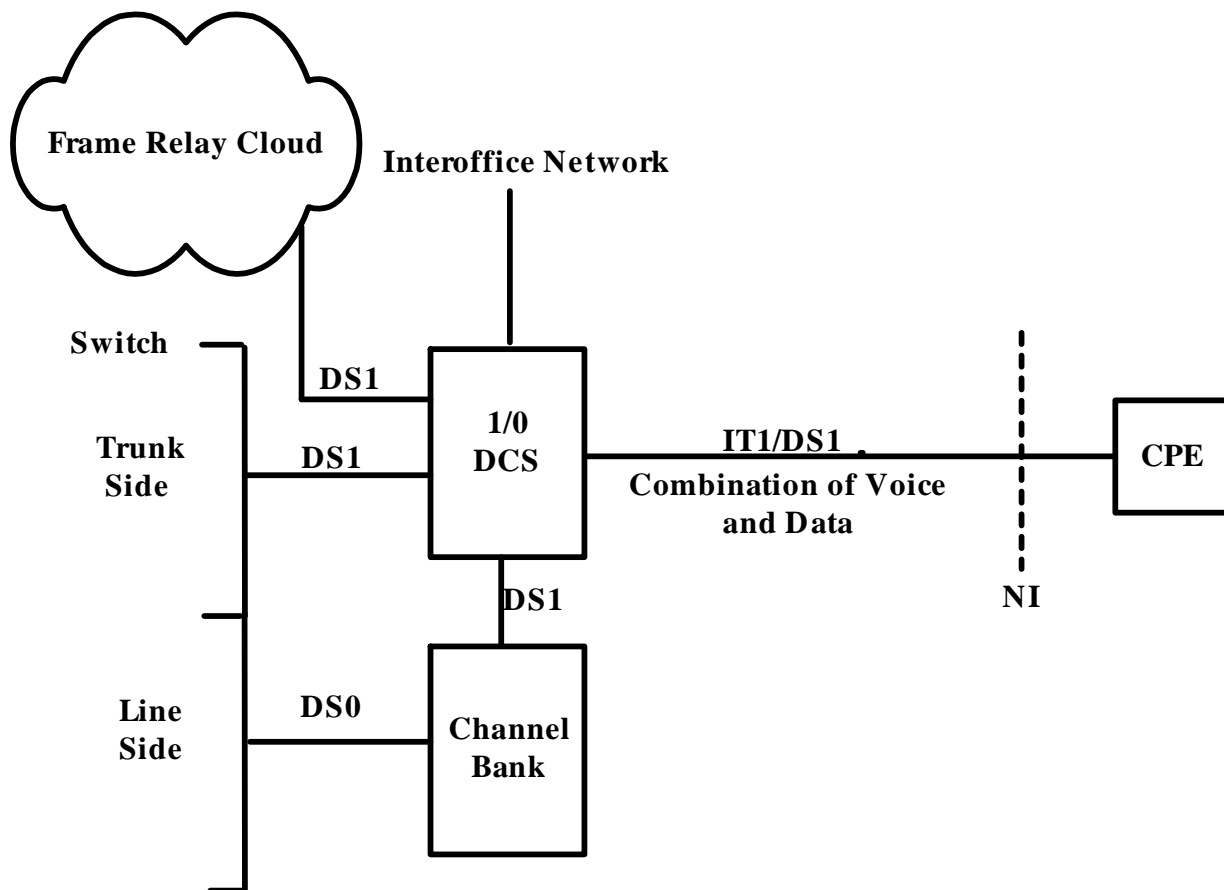
Figure 2-3 IT1 with 1/0 DCS Architecture
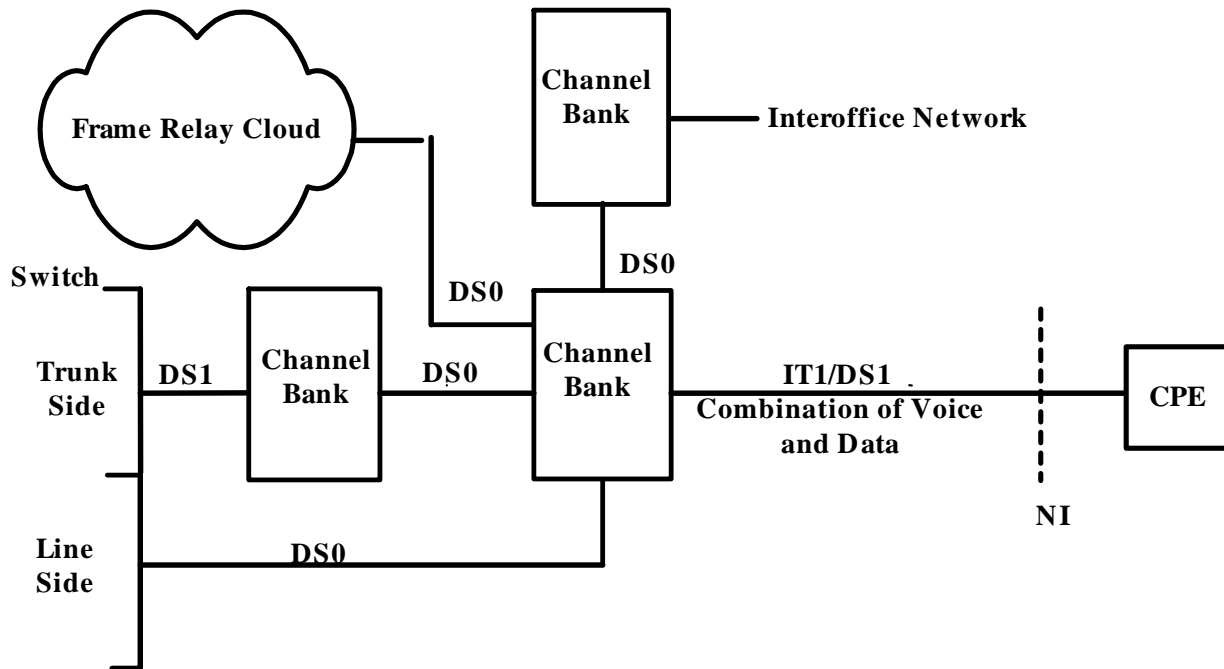
Figure 2-4 IT1 with Channel Bank Architecture

2.3   Availability

. The voice channels are available from any Qwest switch in the 14 state region. Availability of the ISDN Basic Rate Access link and Fractional Frame Relay Dedicated Digital Data channel is limited to specific areas as shown in the respective Qwest's Network Disclosures   The fractional frame relay service is only available from the CO where a 1/0 DCS machine is collocated with a Frame Relay Switch or from CO that is included in Frame Relay cloud.

Customers may refer to the Local Exchange and Network Services Tariff from their state's Public Utilities Commission Office for the IT1 offering and pricing information.

2.4   Benefits

Integrated T-1 offers many benefits to each potential customer who:

- Currently owns a digital PBX

- Plans to purchase a new digital PBX or grow their existing PBX

- Wants to save capital expense up front on the purchase of a new PBX

- Wants the reliability and low error rate of digital transmission

- Wants precision timing for call accounting software

- Uses dial-up data

- Wants to update to current technology

- Needs a reduce loss level on trunks

- Needs Digital Data Service in addition to voice channels

- Wants variable speed data port.

- Wants voice and data (Frame Relay) pipe at a reduced cost

- Needs secured, reliable, protected and rate stabilized service

CONTENTS

Chapter and Section   **Page**

Figures

Tables

3.   Network Channel/Network Channel Interface Codes

3.1   Network Channel (NC) Codes

3.1.1   General

Network Channel (NC) codes are a part of the Telcordia COMMON LANGUAGE®
code set. The NC code is used to identify a channel used with the service. This
section identifies the available channels and their NC codes.

3.1.2   Format

An NC code is a four-character code with two data elements:

• Channel Code

• Optional Feature Code

The format is illustrated in Figure 3-1.

Network Channel Code

Data Element	Channel Code		Optional Feature Code	
Character Position	1	2	3	4
Character Key	X	X	X or -	X or -

X   = Alphanumeric
-    = Hyphen

Figure 3-1 Format Structure for NC Codes

The **Channel Code** (character positions 1 and 2) is a two-character alpha or
alphanumeric code that describes the channel service in an abbreviated form. The
channel code will frequently, but not always, be specified as the service code of the
special service circuits or the transmission grade of the message trunk circuit. The
NC channel code field is always filled.

The **Optional Feature Code** (character positions 3 and 4) is a two-character alpha or
alphanumeric or hyphen code that represents the option codes available for each
channel code. Varying combinations of this code will allow the customer to enhance
the technical performance of the requested channel, or to further identify the type of
service. It is also used to specify options such as conditioning, effective 4-wire,
multiplexing, etc. The NC optional code field is always filled.

Further information about NC Codes may be found in ANSI T1.223-1997, *Information
Interchange — Structure and Representation of Network Channel (NC) and Network
Channel Interface (NCI) Codes for the North American Telecommunications System.*

3.2   Network Channel Interface (NCI) Codes

3.2.1   General

Network Channel Interface (NCI) codes are a part of the COMMON LANGUAGE®
code set. The NCI code is used to identify a network interface of a service in our
mechanized systems.

3.2.2   Format

An NCI code is a maximum twelve-character code that consists of five (5) data
elements:

- Total Conductors

- Protocol

- Impedance

- Protocol Options

- Transmission Level Point(s) (TLP) - not required for this digital service.

The first three fields are required. The last two are optional. The format is
illustrated in Figure 3-2.

N e t w o r k   C h a n n e l   I n t e r f a c e   C o d e

Total Conductors		Protocol		Impedance	Delimiter	Protocol Options			Delimiter	TLP Level	
										Transmit	Receive
1	2	3	4	5	6	7	8	9	10	11	12
N	N	A	A	X	•	X	X	X	•	X or -	X or -

A   = Alpha
N   = Numeric
X   = Alphanumeric
•   = Delimiter (normally a period)
-    = Hyphen

Figure 3-2 Format Structure for NCI Codes

Total Conductors (character positions 1 and 2) is a two-character numeric code that represents the total number of physical conductors (e.g., wires or fibers) required at the interface.

Protocol (character position 3 and 4) is a two-character alpha code that defines requirements for the interface regarding signaling/transmission.

Impedance (character position 5) is a one-character alpha or numeric code representing the nominal reference impedance that will terminate the channel for the purpose of evaluating transmission performance. Values are listed in Table 3-1.

Table 3-1 NCI Impedance Values

Impedance in Ohms (Character Position 5)			
Data Value	Code	Data Value	Code
110	0	124	7
150	1	Variable	8
600	2	100	9
900	3 *	Fiber	F
1200	4	Radio	Z
135	5	50 Coaxial	C
75	6		

* Except for interface code 04DD3, the impedance character 3, when used with a 4-wire voice-frequency path at the POT, denotes a historical customer (IC) provided transmission termination rather than a 900 ohm impedance. Such terminations were provided by customers in accordance with FCC Docket No. 20099 settlement Agreement and by Automatic Transmission Test and Control Circuit used in the previous provisioning process.

Protocol Options (character positions 7, 8, and 9) is a one to three-character alpha, numeric, or alphanumeric code that describes additional features (e.g., bit rate or bandwidth) on the Protocol to be used. It is an optional field that is always left justified.

CONTENTS

4.   Options Available on Qwest Integrated T-1 Service

4.1   Introduction

In the North American hierarchy of digital bit-rates, 1.544 Mbit/s is defined as *Digital Signal level 1*, the short form of which *(DS1)*, is being used throughout this document. IT1 will utilize *Digital Signal level 1* (DS1) for signal transport. Since transmission is digital from end-to-end, the signal is clean and pure; free of crosstalk, amplified noise and distortion. Network control centers in major cities throughout the Qwest territory ensure exacting standards of reliability 24 hours a day, seven days a week.

A number of optional enhancements are available with IT1 service. Some of these are CO Multiplexing, Clear Channel Capability, Extended Superframe, Customer Controlled Reconfiguration, Synchronization, etc. There are a number of applications available on an IT1 channel. Some examples of situations where IT1 can be applied are Disaster Recovery, Improved Front-End Processor Performance, Centralized Data Processing, High Speed Host to Host Channel Networking, Inter-PBX Voice Communications, Integrated Voice/Data, Video Transmissions Applications, etc.

IT1 channel interface options include a choice of *frame format* and *line code* of the digital signal. Each of these have service quality implications. Terminal equipment at both ends of an IT1 channel must use the same line code and must use compatible frame formats. Vendors of End-User (EU) customer equipment will usually include recommendations that describe the interface characteristics to be ordered from Qwest. The vendors' option list will be based on the features available in their equipment. Not all terminal equipment or *Network Channel Terminating Equipment* (NCTE) have equal capabilities so some options should be considered before equipment is selected.

An overview of these options/applications can be obtained from Qwest's Technical Publication 77375, *1.544 Mbit/s Channel Interfaces*.

4.2   Frame Formats

All IT1 frame formats include a repeated reference sequence of bits (frame-bits) that enclose transmitted user data, providing the ability for receivers of the signal to identify byte and frame boundaries for demultiplexing the data. Some frame formats not only provide this elementary synchronizing function, but also provide optional enhancements that greatly improve the ability of the customer to monitor the quality of the signal being transported. Frame formats and their advantages and disadvantages are discussed below.

4.2.1   Superframe (SF)

The *Superframe* (SF) frame format is also known as *D4* framing. Because of its age, it is the most widely used DS1 frame format. One Superframe consists of 12 DS1 frames. The SF *frame pattern* is 12 bits in length, and one bit of the pattern is

transmitted sequentially as the 1st bit of each DS1 frame. The SF format has a limited ability to measure the performance of the DS1.

4.2.2   Extended Superframe (ESF) - General

There are multiple versions of the *Extended Superfram*e (ESF) format. In all versions, the extended superframe is 24 DS1 frames in length, and the ESF frame pattern is only 6 bits in length. Since there is one "frame-bit" per DS1 frame, this leaves 18 for other purposes, allowing for enhanced performance monitoring.

In all ESF versions, the 18 bits per ESF that are not needed to synchronize the equipment, are time-shared (time division multiplexed) to provide:

- Channel for the transmission of a CRC-6 (6 bit Cyclic Redundancy Check) value, and

- A 4 kbit/s data link.

4.3   Compatible Network Channel Interface (NCI) Codes

Electrical signal specifications at an Interface are encoded into *NCI codes.* Customers provide a *Network Channel Interface (NCI) code* to Qwest to advise the Engineer of the specific technical requirements at a Network Interface.

This section provides compatibility information for the IT1 NCI codes that may be used at an IT1 interface with Qwest. Not all Interfaces are available with all Qwest services. Other Technical Publications or Service Publications discuss the services that may be available using interfaces disclosed in this publication.

4.4   NCI Code Function

Optional NCI coding for IT1 interfaces provides the following:

- Frame format - several options
  - Superframe (SF)
  - ANSI Extended Superframe (ESF)
  - Non-ANSI ESF
- Line code - two options
  - Alternate Mark Inversion (AMI)
  - Binary 8 Zero Substitution (B8ZS)

It is recommended that the customer should order B8ZS for their IT1 if any of the DS0 channels require clear channel capability such as Digital Data Service (DDS) or Basic ISDN 2B+D (SLS).

4.4.1   NCI Codes with CO Multiplexing

Central Office Multiplexing gives flexibility to DS1 and DS0 services with its ability to multiplex a number of lower bit rate channels into a higher bit rate channel or to perform the reverse. DS1 multiplexing includes DS1 to analog (voice band signals) and DS1 to DS0 (digital data signals). Table 4-1 shows the NCI code with CO Multiplexing.

Table 4-1 Codes for Customer Premises to CO Channel with a CO Multiplexer

Equipment Frame Format and Line Code	NC Code see note	NCI at End-User premises
Frame Format= SF Line Code= AMI	H C - G	04DU9.BN or BX
Frame Format= SF Line Code= B8ZS	H C Z G	04DU9.DN or DX
Frame Format= ANSI ESF Line Code= AMI	H C D G	04DU9.1KN or 1KX
Frame Format= ANSI-ESF LineCode= B8ZS	H C E G	04DU9.1SN or 1SX
Frame Format=non-ANSI ESF Line Code= AMI	H C F G	04DU9.CN or CX
Frame Format=non-ANSI ESF Line Code= B8ZS	H C G G	04DU9.SN or SX

NOTE: In Column B, the NC code 4th character G has the following multiplexer (MUX) type definitions:

G   =   Qwest CO DS1 to voice and digital data mux.

4.5   Protocol Codes - CS and DU

Protocol Code *DU* denotes the interface between Qwest and End-User equipment at an End-User premises. It is commonly called an *Access Interface.* Protocol Option codes, discussed later, provide two interface options: a *Conventional Interface* and a *Digital Signal Level 1 Cross-Connect (DSX-1) Interface.*

Protocol Code *CS* provides a signal that conforms to DSX-1, which is part of the North American digital hierarchy for the cross-connect of digital signals. *CS* also denotes that the channel terminates on a Qwest Digital Cross-Connect System (DCS).

4.5.1   Protocol Option Codes - Master List

IT1 terminal equipment varies in its frame format and line code capability, so not every Protocol Option code is available for every service. Table 4-2 lists the Protocol Option codes that <u>may</u> be used with Qwest DS1 channels. Additionally, the table provides the Option Code suffix for selection of the End-User premises Conventional and DSX-1 interfaces.

Table 4-3 DS1 Protocol Option Codes

	Permissible End-User Premises Interface, Protocol Option Codes
Code	**Meaning**
BN	SF / AMI / Conventional interface / CSU power = no
BX	SF / AMI / DSX-1 interface
CN	non-ANSI ESF / AMI / Conventional interface / CSU power = no
CX	non-ANSI ESF / AMI / DSX-1 interface
DN	SF / B8ZS / Conventional interface / CSU power = no
DX	SF with B8ZS / DSX-1 interface
SN	non-ANSI ESF / B8ZS / Conventional interface/ CSU power = no
SX	non-ANSI ESF / B8ZS / DSX-1 interface
1KN	ANSI ESF / AMI / Conventional interface / CSU power = no
1KX	ANSI ESF / AMI / DSX-1 interface
1SN	ANSI ESF / B8ZS / Conventional interface / CSU power = no
1SX	ANSI ESF / B8ZS / DSX-1 interface

AMI=	Bipolar Alternate Mark Inversion line code: ref. - ANSI T1.102-1993 or ANSI T1.403-1995
B8ZS=	Binary, 8 zero substitution line code: ref. - ANSI T1.102-1993 or ANSI T1.403-1995
ESF=	Extended Superframe frame format: ANSI ESF - Format only: ref. ANSI T1.403-1995 Non-ANSI ESF - Format only: ref. AT&T PUB 54016 and similar proprietary documents
SF=	Superframe frame format: Format only: ref. Bellcore GR-54-CORE

CONTENTS

Chapter and Section   **Page**

Tables

5.   Services Offered on Qwest IT1

As mentioned in Chapter 2, combinations of up to 24 voice and data channels are used for voice, and/or data applications on a single DS1 pipe. These applications are Advanced Voice Channel, Basic Voice Channel, Basic ISDN 2B+D (SLS), Basic Dedicated Digital Data Channel, and Frame Relay Dedicated Digital Data Channel. These services are briefly discussed below.

5.1   Advanced and Basic Voice Channel

Advanced and Basic Voice Channel provide channels on IT1 service that transmits a digital signal at the rate of 1.544 Mbit/s between the customer premises and Qwest's serving wire center switch. The customer can assign any number of these channels to the line side or the trunk side of Qwest's central office switch. The two terminations within the switch, the line interface unit verses the trunk interface unit, determine the channel options, i.e., Advanced Voice Channel, Basic Voice Channel.

5.1.1   Advanced Voice Channel

The option of terminating the channels into the trunk unit of the switch is called an Advanced Voice Channel. The customer should order this service if their equipment requires trunk side features such as Direct Inward Dial (DID), Direct Outward Dial (DOD) or 2 way DID.

Table 5-1 NC Codes for Ordering Advanced Voice Channel

NC Code	Voice Grade Channel Service	Technical Performance
UDGT	Advanced Trunk	Direct Inward Dial (DID) Trunk
UDGV	Advanced Trunk	Direct Outward Dial (DOD) Trunk with Answer Supervision
UDGM	Advanced Trunk	2-Way DID/DOD Trunk with Answer Supervision

5.1.2   Basic Voice Channel

For the Basic Voice Channel, Qwest terminates the channels into the line unit of the switch using a multiplexer. The customer provided equipment (CPE) derives the twenty-four 64 Kb/s channels within the IT1.

The customer should order the Basic Voice Channel if their equipment requires line side features such as Caller ID.

Table 5-2 NC Codes for Ordering Basic Voice Channel

NC Code	Voice Grade Channel Service	Technical Performance
UCGF	Voice Line Transmission Characteristics & CO Switching	Loop Start, DTMF, & 2-Way
UCGR	Voice Line Transmission Characteristics & CO Switching	Loop Start, DTMF, & In-Only (Terminate Only)
UCGU	Voice Line Transmission Characteristics & CO Switching	Loop Start, DTMF, & Out-Only (Originate Only)
UDGG	Voice Trunk Transmission Characteristics & CO Switching	Ground Start, DTMF, & 2-Way
UDGS	Voice Trunk Transmission Characteristics & CO Switching	Ground Start, DTMF & In-Only (Terminate Only)
UDGV	Voice Trunk Transmission Characteristics & CO Switching	Ground Start, DTMF & Out-Only (Originate Only)

Advanced and Basic Voice Channels are also referred as Advanced and Basic Digital Switched Services respectively in Qwest's Technical Publications.   Qwest's Technical Publication 77319, *Qwest Digital Switched Service can* also be consulted for the appropriate NC/NCI codes to order these services.

5.2   Basic ISDN 2B+D (SLS)

The Basic ISDN 2B+D (SLS) service utilizes three consecutive DS0 channels on the IT1 to provide two primary 64 kb/s or B channels that can be used simultaneously and independently to carry any combination of voice, data, image or video calls. It also provides a third, secondary 16 kb/s or D channel for low to moderate-speed data communications.

The two B channels are transported as independent, byte-oriented 64 kb/s channels, without regard for time relationships between the two channels. The D channel carries signaling and routing information for B channels as well as customer data packets.

This service is transported on the IT1 facility using a sequential 3 DS0 counting method as described in TR-NWT-000397, *ISDN Basic Access Transport System Requirements.* This counting method assigns two sequential timeslots for the B channels with the D channel assigned to the third sequential timeslot. This multiplexing method restricts assignment of the first "B" channel to timeslots 1-22 of the IT1 facility.

Table 5-3 NC Code for Ordering Basic ISDN 2B+D (SLS)

Network Channel Code	Description
UB - -	ISDN

5.3   Basic Dedicated Digital Data Channel

The Basic Dedicated Digital Data Channel Service provides channels with the capability of transmitting digital data. The available data rate for IT1 service is 56 and 64 kbit/s. The 64 kbit/s data rate may not be available in all jurisdictions. The service provides synchronous serial data between two End-Users or between an End-User and another carrier. Qwest provides timing for this service through facilities to the End-User on the received bit stream. The Basic Dedicated Digital Data Channel is only available between locations connectable through compatible digital facilities. Table 5-4 gives compatible NC codes for 56 and 64 kb/s services.

Table 5-4 NC Code for Ordering Basic Dedicated Digital Data Channel

NC Code	Characteristics
XH- -	56kb/s (Point to Point; No Options)
XD- -	64kb/s; Available only with DS1 Clear Channel Capability (CCC)

* Not available in all jurisdictions.

Qwest's Technical Publication 77204, *Qwest Digital Data Service, Product Description, Application, and Interface Combinations* may also be consulted for the appropriate NC/NCI codes for additional services.

In order to provide near broadcast quality video either Basic ISDN 2B+D (SLS) or Basic Dedicated Digital Data Channel can be used. The number of channels required for video depends on the quality of video. It is recommended that consecutive channels be used for this type of service. CPE should be equipped to accommodate the loss of synchronization between multiple channels.

5.4　　Frame Relay Dedicated Digital Data Channel

Qwest's Frame Relay Dedicated Digital Data Channel employs "fast packets" technology with access speed of 56 kb/s and 64 kb/s to provide high speed connection oriented data transfer service. Cells and Frames are considered "fast packets". Cells have a fixed length of 53 octets while a frame is considered to be variable size. This service is useful for applications such as Local Area Network (LAN) and file transfer that includes short burst of data with variable bandwidth. The frame relay service has less overhead than X.25 protocol which results in less processing for the nodes translating in less time delay and increased throughput.

Frame Relay Dedicated Digital Data Channels utilizes Permanent Virtual Circuits (PVC) to establish connection between customer locations to provide higher speed and lower time delay then traditional packet-switching technologies. Since there are multiple physical dedicated lines, multiple logical connections can be established on a single Frame Relay Service (FRS) Access Link giving the user flexibility of simultaneous data transfer applications. Qwest's Technical Publication 77372, *Frame Relay Service* may also be consulted for the appropriate NC/NCI codes for ordering these services.

Enhancements to the Qwest Frame Relay Dedicated Digital Data Channel Service include the support for fractional port access within an IT1 Service. The signal characteristics and the physical NI described in Qwest Technical Publication 77372 are also applicable for the fractional Frame Relay Dedicated Digital Data Channel. It provides the capability for the Qwest IT1 subscribers to access a Qwest FRS via 56/64 kbit/s channels provisioned within IT1. The 64kbit/s increments are available in the instances where the customer chooses B8ZS line coding. The fractional port access speeds supported are (Nx56) kbit/s or (Nx64) kbit/s, where N equals 1, to 2, 4, 6, 8 and 12. Multiple fractional access circuits may be established on a single IT1 as individual Frame Relay circuits.

The NC Codes for ordering Frame Relay Dedicated Digital Data Channel are given in Table 5-5.

Table 5-5 NC Codes for Ordering Fractional Frame Relay Dedicated Digital Data Channel

Network Channel Code	Description
HXFA	Fractional, Fast Packet, 1 Channel
HXFB	Fractional, Fast Packet, 2 Channel
HXFD	Fractional, Fast Packet, 4 Channel
HXFF	Fractional, Fast Packet, 6 Channel
HXFH	Fractional, Fast Packet, 8 Channel
HXFL	Fractional, Fast Packet, 12 Channels

CONTENTS

6.   Definitions

6.1   Acronyms

AMI	Alternate Mark Inversion
ANSI	America National Standards Institute
B8ZS	Bipolar with 8 Zero Substitution
Bellcore	Bell Communications Research, Inc.
CO	Central Office
CPE	1) Customer Provided Equipment 2) Customer Premises Equipment
CRC-6	6 bit Cyclic Redundancy Check
CSU	Channel Service Unit
DCS	Digital Cross-Connect System
DDS	Digital Data Service
DID	Direct Inward Dialing
DOD	Direct Outward Dialing
DS1	Digital Signal Level 1 (1.544 Mbit/s)
DS0	Digital Signal Level 0 (64 kbit/s) (1 voice channel)
DSU	1) Digital Service Unit 2) Data Service Unit
DSX-1	Digital Signal Level 1 Cross-Connect
ESF	Extended Super Frame
EU	End-User
FCC	Federal Communications Commission
FRS	Frame Relay Service
IC/IEC	Interexchange Carrier
ISDN	Integrated Services Digital Network
IT1	Integrated T-1
kbit/s	kilobits per second (1,000 bit/s)
LAN	Local Area Network
Mbit/s	Megabit per Second

NC	Network Channel
NCI	Network Channel Interface
NCTE	Network Channel Terminating Equipment
NI	Network Interface
PBX	Private Branch Exchange
SF	Superframe Format
SLS	Single Line Service
TLP	Transmission Level Point
POT	Point Of Termination
PVC	Permanent Virtual Circuit
WAN	Wide Area Network

6.2   Glossary

Bits/second (bit/s)

Bits per second, e.g., 1200 bit/s. In data transmission, it is the number of binary zero and one bits transmitted in 1 second. Modern terminology uses "bit/s" e.g., 1200 bit/s.

Channel

An electrical or photonic, in the case of fiber optic based transmission systems, communications path between two or more points of termination.

CODEC

Equipment that converts an analog signal into a digital signal (binary format) and which may compress the information content so that less band width is required for transmission compared to the original signal format. Conversely, the decoder part converts the digital signal back into an analog signal and may provide for expansion of the signal.

Customers

Denotes any individual, partnership or corporation who subscribes to the services provided by Qwest customers are divided into two distinct and separate categories: (1) carriers, who provide interexchange services for hire for others, and (2) end-users, who request services only for their own use.

Customer Interface

The interface with a customer at a point of termination.

Customer Premises

Denotes a building or portion(s) of a building occupied by a single customer or end-user either as a place of business or residence. Adjacent buildings and the buildings on the same continuous property occupied by the customer and not separated by a public thoroughfare are also considered the customer's premises.

Customer Premises Equipment (CPE)

All telecommunication equipment located at a customer's location.

Customer Provided Equipment (CPE)

Equipment owned and maintained by the customer and located on their side of the End-User Point of Termination (EU-POT) network interface.

Digital Hierarchy Level

The level in the digital hierarchy. The levels and the respective bit rates are:

Level	Bit Rate
DS0	64.0 kbit/s
DS1	1.544 Mbit/s

Integrated Services Digital Network (ISDN)

A network providing or supporting a range of telecommunications services that provides digital connections between End-Users.

Local Area Network

Network permitting the interconnection and intercommunication of a group of computers, primarily for the sharing or resources such as data storage devices and printers.

Megabit per Second (Mbit/s)

One million (1,000,000) bits per second

Network Channel (NC) Code

The Network Channel (NC) code is an encoded representation used to identify both switched and non-switched channel services. Included in this code set are customer options associated with individual channel services, or feature groups and other switched services.

Network Channel Interface (NCI) Code

The Network Channel Interface (NCI) code is an encoded representation used to identify five (5) interface elements located at a Point of Termination (POT) at a central office or at the Network Interface at a customer location. The Interface code elements are: Total Conductors, Protocol, Impedance, Protocol Options, and Transmission Level Points (TLP). (At a digital interface, the TLP element of the NCI code is not used.)

Network Interface (NI)

The point of demarcation on the customer's premises at which Qwest's responsibility for the provision of service ends.

Service Code (A COMMON LANGUAGE® code set)

A coded designation by which a particular Special Service Circuit may be identified. This designation must be unique, in a form that is readable and understandable, and be acceptable for both manual and mechanized procedures. [Special Service, as used by COMMON LANGUAGE®, may be called "Private Line", "Private Line Transport", "Switched Specials", "Dedicated Access", "Special Access", etc. in various tariffs and technical publications. Special Service is actually: COMMON LANGUAGE® Circuit Identification - Special Service, (abbreviated CLCI™ - S/S).]

CONTENTS

7.   References

7.1   American National Standards Institute Documents

ANSI T1.102-1993   *Digital Hierarchy - Electrical Interfaces.*

ANSI T1.223-1997   *Information Interchange — Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for the North American Telecommunications System.*

ANSI T1.403-1995   *Network-to-Customer Installation - DS1 Metallic Interface.*

7.2   AT&T Documents

PUB 54016   *Requirements for Interfacing Digital Terminal Equipment to Services Employing the Extended Superframe Format.* September 1989.

7.3   Telcordia Documents

GR-54-CORE   *DS1 High-Capacity Digital Service End User Metallic Interface Specifications.* Issue 1, December 1995.

GR-499-CORE   *Transport Systems Generic Requirements (TSGR): Common Requirements.* Issue 1, December 1995.

SR-STS-000307   *NC/NCI Code Dictionary.* Issue 8, April 1997.

TR-NWT-000397   *ISDN Basic Access Transport System Requirements.* Issue 3, December 1993.

7.4   Qwest Technical Publications

PUB 77200   *Qwest DS1 Service and Qwest DS1 Rate Synchronization Service.* Issue F, September 2001.

PUB 77204   *Qwest Digital Data Service, Product Description, Application, and Interface Combinations.* Issue E, September 2001

PUB 77319   *Qwest Digital Switched Service.* Issue E, July 2001

PUB 77372   *Frame Relay Service.* Issue H, December 2000

PUB 77375   *1.544 Mbit/s Channel Interfaces.* Issue F, December 2001

7.5   Ordering Information

All documents are subject to change and their citation in this document reflects the most current information available at the time of printing. Readers are advised to check status and availability of all documents.

Those who are not Qwest employees may order;

American National Standards Institute (ANSI) documents from:

> American National Standards Institute
> Attn: Customer Service
> 11 West 42nd Street
> New York, NY 10036
> Phone: (212) 642-4900
> Fax: (212) 302-1286
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> ANSI has a catalog available which describes their publications.

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> Piscataway, NJ 08854-4196
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> Phone: (800) 521-CORE (2673) (U.S. and Canada)
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