Qwest Communications International, Inc.
Technical Publication

IP Centrex

NOTICE

Internet Protocol Centrex (IP Centrex) is a Voice over Internet Protocol (VoIP) service integrated with our existing Centrex offering. The IP Centrex service will provide Qwest business customers with a Centrex Service that interfaces with IP telephony devices on the customer's data network. This new interface will be provided through the use of the IP Centrex Enabling technology. The Qwest provides transport between our selected Class 5 switches and the customer's demarcation point for this service. This allows the standard set of Centrex features, including Analog and ISDN Features, to be offered to the customer's IP telephony devices

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the technical parameters of our service?   YES _____   NO _____

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Chapter and Section **Page**

1. Introduction

1.1 General

Internet Protocol Centrex (IP Centrex) is a Voice over Internet Protocol (VoIP) service integrated with our existing Centrex offering. The IP Centrex service will provide Qwest business customers with a Centrex Service that interfaces with IP telephony devices on the customer's data network. This new interface will be provided through the use of the IP Centrex Enabling technology. The Qwest provides transport between our selected Class 5 switches and the customer's demarcation point for this service. This allows the standard set of Centrex features, including Analog and ISDN Features, to be offered to the customer's IP telephony devices

1.2 Reason for Reissue

This is a new publication. If it is reissued, the reason will be noted in this paragraph.

1.3 Purpose

The purpose of this document is to describe Qwest IP Centrex service. Sufficient technical detail is furnished to enable a customer to select options, bandwidth and interfaces suitable for their application needs. This document describes the technical features of the offering. It is not the intent of this document to provide ordering information beyond specific, available Network Channel and Network Channel Interface Codes.

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2.   Service Description

2.1   General

Internet Protocol Centrex (IP Centrex) is a Voice over Internet Protocol (VoIP) service integrated with our existing Centrex offering. The IP Centrex service will provide Qwest business customers with a Centrex Service that interfaces with IP telephony devices on the customer's data network. This new interface will be provided through the use of the IP Centrex Enabling technology. The Qwest provides transport between our selected Class 5 switches and the customer's demarcation point for this service. This allows the standard set of Centrex features, including Analog and ISDN Features, to be offered to the customer's IP telephony devices

The Enabled Architecture uses VoIP protocols, which permits circuit switched voice to interconnect with the customer's LAN (local area network), allowing the customer to utilize VoIP functionality on their LAN. Network Changes include:

- The individual Centrex user will utilize a compatible IP telephony device to register with a Qwest IP Centrex Enabling Platform's Voice Gateway (iMerge Centrex Feature Gateway) in the Qwest managed network. All call attempts originated from or terminated to the IP telephony devices will be processed by the IP Centrex Enabling Platform. The central office switch will provide all features and call routing.

- The Qwest IP Centrex Enabling Platform utilizes the Lucent IP Centrex Feature Gateway (CFG), iMerge. This CFG connects over a standard GR303 interface to selected 5ESS and DMS100 Class 5 central offices.

- The Qwest managed network will interface over customer dedicated transport with the customer's LAN at DS1 (n x DS1), DS3 (n x DS3), or OC3 rate. This service also available via Qwest Metro Optical Ethernet.

- The IP Centrex customer's LAN and dedicated transport bandwidth must meet Qwest prerequisite customer interface requirements to support service level agreements. Customers' interface requirements and service location will be negotiated at time of service agreement.

Centrex CPE (IP Telephone Set) Manufacturers and Customer LAN (Router/Firewall) Manufacturers must meet IP Centrex Customer Interface Specifications for Product Compatibility. The integrated IP Centrex Enabling platform consists of two Network Elements: iMerge Centrex Feature Gateway and Cisco 76xx or 65xx series Router. Information about the Lucent iMerge (CFG) product line can be obtained from Lucent Technologies (www.lucent.com).

2.1.1   IP Network Requirements

IP telephony requires a network that can meet demanding performance specifications. It is the customer's sole responsibility to ensure the current network is fully prepared for convergence of voice and data services, and the resulting converged network continues to meet performance specifications. This document outlines many of the performance specifications for a converged network and is based on the experience of Qwest and our partners.

2.1.2   Customer IP Network Performance Requirements

- Full duplex, switched 10/100 Mbit/s Ethernet LAN connectivity to each desktop. 100 Mbit/s Ethernet LAN strongly recommended. Token Ring and hubs are not supported.

- Category 5 or higher cabling to each desktop. Category 3 and coaxial cabling is not supported.

- Adequate bandwidth to support *both* voice and data traffic. Consider voice path requirements across all WAN segments and desired CODECs.

2.1.3   Customer IP Address Requirements

IP Telephony requires a minimum of 2 IP addresses per desktop (one for an IP Phone and the other for computing). Additional IP addresses are required for associated information such as subnet mask, default gateway and other services.

IP Addresses can be configured statically on the IP phone or provided by the Dynamic Host Configuration Protocol (DHCP). Network address translation (NAT) cannot be present in the proposed voice path over the data network and should be disabled, unless they are H.323 state aware.

Customers who use VoIP protocol MGCP must statically allocate IP addresses to the IP telephony device.

The following are several methods for meeting the enterprise IP addressing needs:

- Assigning IP addresses using the same subnet as data devices. This is an acceptable solution provided current IP addresses do not already exceed 50% of the available addresses.

- Modify the IP addressing plan to pull out new address from existing subnets for IP telephony device.

- Create a separate IP subnet for IP phones. The new subnet could use public or private addresses. Qwest recommends this method to place computing devices in a separate subnet from IP telephony device.

  - For customer IP telephony devices Qwest will allocate IP addresses from RFC 1918 space that do not conflict with the customers own 1918 space address.

  - If IP address conflict can not be resolved between Qwest and the customer Qwest will accept the customer's IP addresses from either private or public IP address space. Private addresses are preferred. Public IP address space can be provided by Qwest or the customer. Qwest must approve the address selection.

  - An alternative to the above solution is for the customer to implement NAT on their router to preserve the unique IP address requirement.

2.1.4   Customer IP Network Services' Requirements

- Routers support Layer 3 ToS /Diffserv.

- Layer 2 Switches must support CoS (Class of Service) tagging.

- Firewalls must be VoIP protocol and H.323 aware.

- Separate VLAN for voice and data traffic.

2.1.5   Network Availability

A converged network can greatly reduce the cost of maintaining both a voice and data infrastructure. The risk of a converged network is all applications and communications now become dependent on the availability and survivability of the converged network. The follow list outlines critical items that will minimize risk and increase availability and survivability.

- LAN switches and routers are configured with redundancy options such as management modules, links, protocols (i.e., Spanning Tree protocol), power supplies and are powered through a UPS.

- LAN switches support and IP phones use in-line power (802.3af). (Qwest strongly recommends the use of in-line power with UPS instead of local power options).

- Traditional Analog phone lines are dispersed throughout the enterprise for emergency dialing during extended power outages and system failures.

- Servers supporting call processing and databases are backed-up daily. Server restoration is practiced quarterly and is well documented.

? Security policies are documented, tested and enforceable.

2.1.6   Converged Network Management Requirements

The Network Requirements, Network Services' Requirements and Network Availability sections of this document outline the minimum requirements to support voice on a converged network. These sections are not exhaustive and it is the responsibility of the customer to fully understand how changes in the converged network will affect voice quality and reliability. The addition of new network applications, increases and movement of customer's staff, and equipment failures can all have immediate and dramatic impact on the IP telephony services transported over the converged network. All network changes must be approached cautiously.

2.2   Standards Supported in the iMerge Platform

This document assumes that the reader has a fundamental understanding of packet-based voice telephony, and a conceptual understanding of the VoIP protocols (H.323 and MGCP) and architectural elements that comprise a packet voice telephony network. Readers seeking detailed understanding are urged to become familiar with the following recommendations and specifications before using this document:

- H.323 v2 (or higher), Packet-Based Multimedia Communications Systems

- H.225.0 v2 (or higher), Call signaling protocols and media stream packetization for packet based multimedia communication systems.

- H.245 v3 (or higher), Control protocol for multimedia communication.

- H.235 v2 (or higher), Security and encryption for H-Series multimedia terminals.

- RFC 2705, Media Gateway Control Protocol (MGCP) Version 1.0, October 1999

- GR-303-CORE, Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface, Issue 4, December 2000.

- ITU-T Recommendation G.711 "Pulse Code Modulation (PCM) of Voice Frequencies", 1993

- ITU-T Recommendation G.723.1 "Dual Rate Speech Coder for Multimedia Communications Transmitting at 5.3 and 6.3 kbits/s"; 03/96

- ITU-T Recommendation G.726 "40, 32, 24, 16 kbits/s Adaptive Differential Pulse Code Modulation (ADPCM)"; 1990

- ITU-T Recommendation G.729 "Coding of Speech at 8 kbits/s using Conjugate-Structure Algebraic-Code-Excited Linear-Prediction (CS-ACELP)"; 03/96

- ITU-T Recommendation G.729 "Annex A: Reduced Complexity 8 kbits/s CS-ACELP Speech Codec"; 11/96

- ITU-T Recommendation G.729 "Annex B: A Silence Compression Scheme for G.729 Optimized for Terminals Conforming to Recommendation V.70"; 11/96

- ITU-T Recommendation G.168 "Digital Network Echo Cancellers"; 04/97

2.3   IP Telephony, 911 and E911

The installation of an IP Telephony solution typically enables end-users to freely move their communication equipment on their LAN segment. While this capability has many benefits, one consequence is 911 and E-911 calls may be incorrectly routed. Therefore, it is the responsibility of the customer to create and enforce policies that meet 911 and E-911 call delivery criteria.

2.4   Network Interface

Interface to the Qwest router is via DS1, DS3 or OC3 facility depending on the bandwidth required to support the customer traffic. See Chapter 3 of this document for appropriate NC-NCI codes and combinations for the DS1, DS3 or OC3 facilities. The bandwidth is calculated utilizing the Lucent iMerge Configuration Tool current release and the following assumptions:

- Qwest uses one-way calling for IP bandwidth calculations due to the router dataflow.

- An H.323 Analog CPE device requires 90.4Kbps of bandwidth for payload and overhead.

- An H.323 ISDN, Nortel P-Phone or EBS CPE device requires 116.4Kbps for bandwidth for payload and overhead.

- Qwest calculates the full analog and ISDN, P-Phone or EBS CPE IP bandwidth required for the broadband facility.

CONTENTS

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 Bellcore 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

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

Channel Code
Optional Feature Code

The format is illustrated in Figure 3-1.

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

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.*

3.1.3   Available Network Channel Codes

Table 3-1 lists the available Network Channel (NC) codes for IP Centrex Service.

Table 3-1 Available Network Channel Codes —IP Centrex Service.

Network Channel Code	Description	NC/NCI Table
HCE9	DS1 ANSI ESF & B8ZS High Speed Data (HSD) Termination for Unchannelized Application (e.g., IPRouting Device)	3-5
HFC9	DS3 C-Bit Parity HSD, High Speed Data Termination for Unchannelized Application (e.g., IP RoutingDevice)	3-6
OB-9	OC 3 Point-to-Point channel and no further parameters High Speed Data (HSD) Termination on an IP routing Device	3-7

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)

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 3-2

Table 3-2 NCI Impedance Values

Impedance in Ohms (Character Position 5)	
Data Value	Code
75	6
100	9
Fiber	F

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.

Transmission Level Point(s) (character positions 8 through 12) is assigned one or two-character alpha code corresponding to a value for Transmission Level Point(s) (TLPs) from either the Exchange Carrier/service provider or customer end. Values are listed in Table 3-3.

The convention for TLP Levels is as follows:

- Transmitting TLP Level signifies the TLP transmit signal level at the Qwest interface when transmitting to the customer.

- Receiving TLP Level signifies the TLP transmit signal level at the Qwest interface when receiving from the customer.

Further information about NCI Codes may be found in ANSI T1.223-1997.

3.2.3   Available Network Channel Interface Codes

Table 3-4 lists the NCI codes valid for IP Centrex Service.

Table 3-3 Available NCI Codes

Digital Termination On A Switch	CO
04CX9 — 1.544 Mbit/s (DS1)	
04CX6.3 — 44.736 Mbit/s (DS3)	
04CXF.A — OC3 Termination on a switch	
Digital Hierarchy Interface (Access Customer Interface)	**EU**
04DS6.44A — 44.736 Mbit/s (DS3) Unchannelized Application and C-Bit Parity	
Digital Access Interface (End User Interface)	**EU**
04DU9.1SN — 1.544 Mbit/s (DS1) ANSI ESF Format with B8ZS Clear Channel Capability, without line power per GR-54-CORE	
04DU9,1SX — 1.544 Mbit/s (DS1) ANSI ESF Format with B8ZS Clear Channel Capability, without line power and with 0 attenuation per GR-54-CORE	
SONET /SDH Optical Interface	**EU**
02SOF.D — ANSI: Intermediate Reach – 1, Single Longitudinal Mode Laser, 1310 nm (ITU-T: S-16.1 & SLM)	

3.3 Valid Network Channel/Network Channel Interface Combinations

This section describes valid combinations of NC and NCI codes. The term "Digital" is used in the tables to represent a DS1 or higher-level digital interface. Representative NCI codes include 04DS9.15, 04DJ9.1S, 04DU9.BN, 04SOF.D and 04DS6.44, etc.

3.3.1   DS1 HSD (High Speed Data) HCE9

Table 3-4 DS1 HSD (High Speed Data) HCE9

DS1		
HC		
E	ANSI ESF & B8ZS	
9	HSD, High Speed Data Termination for Unchannelized Application (e.g., IP Routing Device)	
Location	NCI	SEC NCI
EU-CO	04DU9.1SN, 04DU9.1SX	04CX9

3.3.2   DS3 HSD (High Speed Data) HFC9

Table 3-5 DS3 HSD (High Speed Data) HFC9

DS3		
HF		
C	C-Bit Parity	
9	HSD, High Speed Data Termination for Unchannelized Application (e.g., IP Routing Device)	
Location	NCI	SEC NCI
EU-CO	04DS6.44A	04CX6.3

3.3.3   OC3 HSD (High Speed Data) OB-9

Table 3-6 OC3 HSD (High Speed Data) OB-9

OC3		
OB		
-	Point-to-Point channel and no further parameters	
9	High Speed Data (HSD) Termination on an IP routing Device	
Location	NCI	SEC NCI
EU-CO	O2SOF.D	O2CXF.A

Note: EU-CO = End User-Central Office.

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Chapter and Section   **Page**

4.   Definitions

4.1   Acronyms

AC	Access Customer
AD	Amendment; for example, IS0 8327 AD2
ALEC	Alternate Local Exchange Carrier
AMI	Alternate Mark Inversion
ANSI	American National Standards Institute
AP	Access Provider
APOP	Alternate Point of Presence
APOT	Actual Point Of Termination
ASR	Access Service Request
ATM	Asynchronous Transfer Mode
ATT/IS	AT&T Information Systems
ATTCOM	AT&T Communications
B8ZS	Bipolar with 8 Zero Substitution
BIT	Binary Digit
BOC	Bell Operating Company
BOCS	Bell Operating Companies
bps	Bits Per Second (Now bit/s)
BPV	Bipolar Violation
BRI	Basic Rate Interface
BW	Bandwidth
CCC	Clear Channel Capability
CENTREX	Centralized Exchange for Business Customer Services
CENTREX/ CENTRON	Centralized Exchange for Business Customer Services
CLLI™	Common Language® Location Identification
CO	Central Office
COE	Central Office Equipment
CP	Customer Premises
CPE	Customer Premises Equipment
CPOI	Collocation Point of Interconnection

CPS	Cycles Per Second
CTX	Centrex
CU	Channel Unit
CV	1) Code Violation 2) Coding Violations
CXR	Carrier
dB	Decibel
dBm	Decibel reference to one milliwatt
dBrnC	Decibel Reference Noise C-Message Weighting
dBrnC0	dBrnC referred to 0 TLP
dBrn	Decibel noise referenced to one picowatt (-90 dBm)
dBv	Decibels Relative to voltage
DC	Direct Current
DCS	Digital Cross-Connect System
DHCP	Dynamic Host Configuration Protocol
DLC	Digital Loop Carrier
DS	Digital Signal
DS1	High Capacity 1.544 Mbit/s Service Digital Signal Level 1 (1.544 Mbit/s)
DS3	High Capacity 44.736 Mbit/s Service Digital Signal Level 3 (44.736 Mbit/s)
DS0	Digital Signal Level 0 (64 kbit/s) (1 voice channel)
DSX	Digital Signal Cross-Connect
DSX-1	Digital Signal Level 1 Cross-Connect
DSX-3	Digital Signal Level 3 Cross-Connect
DTMF	Dual Tone MultiFrequency
E-911	Enhanced 911 Services
EBS	Electronic Business Set (Proprietary-Phone) DMS-100 only
EC	Exchange Carrier
EFS	Error Free Seconds
EIA	Electronic Industries Association
EO	End Office
ES	Erred Seconds
ESF	Extended Super Frame

ESP	Enhanced Service Provider
EU	End-User
EU-POT	End-User-Point of Termination
FAX	Facsimile
FM	Frequency Modulation
Gbit/s	Gigabit per Second
GHz	Gigahertz
HCDS	High Capacity Digital Service
HERTZ	Cycles per Second
Hz	1 Hertz (formerly 1 cycle per second)
IC	Interexchange Carrier (or IEC)
IC/IEC	Interexchange Carrier
ICO	Independent Company Office
IC-POP	Interexchange Carrier-Point of Presence
IDF	Intermediate Distributing Frame
IDLC	Integrated Digital Loop Carrier
IEC	Interexchange Carrier (or IC)
IEEE	Institute for Electrical and Electronic Engineers
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ISP	Internet Service Provider
ISUP	Integrated Services Digital User Port
ITU	International Telecommunication Union (formerly CCITT)
IX	Interexchange
IXC	Interexchange Carrier
kbit/s	kilobits per second (1,000 bit/s)
kHz	Kilohertz (1,000 Cycles Per Second)
LAN	Local Area Network
LASER	Light Amplification by Stimulated Emission of Radiation
LEC	Local Exchange Carrier
LED	Light Emitting Diode
mA	Milliamperes (one thousandth of an ampere)

MAN	Metropolitan Area Network
Mbit/s	Megabit per Second
MF	Multifrequency
MGCP	Media Gateway Control Protocol
MODEM	MOdulator/DEModulator
MPOP	Minimum Point Of Presence
MUX	Multiplexer
NAT	Network Address Translation
NC	Network Channel
NCI	Network Channel Interface
NCTE	Network Channel Terminating Equipment
NE	Network Element
NI	Network Interface
OC	Optical Carrier
OC-3	Optical Carrier level 3
OS	Operating System
OSS	Operations Support System
PBX	Private Branch Exchange
PCM	Pulse Code Modulation
PL	Private Line
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RBOC	Regional Bell Operating Company
SECNCI	Secondary NCI
SONET	Synchronous Optical Network
TCP/IP	Transmission Control Protocol/Internet Protocol
TIA	Telecommunications Industry Association
TOC	Table of Contents
ToS	Type of Service
UPS	Uninterruptible Power Supply
VF	Voice Frequency
VLAN	Virtual Local Area Network

VoIP   Voice over Internet Protocol

WAN   Wide Area Network

2B1Q   Two binary, one quaternary

911   Basic Emergency Service

4.2   Glossary

Access Customers

Any of the companies that provide telecommunications service between LATAs and/or order from the Access Tariffs. Includes Interexchange Carriers.

Access Providers

Any of the telephone companies licensed by the appropriate utility commission to provide local telecommunication service within a LATA. This includes Bell Operating Companies, Information Distribution Companies, Non-Bell Operating Companies and other Local Exchange Carriers.

Acronym

A word formed from the first (or first few) letters of a series of words.

Address Signals

Signals used to convey call destination information, such as telephone station code, central office code, and area code. Some forms of address signals are called pulses, e.g., Dial Pulses (DP) and Multifrequency (MF) pulses.

Alternate Exchange Carrier

A Competitive Local Exchange Carrier providing dial tone services, local distribution loops and/or similar services in an area formerly franchised to QWEST.

Alternate Mark Inversion (AMI)

A one (mark) pulse which is the opposite polarity as its predecessor.

American National Standards Institute (ANSI)

An organization supported by the telecommunications industry to establish performance and interface standards.

ASCII

American Standard Code for Information Interchange. A standard 8-bit information code used with most computers and data terminals.

Availability

The relative amount of time that a service is "usable" by a customer, represented as a percentage over a consecutive 12-month period.

Bandwidth

The range of frequencies that contain most of the energy or power of a signal; also, the range of frequencies over which a circuit of system is designed to operate.

BAUD

A unit of signaling speed. It is the reciprocal of the time duration in seconds of the shortest signal element (binary 1 or 0) within a code signal. The rates specified are the number of signal elements per second.

Bipolar Violation (BPV)

An unexpected violation (not a predetermined signature) of the Bipolar Alternate Mark Inversion (AMI) line-code rule. A violation is declared for AMI if two successive pulses have the same polarity if the bipolar violation is not part of an intentional byte used for special control, e.g. BnZS.

Bipolar With 8 Zero Substitution (B8ZS)

Bipolar 8 Zero Substitution is an application of BPRZ and is an exception to the Alternate Mark Inversion (AMI) line-code rule. It is one method of providing bit independence for digital transmission by providing a minimum 1s density of 1 in 8 bits.

Bit (Binary Digit)

A binary unit of information. It is represented by one of two possible conditions, such as the value 0 or 1, on or off, high potential or low potential, conducting or not conducting, magnetized or demagnetized. A Bit is the smallest unit of information, by definition.

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.

Byte

A consecutive number of bits usually constituting a complete character or symbol. If the length of the byte is not specified, it is conventionally assumed to have a length of 8-bits. In the Digital Data System, a byte refers to an arbitrary group of 8 consecutive bits; it does not correspond to a byte of customer data.

C-Bit Parity

An M-framed application in which the C bits are used for network management and maintenance functions instead of denoting the presence or absence of stuff bits.

CCS

A hundred call seconds this is a standard unit of traffic load that is equal to 100 seconds of usage.

Call

The sequence of events begun when an End-User makes a request for service and provides an address code, and concluded when communication between the End-Users has terminated.

Call Attempt

Denotes the act of an End-User or customer provided equipment (CPE) providing the complete number (e.g. 0, 911, or 10 digits) using accepted network supervisory and address signaling protocols to the serving dial-tone central office.

Called Number

The called number is the telephone number originally dialed by the calling party.

Central Office (CO)

A local switching system (or a portion thereof) and its associated equipment located at a wire center.

Channel

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

Channelize

The process of multiplexing-demultiplexing channels using analog or digital techniques.

Character

Letter, numeral, punctuation, control figure or any other symbol contained in a message.

CODEC

Equipment that converts an analog signal into a digital signal (binary format) and which may compress the information content so that less bandwidth 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.

Converged network

A network transiting both voice and data.

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 as either 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 same customer's premises.

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.

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 services for hire for others, and (2) End-Users, who request services only for their own use.

Demarcation Point

See Network Interface

. **Digital Cross-Connect System (DCS)**

An intelligent (processor controlled) digital terminal that provides the capability to perform electronic cross-connects on digital channels operating at or below the bit rate of the transport systems terminated on the unit. This unit may also provide other features, e.g., bridging.

DiffServ

A set of technologies which allow Internet and other IP-based network service providers to offer differentiated levels of service to individual customers and their information stream.

Digital Hierarchy Level

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

Level	Bit Rate	Level	Bit Rate
DS0	64.0 kbit/s	DS3	44.736 Mbit/s
DS1	1.544 Mbit/s	DS4NA	139.264 Mbit/s
DS1C	3.152 Mbit/s	DS4	274.176 Mbit/s
DS2	6.312 Mbit/s		

Digital Loop Carrier (DLC)

A digital transport facility used to carry circuits or channels on part of all of the loop between the serving wire center and the customer's location. Copper or fiber is normally used as the transport medium.

Diversity

Routing of customer circuits or access lines over physically separated facilities.

DS1 Clear Channel

Denotes that 1.536 Mbit/s of a 1.544 Mbit/s DS1 facility are available for customer information. The remaining 8 kilobits, or overhead, are for error correction, framing, and network performance/status/information.

Embedded Operations Channel (EOC)

Use of some bits in the bit stream of a transport system for maintenance purposes.

Encryption

A process of encoding and decoding information so that it is not easily decipherable by unintended recipients.

End Office

A designation of a QWEST switching system that occupies the lowest level of the public switched network hierarchy. It is the designation of a switching system that connects lines to lines, and lines to trunks (a local switching system).

End Office Switch

The term "End Office Switch" denotes a QWEST switching system where local exchange services are terminated for purposes of interconnection to other exchange services or trunks. Included are Remote Switching modules and Remote Switching Systems served by a host office in a different wire center. See also "Local Switching System".

End-User (EU)

The term "End-User" denotes any customer of telecommunications service that is not a carrier, except that a carrier shall be deemed to be an "End-User" to the extent that such carrier uses a telecommunications service for administrative purposes without making such service available to others, directly or indirectly. The term is frequently used to denote the difference between a Carrier interface and an interface subject to unique regulatory requirements at non-Carrier customer premises (FCC Part 68, etc.)

End-User POT (EU-POT)

The Network Interface at the End-User's premises at which QWEST Communication, Inc.'s responsibility for the provision of service ends.

Enhanced Services Provider (ESP)

A business that provides enhanced services by using the ONA services made available by regulated telecommunications providers; also refers to interexchange carriers and resellers that act as ESPs.

Enhanced Services

As defined by the FCC, enhanced services are any services offered over common carrier transmission facilities that employ computer processing applications that act on the format, content, code, protocol or similar aspects of the subscriber's transmitted information; that provide the subscriber with additional, different or restructured information; or involve customer interaction with stored information. Examples of enhanced services include videotex, voice storage and retrieval, on-line business information, on-line travel information, electronic mail and protocol conversion in connection with packet switching service.

Ethernet

A packet-switched local network design employing Carrier Sense Multiple Access with Collision Detection (CSMA/CD) as access control mechanism.

Extended Superframe (ESF) Format

An Extended Superframe consists of twenty-four consecutive DS1 frames. Bit one of each frame (the F-bit) is time shared during the 24 frames to describe a 6 bit frame pattern, a 6 bit Cyclic Redundancy Check (CRC) remainder, and a 12 bit data link. The transfer rate of each is 2 kbit/s, 2 kbit/s, and 4 kbit/s respectively.

Facilities

Facilities are the transmission paths between the demarcation points serving customer locations, a demarcation point serving a customer location and a QWEST Central Office, or two QWEST offices.

Firewall

A combination of hardware and software which limits the exposure of a computer or group of computers to an attack from outside.

Free (Unframed) Format

A non-standard use of the first bit in each DS1 frame, such that a synchronization pattern is either not transmitted or is held private by the user. Performance monitoring by a Carrier is not possible when framing is not evident.

Gigabit per Second (Gbit/s)

One billion (1,000,000,000) bits per second.

Impedance

The total opposition offered by an electric circuit to the flow of an alternating current of a single frequency. It is a combination of resistance and reactance and is measured in ohms.

Individual Case Basis (ICB)

Denotes a condition in which rates and charges for an offering are developed based on the circumstances in each case.

Integrated Services Digital Network (ISDN)

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

Interconnector

Any customer who subscribes to Expanded Interconnection-Collocation (EIC) Service and who provides fiber optic or (where permitted) metallic facilities to QWEST-designated locations for connection to EIC Service.

InterConnection Distribution Frame (ICDF)

The generic name for a cross-connect frame(s) designated as the Network Interface between QWEST and a collocated Certified Local Exchange Carrier or Co-Provider. ICDFs are generally level-specific (e.g., DS0/voice, DS1, DS3 or optical). These frames typically serve other purposes and normally will have a more specific name depending on usage in a specific wire center.

Interexchange Carrier (IC)/(IEC) or Interexchange Common Carrier

Any individual, partnership, association, joint-stock company, trust, governmental entity or corporation engaged for hire in interexchange, interstate or foreign communication by wire or radio.

Interface Code

See Network Channel Interface

Jitter

The mean deviation of the difference in packet spacing at the receiver compared to the packet spacing at the sender for a pair of packets. This value is equivalent to the deviation in transit time for a pair of packets. This delay is the perceived voice quality.

Kilobit/Second (kbit/s)

One thousand (1000) bits/second

Latency

The time it takes to get information through a network.

Layer 1

Physical Layer. Provides the transparent transmission of bit streams between systems including relaying through different media.

Layer 2

Data Link Layer. Provides the transfer of software between directly connected systems and detects any errors in the transfer. Establishes, maintains and releases software data links; handles error and flow control.

Layer 3

Network Layer. Determines how data is transferred between computers. It also addresses routing within and between individual networks.

Local Area Network (LAN)

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

Local Switching System

A switching system that connects lines to lines, and lines to trunks. It may be located entirely at one wire center, or may be geographically dispersed as in some host-remote configurations.

Local Traffic

Traffic that is classified as local in the tariff on file with the appropriate regulatory body.

Local Wire Center

The Wire Center which normally provides service to a customer.

Loopback

An out-of-service test procedure applied to a full duplex channel that causes a received signal to be returned to the source.

Megabit per Second (Mbit/s)

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

Metallic Facilities

A facility that consists of continuous metallic conductors, i.e., devoid of electronic enhancements that would corrupt Direct Current continuity.

Multiplexer (Mux)

Equipment used to multiplex, or do multiplexing: Multiplexing is a technique of modulating (analog) or interleaving (digital) multiple, relatively narrow bandwidth channels into a single channel having a wider bandwidth (analog) or higher bit-rate (digital). The term Multiplexer implies the demultiplexing function is present to reverse the process so it is not usually stated.

Network

The interconnected telecommunications equipment and facilities.

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, Impedances, 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.

Ohm

The unit of electric resistance.

Optical Carrier (OC)

Optical carrier, the nomenclature for the line rate of the optical transmission signal described in this document.

Optical Interface (OI)

The Optical Interface is the transmit point wherein light waves move away from the interface toward an optical receiver.

Packet

A unit of data, consisting of binary digits including data and call-control signals, that is switched and transmitted as a composite whole.

Point of Presence (POP)

A physical location within a LATA at which an Interexchange Carrier (IC) establishes itself for the purpose of obtaining LATA access and to which QWEST provides access service.

Point of Termination (POT)

The physical telecommunications interface that establishes the technical interface, the test point(s), and the point(s) of operational responsibility. (See Network Interface).

Point-To-Point

A circuit connecting two (and only two) points.

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.

Private Branch Exchange (PBX)

Denotes the data station selector located in QWEST Central Office connected directly by an access line to the Selector Control Unit (SCU) at the master station.

Protocol

The rules for communication system operation which must be followed if communication is to be effected; the complete interaction of all possible series of messages across an interface. Protocols may govern portions of a network, types of service, or administrative procedures.

Protocol Code

The Protocol (character positions 3 and 4 or the Network Channel Interface [NCI] Code) is a two-character alpha code that defines requirements for the interface regarding signaling and transmission.

Pulse Code Modulation (PCM)

A type of modulation wherein the waveform of each channel is sampled many times per second in sequence. The amplitude of each sample is then encoded into a binary code and transmitted to the distant end where the pulse train is decoded and distributed to each channel in the exact time sequence to reproduce the original waveform of the channel.

Route

The physical path established through a network for a particular circuit.

Router

A router is, in the strictest terms, an interface between two networks. Routers are highly intelligent devices that connect like and unlike LANs. They connect MANs and WANs, such as X.25, Frame Relay and ATM. Routers are protocol-sensitive, typically supporting multiple protocols. Routers most commonly operate at the bottom 3 layers of the OSI model, using the Physical, Link and Network Layers to provide addressing and switching. Routers may also operate at the Layer 4, transport Layer, in order to ensure end-to-end reliability of data transfer.

Serving Area

Geographic area which is normally provided telecommunications services via one Wire Center.

Serving Wire Center

The term "Serving Wire Center" denotes a QWEST Central Office from which dial tone for the local Exchange Service would normally be provided to the demarcation point on the property at which the customer is served.

Signaling

The transmission of information to establish, monitor, or release connections and/or provide Network Control.

Subnet

A portion of a network, which may be a physically independent network, which shares a network address with other portions of the network and is distinguished by a subnet number.

Superframe Format (SF)

A superframe consists of 12 consecutive DS1 frames. Bit one of each frame (the F-bit) is used to describe a 12-bit framing pattern during the 12 frames.

Synchronous Optical Network (SONET)

A standard providing electrical and optical specifications for the physical and higher layers, the first stage of which is at 51.84 Mbit/s, the Optical Channel 1 (OC-1) level. Other rates, defined as OC-n where n=3 through a number not yet firm, are possible.

Time Slot Management Channel (TMC)

A dedicated channel for sending control messages used to set up and tear down calls in a T-1 Frame. In a GR-303 interface group, the primary TMC is usually channel 24 of the first DS-1, while a redundant TMC (if used) would be located in a different DS-1.

Token Ring

A local network access mechanism and topology in which a token is passed from station to station in sequential order. Stations wishing to transmit must wait for the token to arrive before transmitting data. Throughout this document, the term "Token Ring" is used interchangeably with the IEEE Std. 802.5-1992 Edition.

Transmission Control Protocol/Internet Protocol (TCP/IP)

Internetworking software suite originated on the Department of Defense's Arpanet network. IP corresponds to Open Systems Interconnection (OSI) network Level 3, TCP to OSI Layer 4 and 5.

Voiceband

Relating to the frequency spectrum from 300 to 3000 Hz.

Wire Center

A building in which one or more central offices, used for the provision of local exchange services, are located.

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5. References

5.1 American National Standards Institute (ANSI) documents from:

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.

5.2 International Telecommunications Union - Telecommunications Sector (ITU-T) Publications

ITU-T Recommendation H.225.0 v2 (or higher), Call signaling protocols and media stream packetization for packet based multimedia communication systems.

ITU-T Recommendation H.245 v3 (or higher), Control protocol for multimedia communication.

ITU-T Recommendation H.235 v2 (or higher), Security and encryption for H-Series multimedia terminals.

ITU-T Recommendation G.711 "Pulse Code Modulation (PCM) of Voice Frequencies", 1993

ITU-T Recommendation G.723.1 "Dual Rate Speech Coder for Multimedia Communications Transmitting at 5.3 and 6.3 kbits/s"; 03/96

ITU-T Recommendation G.729 "Coding of Speech at 8 kbits/s using Conjugate-Structure Algebraic-Code-Excited Linear-Prediction (CS-ACELP)"; 03/96

ITU-T Recommendation G.729 "Annex A: Reduced Complexity 8 kbits/s CS-ACELP Speech Codec"; 11/96

5.3 IETF Documents:

RFC 2705,Media Gateway Control Protocol (MGCP) Version 1.0, October 1999

RFC 1918 Address Allocation for Private Internets

5.4 Lucent Documents

siMerge® Gateway Business Application Engineering (current release)

iMerge® Configuration Tool (current release)

5.5 Telcordia Documents

GR-303-CORE   *Integrated Digital Loop Carrier System Generic Requirements Objectives,*.and Interface, Issue 4 December 2000

ISI-SR-STS 000307   NC/NCI Code Dictionary

5.6   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;

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
> Web: web.ansi.org/public/search.asp

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> Piscataway, NJ 08854-4156
> Fax: (732) 699-2559
> Phone: (800) 521-CORE (2673) (U.S. and Canada)
> Phone: (908) 699-5800 (Others)
> Web: www.telcordia.com

IETF documents from:

> www.IETF.org

International Telecommunications Union documents may be ordered from:

> International Telecommunications Union
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> Geneva 20, SWITZERLAND
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