Qwest Communications International Inc. Technical Publication

Qwest DSL Ô Services

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Issue K
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NOTICE

Technical Publication 77392, is a reference document providing technical disclosure information for all Qwest DSL™ Services Network Channel Interface (NCI) codes Qwest Corporation supports.

Technical Publication 77392 is being reissued to provide a note clarifying the distinction between IDSL and ISDN.~~Technical Publication 77392 is being reissued to provide a note clarifying the distinction between IDSL and ISDN.~~

DMT and CAP are used in this document to denote the line code utilized on the Digital Subscriber Lines used in the Qwest DSL™ Services offering. Rate Adaptive Digital Subscriber Line (RADSL) is used in this document to denote a type of Digital Subscriber Line that has the ability to change signaling parameters and adjust data rate based on impairments on the subscribers loop.

10Base-T and 100Base-T are used in this document to denote the 10 Megabit per second (Mbit/s) and 100 Mbit/s transmission data rates respectively. Where 10Base-T and 100Base-T are used in reference to Qwest DSL™ Services**,** the information no longer describes a specific product offering provided by Qwest Corporation. Instead, it describes a possible user connection to Customer Provided Equipment (CPE) which is used to connect to, either the DMT RADSL, CAP RADSL or ATM interfaces referred to in this document.

This document provides technical parameters for:

- Required characteristics of Qwest Corporation and Customer signals at DMT RADSL and CAP RADSL network interface to End-Users and Carriers;
- Network Channel Interface codes used to encode the signal characteristics of the DMT RADSL and CAP RADSL interface, and lists those that may be used when ordering Qwest DSL™ Services.
- Characteristics of the DMT RADSL and CAP RADSL Interface.
- Characteristics of the Qwest IDSL™™ Interface
- Specific requirements for the implementation of L2TP on the access link between a Qwest DSL™ Host and the Qwest Corporation Network.
- Specific requirements for Qwest DSL™ Host that are unique to Qwest DSL™ service that are not part of Qwest Corporation requirements for Cell Relay Service, as described in Qwest Corporation Technical Publication77378, “Qwest Corporation ATM Cell Relay Service”.

Technical Publication 77392 is intended to be used with other Qwest Corporation Technical Publications and with Qwest Corporation Service Publications, which provide both the Network Channel and Network Channel Interface codes needed to order Qwest DSL™ Services in conjunction with other Qwest Corporation services.

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COMMENTS on PUB 77392

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CONTENTS

Chapter and Section **Page**

CONTENTS (Continued)

Figures

Tables

CONTENTS

Chapter and Section **Page**

1. Introduction

1.1 General

Technical Publication 77392, is a reference document providing technical disclosure information for all Qwest DSL™ Services Network Channel Interface (NCI) codes Qwest Corporation supports.

1.2 Reason For Reissue

Technical Publication 77392 is being reissued to provide information due to the change in Company information.

1.3 Scope

DMT and CAP are used in this document to denote the line code utilized on the Digital Subscriber Lines used in the Qwest DSL™ Services offering. Rate Adaptive Digital Subscriber Line (RADSL) is used in this document to denote a type of Digital Subscriber Line that has the ability to change signaling parameters and adjust data rate based on impairments on the subscribers loop.

10Base-T and 100Base-T are used in this document to denote the 10-Megabit per second (Mbit/s) and 100 Mbit/s transmission data rates respectively. Where 10Base-T and 100Base-T are used in reference to Qwest DSL™ Services**,** the information no longer describes a specific product offering provided by Qwest Corporation. Instead, it describes a possible user connection to Customer Provided Equipment (CPE) which is used to connect to, either the DMT RADSL, CAP RADSL or ATM interfaces referred to in this document.

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CONTENTS

Chapter and Section **Page**

Figures

Tables

2 Service Description

Qwest DSL™ Services is the umbrella name for Qwest Corporation's family of services using Digital Subscriber Line (DSL) technology. DSL functions in combination with Asynchronous Transfer Mode (ATM) access. The combination between DSL service and ATM access provides subscribers a continuous dedicated access to their Corporate Local Area Network (LAN) or Internet Service Provider (ISP).

DSL provides simultaneous voice and high-speed data services over a single copper wire pair. Data traffic transmits at speeds much faster than voice band analog modems. ATM access allows the ISP or Corporate Local Area Network (LAN) to aggregate the data traffic from many customers who are using DSL.

There are several variations of DSL technology transmitted over copper cabling to move data between customer locations and the serving wire center. Wire center equipment separates the voice traffic from the data traffic. Data traffic is connected to a high-speed network and delivered to the host destination. Voice communications are sent to the local switching system. Qwest DSL™ Services subscribers are provided enough bandwidth for interactive data and video services. Some forms of DSL technologies include: Integrated Services Digital Network (ISDN) Digital Subscriber Line (IDSL), High Bit Rate DSL (HDSL), Single Line HDSL (SHDSL), Asymmetric DSL (ADSL), and Very High Bit Rate DSL (VDSL). The technologies in use by Qwest DSL™ Services are:

- ADSL using Rate Adaptive Digital subscriber Line (RADSL).
- IDSL for customers subscribed to the Qwest Corporation's Qwest IDSL℠.

2.1 Qwest DSLÔ Services Overview

Qwest DSL™ Services consists of two service categories: subscriber and Qwest DSL™ Host. These two categories correspond to the hub and spoke nature of the service architecture (see Figure 2-1 below). Subscriber services are the spoke network connections. Each of the spoke connections must be associated with a host or a network connection to the Qwest DSL™ Host.

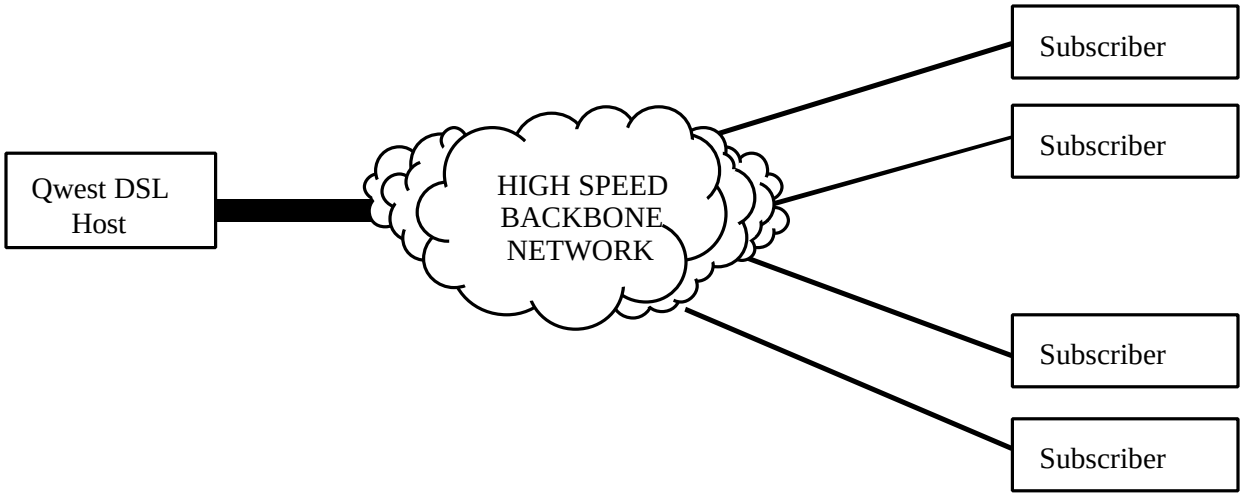

Figure 2- 1 Hub and Spoke Network

2.2 Subscriber Connections

Subscriber service uses xDSL technology to transport high capacity bi-directional data over a single pair of copper wires. In the case of RADSL, the data stream is carried along with Plain Old Telephone Service (POTS). Subscribers are provided with Discrete Multi-Tone (DMT) RADSL interface. Previous RADSL service required a Carrierless Amplitude/Phase Modulation (CAP) RADSL interface. All CAP RADSL services are grandfathered. The RADSL interface connects to either an internal or external RADSL modem at the customer's premises. If a Subscriber's service is provided by Qwest IDSL℠, the IDSL line requires its' own pair of wires and the data stream does not share the same pair of wires as the POTS. In both the RADSL and IDSL cases, all customer data travels directly into the backbone of the Qwest Corporation's data network.

Note: DMT RADSL will be the base line coding technology for Qwest DSL™. CAP RADSL is discontinued, but is supported for indeterminate amount time.

Subscriber service is segmented into eight (8) different available data rates:

- Data rate of 144 Kbit/s Bi-directional (Qwest IDSL℠)
- Data rate of 256 Kbit/s from the network to the user (downstream) and up to 256 Kbit/s from the user to the network (upstream) (Qwest DSL™ 256)
- Data rate of 640 Kbit/s from the network to the user (downstream) and up to 256 Kbit/s from the user to the network (upstream) (Qwest DSL Deluxe™)
- Data rate up to 640 Kbit/s from the network to the user (downstream) and up to 256 Kbit/s from the user to the network (upstream) (Qwest DSL Pro Deluxe™)
- Data rate of 640 Kbit/s from the network to the user (downstream) and up to 640 Kbit/s from the user to the network (upstream) (Qwest DSL Pro™ 640)
- Data rate of 1.024 Mbit/s from the network to the user (downstream) and up to 1 Mbit/s from the user to the network (upstream) (Qwest DSL Pro™ 1M)
- Data rate of 4 Mbit/s from the network to the user (downstream) and up to 1 Mbit/s from the user to the network (upstream) (Qwest DSL Pro™ 4M)
- Data rate of 7 Mbit/s from the network to the user (downstream) and up to 1 Mbit/s from the user to the network (upstream) (Qwest DSL Pro™ 7M)

All eight (8) data rates are provided over copper wires simultaneously carrying POTS and these data rates are provided in eight (8) service classes.

~~2.1.1~~2.2.1 Qwest DSL Ô 256

Qwest DSL™ 256 Service allows the customer to have a permanent or always on down stream of 256 Kbit/s and upstream up to 256 Kbit/s to their ISP or Corporate LAN. Qwest DSL™ 256 is a DMT line coding service.

~~2.1.2~~2.2.2 Qwest DSL Deluxe Ô

Qwest DSL Deluxe™ Service allows the customer to have a permanent or always on downstream up to 640 Kbit/s and upstream up to 256 Kbit/s data connection to their ISP or Corporate LAN. Qwest DSL Deluxe™ is a DMT line coding service.

~~2.1.3~~2.2.3 Qwest DSL Pro Deluxe Ô

Qwest DSL Pro Deluxe™ Service allows the customer to have a permanent or always on downstream 640 Kbit/s and upstream up to 256 Kbit/s data connection to their ISP or Corporate LAN. Qwest DSL Pro Deluxe™ is a DMT line coding service.

~~2.1.4~~2.2.4 Qwest DSL Pro Ô 640

Qwest DSL Pro™ 640 Service allows the customer to have a permanent or always on downstream of 640 Kbit/s and upstream up to 640 Kbit/s data connection to their ISP or Corporate LAN. Qwest DSL Pro™ 640 is a DMT line coding service.

~~2.1.5~~2.2.5 Qwest DSL Pro Ô 1M

Qwest DSL Pro™ 1M Service allows the customer to have a permanent or always on 1.024 Mbit/s downstream, and up to 1Mbit/s upstream data connection to their ISP or Corporate LAN. Qwest DSL Pro™ 1M is a DMT line coding service.

~~2.1.6~~2.2.6 Qwest DSL Pro Ô 4M

Qwest DSL Pro™ 4M Service allows the customer to have a permanent or always on downstream 4 Mbit/s downstream, and up to 1Mbit/s upstream data connection to their ISP or Corporate LAN. Qwest DSL Pro™ 4M is a DMT line coding service.

~~2.1.7~~2.2.7 Qwest DSL Pro Ô 7M

Qwest DSL Pro™ 7M Service allows the customer to have a permanent or always on downstream 7 Mbit/s downstream, and up to 1Mbit/s upstream data connection to their ISP or Corporate LAN. Qwest DSL Pro™ 7M is a DMT line coding service.

~~2.1.8~~2.2.8 Qwest IDSL Ô

This service offering utilizes standard ISDN technology to deliver Qwest DSL™ service to those subscribers who are beyond the loop limits of RADSL or are served from a Digital Loop Carrier (DLC). The service provides a dedicated connection to a Qwest DSL™ Host at a nominal speed of 144 Kbit/s. Unlike the other Qwest DSL™ services, this service requires a separate pair of wires to the subscriber's location and does not include a POTS connection with the service.

2.3 The Hub: Qwest DSL Host Connection

Qwest DSL™ Host functions as the hub of the hub and spoke network. The subscriber is the spoke. Each subscriber connection must be matched with a Qwest DSL™ Host connection.

The Qwest DSL™ Host service is provided to small businesses, corporations or ISPs, allowing them to aggregate data streams from many subscribers onto a single high-speed data connection. An example of such an arrangement is a group of telecommuters to a particular corporation. Each user would have a spoke network connection that is associated with the corporation's hub connection. An ISP would be another example of the Qwest DSL™ Host service. ISPs can use Qwest DSL™ Host as an aggregation point for many subscribers in a given metro area. The Qwest DSL™ Host connection provides the central site with a high speed Asynchronous Transfer Mode (ATM) connection. The transport pipe provisioned to the Qwest DSL™ Host is available at a range of speeds:

- 1.5 Mbit/s (using DS-1 transport and delivering an ATM interface)
- 3-45 Mbit/s peak bandwidth in 3 Mbit/s increments; beginning with 3, 6, 9.... up to a nominal 45 Mbit/s, on a 45 Mbit/s ATM interface.
- 3-155 Mbit/s peak bandwidth in 3 Mbit/s increments; beginning with 3, 6, 9.... up to a nominal 155 Mbit/s, on a 155 Mbit/s ATM interface.

  Note: The 45 Mbit/s ATM interface, if direct mapped, has a maximum cell rate of 104,268 cells/sec or 44.210 Mbit/s.

  Note: A Qwest DSL™ Host using either the 45 Mbit/s or 155 Mbit/s ATM interface will only be allowed to have a maximum of 400 users (Point to Point Protocol (PPP) sessions or Virtual Circuits (VCs)) for each 3 Mbit/s of bandwidth purchased.

The choice of bandwidth at Qwest DSL™ Host allows the Qwest DSL™ Host subscriber (e.g., a telecom manager for a corporation, or the ISP network designer) to specify the appropriate performance level for the telecommuters or Internet users to which they are connected.

2.4 Details Behind DSL

The RADSL Modem, which is Customer Provided Equipment (CPE) and placed at the customer location, removes or places data traffic onto the same pair of wires that carries the customer's telephone service. The customer's telephone service is unaffected by the data traffic because the upstream (user to network direction) and downstream (network to user direction) data channels reside in frequency bands above the voice band. Figure 2-2 shows the representative spectral placements of the upstream and downstream channels, which are placed at frequencies above the POTS channel. The upstream channel occupies the lower frequencies and the downstream channel occupies the higher frequencies for the DSL line signals.

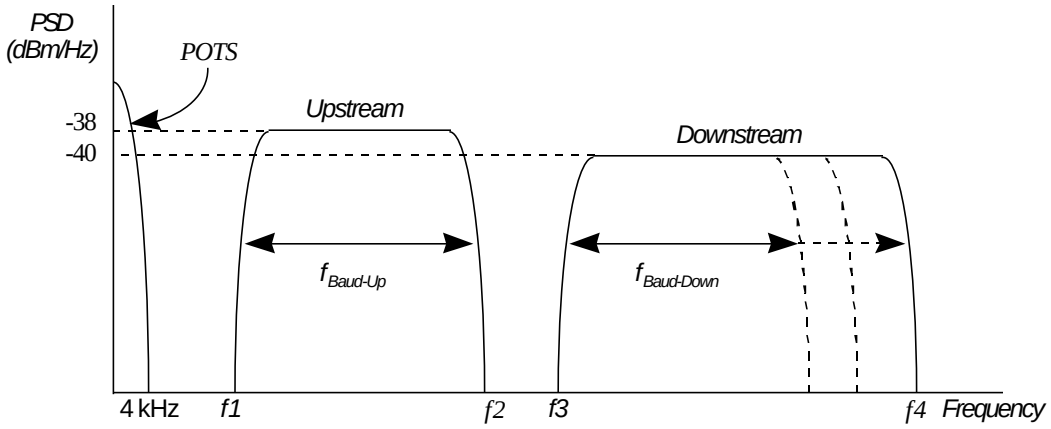

Figure 2- 2 Spectral Relationship of POTS Channel and Data Channels

Figure 2-3 shows the typical serving arrangement for a subscriber. The RADSL modem shown here can be either a stand-alone device or one that is inserted directly into the customer's computer. If the modem is a stand-alone device, it would be connected to the customer's computer by way of a high-speed data connection such as an Ethernet 10/100Base-T or Universal Serial Bus (USB). As previously mentioned, the modem is connected to the telephone wiring. This is accomplished by way of a RJ-11 jack. The customer's telephones are connected to the same telephone wiring. A device called a Microfilter must be placed in line with the cord from the telephone set. A Microfilter is used to prevent ringing transients from interfering with the RADSL signal.

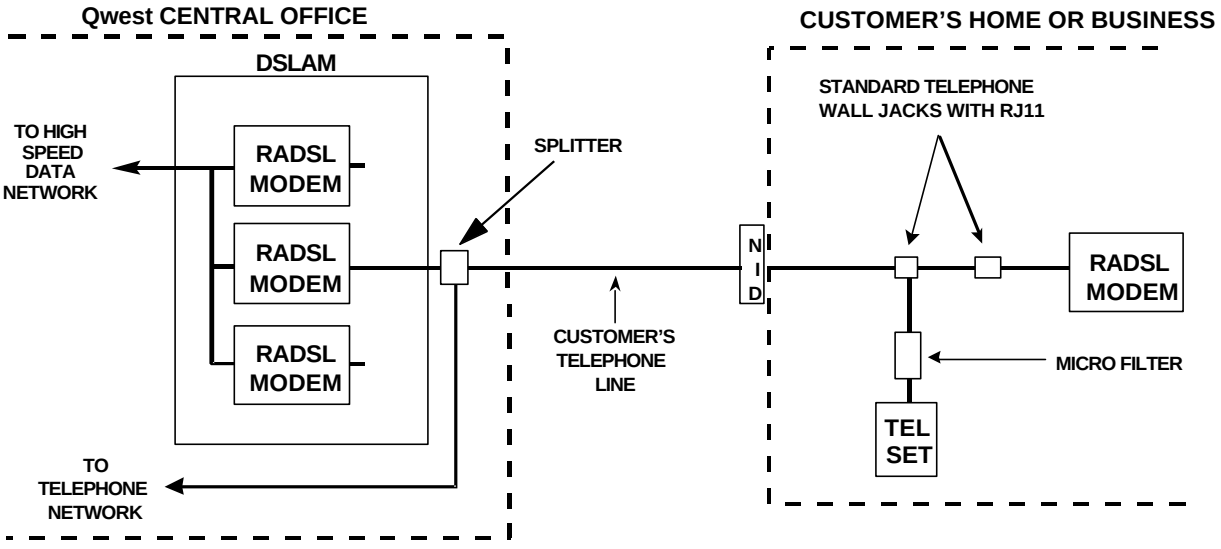

Figure 2- 3 Serving Arrangement for Qwest DSLÔ Subscriber

In the Qwest Corporation's Central Office (CO) (or Remote Terminal) a splitter separates the subscriber's data traffic and voice traffic. The subscriber voice traffic is sent on to the Qwest Corporation's Public Switched Telephone Network (PSTN). Data traffic is sent to a matching RADSL modem in a Digital Subscriber Line Access Multiplexer (DSLAM).

The RADSL modem inside a central office along with the RADSL modem inside the subscriber's home or business form what is referred to as the Digital Subscriber Line (DSL). The data from the subscriber is combined with data from other subscribers served by the same DSLAM and sent to a high-speed data network.

The above serving arrangement is what is used in all case with one exception. That exception is in the case where Plain Old Telephone Service (POTS) is served by what is called a Fiber To The Curb (FTTC) architecture. In a FTTC architecture, there is no physical way to combine the DSL signal with a POTS line. In this case, the DSL service will be provisioned on it's own pair of wires and not combined with any telephone service. In this case, there is no need for filters at the customer end because there is no splitter at the Qwest side that combines telephone service with the DSL signal.

Note 1: Grandfathered Qwest DSL Ô CAP Line Coding Service

The paragraphs below describe Qwest DSL™ Service using CAP Line Coding. All Qwest DSL™ Services using CAP line coding have been grandfathered at release of revision H of Technical Publication 77392, *"Qwest DSL Ô Service"*, April 2001.

In the DSLAM there may be a device called a Line Concentrator Chassis (LCC). It is physically between the splitter and the modem in the DSLAM and all subscriber lines are connected to this chassis, if it is present. The primary purpose of this chassis is to allow for the connection of any subscriber's line to any one of the designated groups of modems in the DSLAM. The equipment in the LCC has the ability to detect when a subscriber's modem is attempting to train and will connect the subscriber's line to one of the available modems in the DSLAM. In a 1 to 1 configuration the number of subscriber lines is equal to the number of modems in the DSLAM and the use of the LCC is optional.

The LCC also provides the ability to allow for subscriber line concentration. In this configuration the number of subscriber lines is greater than the number of modems in the DSLAM and is required in this situation. It is this feature that allows Qwest Corporation to make available a modem-pooled service. As with the 1 to 1 configuration, the equipment in the LCC detects that the subscriber modem is attempting to train. However, in the concentrated configuration the LCC will only be able to connect the subscriber's line to a modem if there is a modem available. If there is no available modem, the LCC will send a signal to the subscriber's modem that indicates there is no modem available. The signal that is sent to the subscriber's modem is described in section 2.4.2.

End Note 1:

2.4.1 Subscriber Modem Requirements

The subscriber must have a RADSL modem inside their home or business. The RADSL modem must conform to ANSI T1.413 Issue 2 1998, *"Telecommunications – Network and Customer Installation Interfaces – Asymmetric Digital Subscriber Line (ADSL) Metallic Interface"*.

Note 2: Grandfathered Qwest DSL Ô CAP Line Coding Service

The paragraphs below describe Qwest DSL™ Service using CAP Line Coding. All Qwest DSL™ Services using CAP line coding have been grandfathered at release of revision H of Technical Publication 77392, *"Qwest DSL Ô Service"*, April 2001.

For modem pooled configuration and discontinued 1 to 1 dedicated configuration, the RADSL modems must conform to Cisco Systems™ document number 78-6088-02, "Carrierless AM/PM Rate Adaptive Digital Subscriber Line Interface Specification", January 29, 1999.

RADSL modems that conform to versions of the interface specification which were published by NetSpeed™ and Cisco Systems™ document number 78-6088-02, "Carrierless AM/PM Rate Adaptive Digital Subscriber Line Interface Specification", January 29, 1999 will continue to work on CAP line coding. However for an upgrade to DMT line coding, it would be required for the user to upgrade their modem to one that complies with ANSI T1.413 Issue 2, 1998.

Users that subscribe to the Qwest DSL Select™ modem pooled version of the service must have a modem that conforms to Cisco Systems™ document number 78-6088-02, "Carrierless AM/PM Rate Adaptive Digital Subscriber Line Interface Specification", January 29, 1999. In particular, the modem must have an idle timer implemented in the modem that can be set by the network. This timer will be set using the Vendor Specific four 16-bit words that are exchanged when the customer modem, RTU-R, trains with the modem in the network. In addition, these words are used for determining compatibility and configuring feature sets. Section 5.1.6 of the above interface specification defines the information contained in these words.

End Note 2:

2.4.2 CISCO™ Digital Off-Hook (DOH) Signaling-Grandfathered

Note 3: Grandfathered Qwest DSL Ô CAP Line Coding Service

The paragraphs below describe Qwest DSL™ Service using CAP Line Coding. All Qwest DSL™ Services using CAP line coding have been grandfathered at release of revision H of Technical Publication 77392, *"Qwest DSL Ô Service"*, April 2001.

Qwest DSL Select™ modem pooled service, the Subscriber Service utilizes the Digital Off-Hook (DOH) signaling capability described in Section 5.1.7 of the Cisco Systems™ interface document mentioned above. However, only the "DOH Busy Signal" function of DOH Signaling is implemented at this time. It will be sent to the user's modem in the unlikely event that no modem is available in the network.

The "DOH Alert Signal" function is not implemented at this time.

Note: The DOH Busy Signal will be turned on even in the 1:1 configuration of the DSLAM. If the number of in service DSLAM modems becomes less than the number of subscribers connected to the DSLAM, those subscribers attempting to connect once all of the in service modems are busy will receive the "DOH Busy Signal".

End Note 3:

2.4.3 Loop Requirements

RADSL modems are designed to operate on copper loops that meet certain criteria. Customer's loops must meet those criteria in order for Qwest Corporation to even consider provisioning the service for the customer. Those criteria are:

- A loop no longer than 15,000 feet of 26-gauge copper or 18,000 feet of 24 gauge copper.
- The customer must be fed by a copper loop directly from the central office (future enhancements will allow customer served from Digital Loop Carrier (DLC) to qualify for this service).
- No load coils on loop.
- All bridge taps must be included in the total loop length.
- The sum of all bridged taps must not exceed 2,500 feet.

In addition, loop length (reach), wire gauge, and line noise are factors in determining the maximum downstream and upstream data rates that may be supported. The RADSL modem used by Qwest Corporation is capable of supporting downstream data rates from 256 Kbit/s up to 7168 Kbit/s; and upstream data rates from 272 Kbit/s up to 1088 Kbit/s as long as the Bit Error Rate (BER) is not in excess of $1x10^{-7}$. Since line noise is not constant, Qwest Corporation will provision the modem in the central office with a noise margin of 6dB for unknown impairments.

2.4.4 2.4.4 Service Speeds

Qwest Corporation will set a maximum downstream and upstream data rate based on the service selected by the customer.

In Section 2.2, Chapter 2, The Qwest DSL™ Service Technical Publication documents the customer has a selection of eight (8) data rates from which to choose. The data rates are service designations and represent a nominal data rate that the customer can connect. The actual payload supported in either the downstream or upstream direction may be different the documented service speeds.

At the time the customer requests a Qwest DSL™ service, the customer will be advised to the class of service speeds their loop will support. The customer may then select the service speed they desire.

The selected service speed will be used to software provision the central office modem for the maximum downstream and upstream data rates (maximum downstream and upstream payload) to be supported on the customer's line. These software settings will determine how the two (2) modems train or synchronize. In particular, it will control the constellation size and baud rate for both the downstream and upstream directions.

Note: Although the customer's line may have been provisioned for a particular maximum payload, the modems may train up at a rate lower than the maximum due to either impairments on or characteristics of the customer's loop.

Note 4: Grandfathered Qwest DSLÔ CAP Line Coding Service

The paragraphs below describe Qwest DSL™ Service using CAP Line Coding. All Qwest DSL™ Services using CAP line coding have been grandfathered per release of revision H of Technical Publication 77392, *"Qwest DSLÔ Service"*, April 2001.

Table 2-1 (For CAP Technology) below shows the relationship between the service speed, the maximum payload, constellation size, and baud rate.

Table 2-1 Service Speeds vs. Modem Training Parameters

Service Speed		Maximum Payload		Constellation Size		Baud Rate In Kbaud	
Down-stream	Upstream	Down-stream	Upstream	Down-stream	Upstream	Down-stream	Upstream
256 Kbit/s	256 Kbit/s	640 Kbit/s	272 Kbit/s	8	8	340	136
			OR				
256 Kbit/s	256 Kbit/s	640 Kbit/s	272 Kbit/s	64	8	136	136
			OR				
256 Kbit/s	256 Kbit/s	512 Kbit/s	272 Kbit/s	32	8	136	136
			OR				
256 Kbit/s	256 Kbit/s	384 Kbit/s	272 Kbit/s	16	8	136	136
			OR				
256 Kbit/s	256 Kbit/s	256 Kbit/s	272 Kbit/s	8	8	136	136
512 Kbit/s	512 Kbit/s	640 Kbit/s	544 Kbit/s	8	32	340	136
			OR				
512 Kbit/s	512 Kbit/s	640 Kbit/s	544 Kbit/s	64	32	136	136
			OR				
512 Kbit/s	512 Kbit/s	512 Kbit/s	544 Kbit/s	32	32	136	136
768 Kbit/s	768 Kbit/s	960 Kbit/s	816 Kbit/s	16	128	340	136
			OR				
768 Kbit/s	768 Kbit/s	896 Kbit/s	816 Kbit/s	256	128	136	136
			OR				
768 Kbit/s	768 Kbit/s	768 Kbit/s	816 Kbit/s	128	128	136	136
1 Mbit/s	1 Mbit/s	1280 Kbit/s	1088 Kbit/s	32	256UC	340	136
			OR				
1 Mbit/s	1 Mbit/s	1024 Kbit/s	1088 Kbit/s	256UC	256UC	136	136
4 Mbit/s	1 Mbit/s	4480 Kbit/s	1088 Kbit/s	256	256UC	680	136
			OR				
4 Mbit/s	1 Mbit/s	4480 Kbit/s	1088 Kbit/s	64	256UC	952	136
7 Mbit/s	1 Mbit/s	7168 Kbit/s	1088 Kbit/s	256UC	256UC	952	136

Note: 256UC represents an un-coded constellation size of 256. All other constellations depicted in the table are Trellis Encoded.

The constellation sizes and baud rates in the table above are described in Sections 5.1.3 and 5.1.5 of the Cisco Systems™ CAP RADSL interface document previously mentioned. This table does not represent all of the possible combinations of constellation size and baud rate that are currently supported by the Cisco Systems™ equipment being used by Qwest Corporation.

End Note 4:

2.4.5 Modem Pooled Service (Qwest DSL Select Ô) -Grandfathered

Note 5: Grandfathered Qwest DSL Ô CAP Line Coding Service

The paragraphs below describe Qwest DSL™ Service using CAP Line Coding. All Qwest DSL™ Services using CAP line coding have been grandfathered per release of revision H of Technical Publication 77392, *"Qwest DSL Ô Service"*, April 2001.

Modem pooling (Qwest DSL Select™) is an offering where a subscriber shares a pool of DSLAM modems with other users and has up to a 640 Kbit/s connection to either an ISP or Corporate LAN. Since the user is sharing a network modem (RTU-C) with other users, the service assumes that the user will disconnect from the network when they have ended their session with their ISP or Corporate LAN.

So that all subscribers in a given DSLAM have a fair opportunity to access a network modem (RTU-C), three timers are implemented that govern the length of time a subscriber is connected to a network modem (RTU-C). Those timers are:

- Idle Timer
- Session Timer
- Lockout Timer

Each of these timers will be discussed in further detail in the paragraphs below. These timers are under network control and can only be set by the network. The value to which each of these timers is set will be determined by Qwest Corporation and based on the ability of each subscriber to gain access to a network modem (RTU-C).

Idle Timer: The idle timer is used to drop the RADSL physical layer due to the lack of cell activity on the user interface. This timer is implemented in the network. The time set by the network is the number of minutes the timer should be allowed to run, without being reset, before the network modem (RTU-C) will drop or disconnect the RADSL Layer. Qwest Corporation is not using the Idle Timer described in the interface specification from Cisco Systems™, which is implemented in the customer's modem.

At the time of modem initialization the Vendor Specific four 16-bit words are exchanged between the network and the user. At this time the contents of the 4 Vendor Specific words sent from the user's modem are examined to determine the software version loaded in the modem.

Note: If the value of the software version in the 4 Vendor Specific Words is not equal to or greater than 1 and the user is subscribed to the modem pooled service, the user's modem will not be allowed to continue connecting to a network modem (RTU-C).

Once modem initialization is complete, the timer starts counting, and will continue to count, as long as the combined total of ingress and egress cells on any of the data PVCs is below a predetermined threshold (cells per minute). If the combined total of ingress and egress cells rises above the threshold, the Idle Timer will be reset or reinitialized based on the value originally set by the network. If the timer is allowed to expire, the network modem (RTU-C) will drop the RADSL layer to the customer (RTU-C). The current implementation of the timer will allow the network to set the idle time anywhere in the range from 1 minute to 511 minutes in 1 minute increments.

Session Timer: The session timer keeps track of the total amount of time a link is active once both the network and user modem have trained to each other, regardless of the amount data traffic. This timer is implemented in the network. Qwest Corporation is not using the Session Timer described in the interface specification from Cisco Systems™, which is implemented in the customer's modem.

The timer starts counting after modem initialization and continues until the user drops the link or until it expires. The timer can not be reset during a session. When the timer expires the network will disconnect the connection between the network modem (RTU-C) and the customer's modem (RTU-R). The current implementation of the timer will allow the network to set the session time anywhere in the range from 30 minutes to 600 minutes (10 hours) in 30 minute increments.

Lockout Timer: This timer is implemented in the network. It is only set upon the expiration of the session timer and will not allow a user to reconnect to a network modem (RTU-C) for some predetermined amount of time. The current implementation of this timer allows the network to prohibit a user from reconnection anywhere in a range from 1 to 30 minutes in 1 minute increments. The timer may also be disabled at the discretion of the network.

End Note 5:

2.4.6 Qwest DSL Ô IDSL

Qwest DSL™ IDSL is a service based on the physical layer transport technology of ISDN. The technical specifications of the physical layer will be the same as those for Qwest Corporation Digital Data Service 2-Wire in Qwest Corporation Technical Publication 77399, Issue A or later. The basic serving arrangement for IDSL is found in Figure 2-4 below.

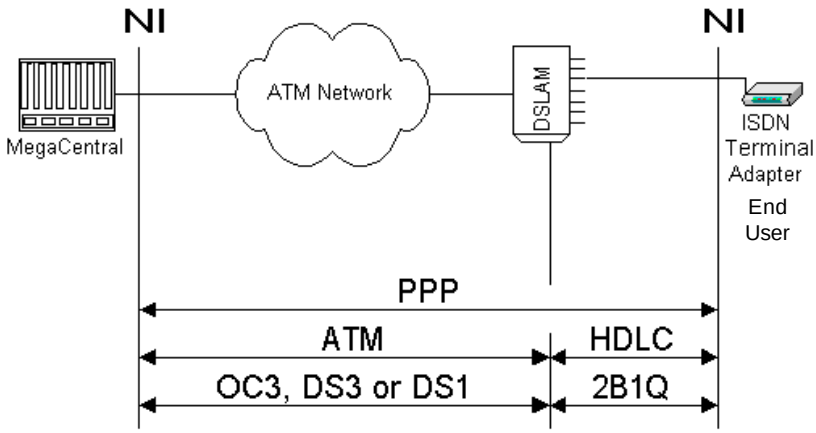

Figure 2- 4 IDSL Basic Serving Arrangement

In this serving arrangement, the DSL transceiver in the DSLAM will be the Line Termination (LT) in the circuit and end user's IDSN NT1/Terminal Adapter will be the Network Termination (NT). The functions of the LT and NT are described in ANSI T1.601-1992, *Telecommunications - Integrated Services Digital Network (ISDN) - Basic Access Interface for use on Metallic Loops for Application on the Network Side of the NT (Layer 1 Specification)*.

Note: When Qwest refers to ISDN or IDSL (xDSL-I) in Wholesale documentation, including the Product Catalog (PCAT), Technical Publications or the LSOG/ASOG documentation, they are referring to the same physical facility capabilities. Competitive Local Exchange Carriers (CLECs) can use these terms interchangeably, ONLY when talking about Loop Qualification or facility capabilities. Likewise, the loop make-up information in the RLD tool will indicate the same physical make-up for ISDN or IDSL requests.~~Note: When Qwest refers to ISDN or IDSL (xDSL-I) in Wholesale documentation, including the Product Catalog (PCAT), Technical Publications or the LSOG/ASOG documentation, they are referring to the same physical facility capabilities. Competitive Local Exchange Carriers (CLECs) can use these terms interchangeably, ONLY when talking about Loop Qualification or facility capabilities. Likewise, the loop make-up information in the RLD tool will indicate the same physical make-up for ISDN or IDSL requests.~~

The difference between ISDN and IDSL is that each can require specific transmission equipment in the CO to generate the appropriate signal. Although the facilities offer the same payload (144kbps), the equipment causes the distinction in the signal (i.e., ISDN = 2B+D channelized signal vs. IDSL = full payload un-channelized signal).

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This service involves the transport of Point to Point Protocol (PPP) from the end user on the right to the Qwest DSL™ Host on the left. It is, therefore, a requirement of the end user's

equipment to support PPP in HDLC Framing as described in Request for Comment (RFC) 1662. In addition, the network will expect that the end user's equipment is capable of bonding both B channels and the D channel for data transmission. This provides for a 144 Kbit/s connection to the Qwest Corporation DSLAM

2.4.7 Data Link Layer (Dedicated PVC Method)

The DSLAMs used by Qwest Corporation support the transport of ATM cells at the data link layer for RADSL modems. Virtual Channel Connection (VCC) address assignments are listed in Table 2-2. A Virtual Path Identifier (VPI) / Virtual Channel Identifier (VCI) address assignment of 0/32 is the default setting for customer premise equipment provided by Qwest Corporation.

Table 2- 2 ATM Address Assignments

CONNECTION TYPE	VPI/VCI ADDRESS	USAGE
VCC	0/32	Data
VCC	0/33	Data
VCC	0/34	Data
VCC	0/35	Data

Figure 2-5 depicts an end-to-end connection of three (3) Subscribers to two (2) Qwest DSL™ Hosts. Customers 1 and 2 have subscribed to Internet Service Provider (ISP) #2 and Customer 3 has subscribed to ISP #1. Each customer has a physical connection to the DSLAM in a serving central office. The customer's RADSL line is provisioned to their desired service speed. At layer 2, the ATM layer, each of the customers will have their own Permanent Virtual Circuit (PVC) between themselves and their subscribed Qwest DSL™ Host. The PVC arrangement ensures security and separation of customer data traffic through the Qwest Corporation network.

The subscriber's ATM address on the VCC between themselves and the DSLAM will be one of the VPI/VCI addresses listed in Table 2-2. At the DSLAM, each subscriber's VCC will be mapped into separate and unique ATM Network VCC. Each ATM Network VCC has a separate VPI/VCI address for the ATM link connecting the DSLAM to the Qwest Corporation ATM Network. For example, Customer #1's address on the ATM link may be 2/34 while Customers 2 and 3' addresses maybe 2/66 and 1/45, respectively. The ATM switch traffic parameters associated with each customer's VCC is based on an Unspecified Bit Rate (UBR) service class.

The Qwest DSL™ Host is connected to the Qwest Corporation ATM Network by way of an ATM Interface. At the ATM Interface, each subscriber PVC is mapped into an individual VCC. Each VCC has a unique VPI/VCI address. Each Qwest DSL™ Host's ATM link VCC is provisioned as an UBR class of service. The traffic parameters for each VCC on the Qwest DSL™ Host ATM link will be based on the subscribed service speed.

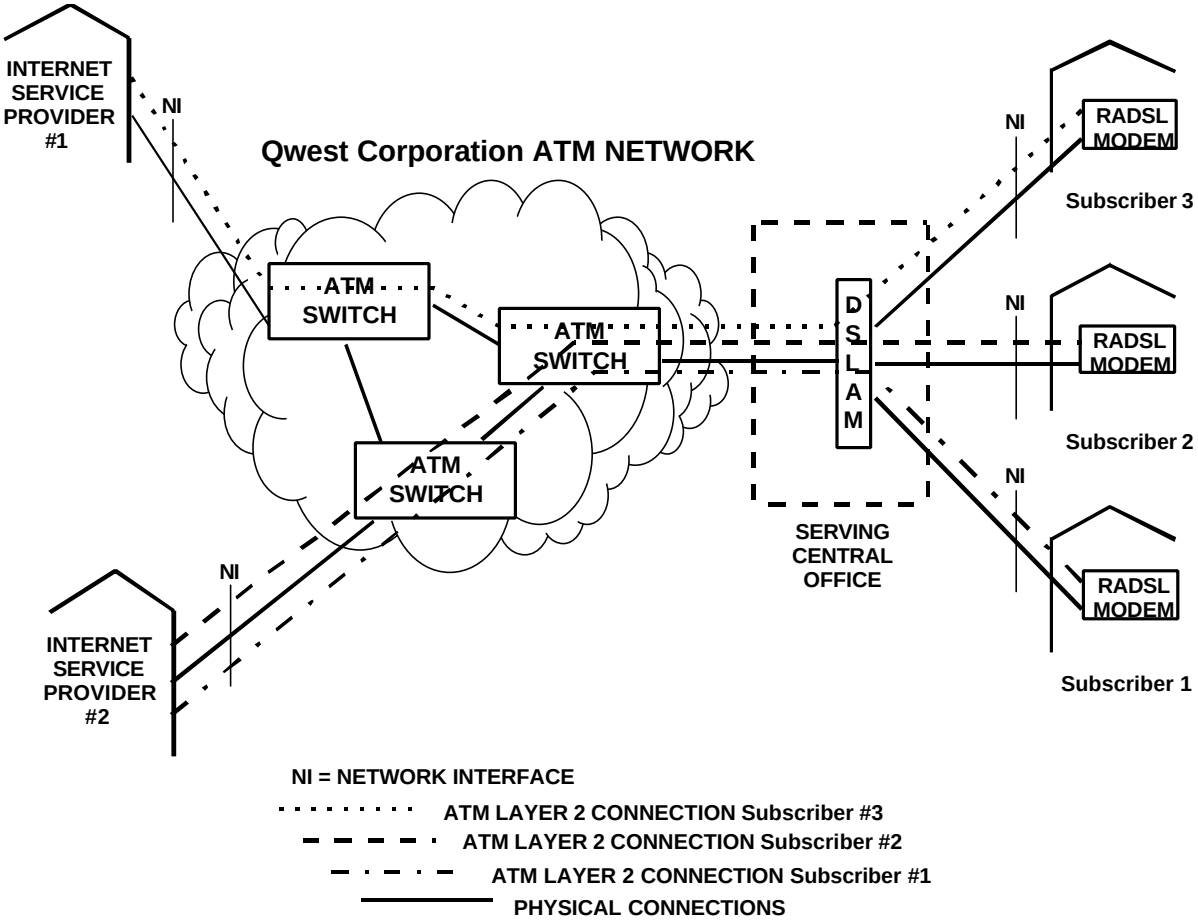

Figure 2- 5 End-to-End Layer 2 Connections

Note: Information on how the Unspecified Bit Rate (UBR) service class is implemented in the Qwest Corporation ATM Network can be found in Qwest Corporation Technical Publication 77378, "Qwest Corporation ATM Cell Relay Service", Issue D, or later

2.4.8 Data Link Layer (Tunneling Method Non-Concentrated)

In order to conserve virtual channels both in the network and on the access link to the Qwest DSL™ Host, Qwest Corporation offers the option for Subscriber traffic to be placed into a layer 2 tunnel prior to being delivered to the Qwest DSL™ Host. As with the dedicated PVC method described above, the connection to the network by the Subscriber is unchanged.

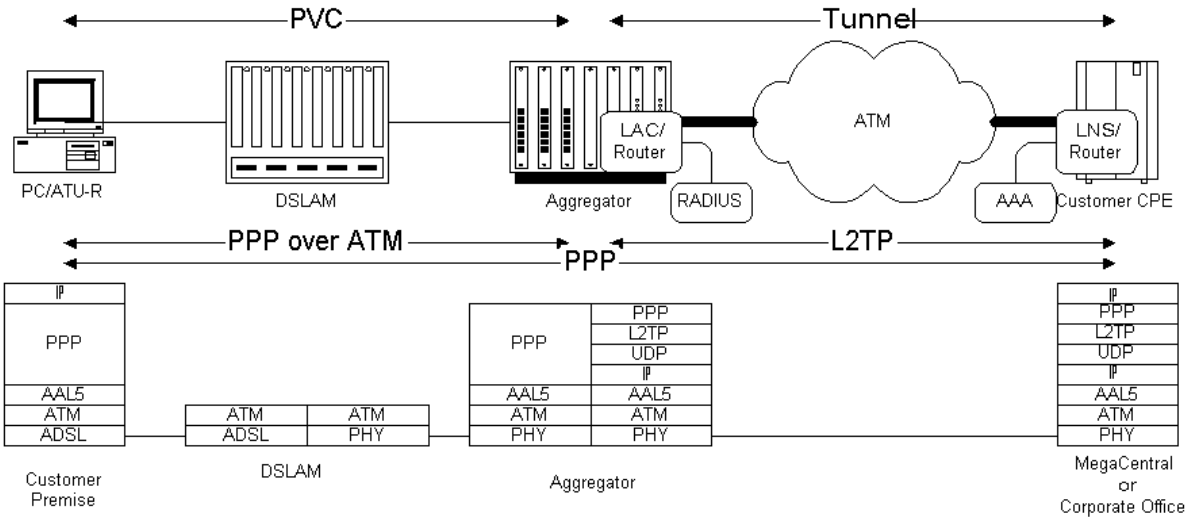

Figure 2- 6 Layer 2 Tunneling Connection

Figure 2-6 shows, at a high level, both the generic architecture and protocol stacks used to accomplish the tunneling of Subscriber traffic. From circuit point of view, the DSLAMs will connect to an aggregator instead of directly to an ATM switch. With the aggregator now in the network, the traffic received from customers may optionally be placed into a Layer 2 Tunneling Protocol (L2TP) tunnel prior to entering the ATM network. Any other customer traffic that is not to be placed in a tunnel will pass through the aggregator and into the ATM network just as before.

As can be seen by the above figure, the tunneling option involves the transport of PPP packets from the end user on the left to the Qwest DSL™ Host on the right. Therefore, in order for a Qwest DSL™ Host to have their customer's traffic placed into a tunnel, that customer must be communicating with the Qwest DSL™ Host by way of PPP. The encapsulation method used by the Subscriber using RADSL must be in accordance with RFC 2364 "PPP Over ATM Adaptation Layer 5" (PPP Over AAL5). Specifically, the customer's equipment must support virtual circuit multiplexed PPP payloads, as described in section 5 of that RFC.

Next, the Qwest DSL™ Host must support the protocol stack on the left side of Figure 2-6. The associated RFCs and protocol names are:

RFC 768, User Datagram Protocol (UDP)
RFC 2684, Multiprotocol Encapsulation over ATM Adaptation Layer 5
RFC 1661, Point-to-Point Protocol (PPP)
RFC 1662, PPP in HDLC-like Framing
RFC 2661, Layer 2 Tunneling Protocol (L2TP)
RFC 791, STD 5, Internet Protocol (IP)

In the paragraphs that follow are any restrictions or conditions that may apply to the above RFCs. If an RFC does not appear below, it may be assumed that no restrictions or conditions apply to the implementation of that RFC in this application.

RFC 2684:

Qwest Corporation will support both Logical Link Control (LLC) encapsulation and Virtual Circuit (VC) multiplexing. However, LLC encapsulation will be the default. In addition, in either LLC encapsulation or in VC multiplexing, Qwest Corporation will only support routed Internet Protocol (IP). Other routed protocols or any protocol, including IP, operating in bridged mode will not be supported.

RFC 2661:

The Qwest Corporation aggregation device will function as the L2TP Access Concentrator (LAC). The Qwest DSL™ Host will have the device that will function as the L2TP Network Server (LNS). As the LAC, Qwest Corporation will not perform the functions of Authentication, Authorization and Accounting (AAA) for the Qwest DSL™ Host. However, the Qwest Corporation LAC will bind a specific Subscriber to a specific L2TP tunnel that is assigned to a specific Qwest DSL™ Host. Future enhancements will provide the capability to allow a user to select a tunnel based on a L2T domain name provided during the PPP establishment/login process.

Section 4.3. Hiding of AVP Attribute Values: This section describes a method of indicating to a peer that the present value of an Attribute Value Pair (AVP) is hidden. Qwest Corporation will not support this capability at this time.

Section 4.4.5. Proxy LCP and Authentication AVPs: This section describes Attribute Value Pairs (AVP) and methods for negotiating LCP and user authentication. This does not apply to the implementation of L2TP Tunnels for Qwest DSL™ services.

Section 5.1 Control Connection Establishment: The tunnels will be predefined in both the Qwest Corporation aggregation network and the Qwest DSL™ Host's router. The Qwest Corporation LAC will establish the L2TP tunnel when the first Subscriber who is bound to the tunnel attempts to establish a PPP session with the Qwest DSL™ Host. The tunnel will remain established as long as there is at least one active PPP session across the tunnel.

Section 5.1.1 Tunnel Authentication: Qwest Corporation will assign the tunnel name and domain name based on the registered domain name of the Qwest DSL™ Host. Also, Qwest Corporation will assign the tunnel password and provide the tunnel name, tunnel password and tunnel domain name to the Qwest DSL™ Host. For the case were the Qwest DSL™ Host has Virtual Circuits from 2 or more aggregation devices in the US WEST network; the tunnel name, password and tunnel domain name for the first tunnel on each of those VCs will be the same. It will be the end point IP addresses assigned to each tunnel that will uniquely identify the tunnel. This is depicted in figure 2-7 below.

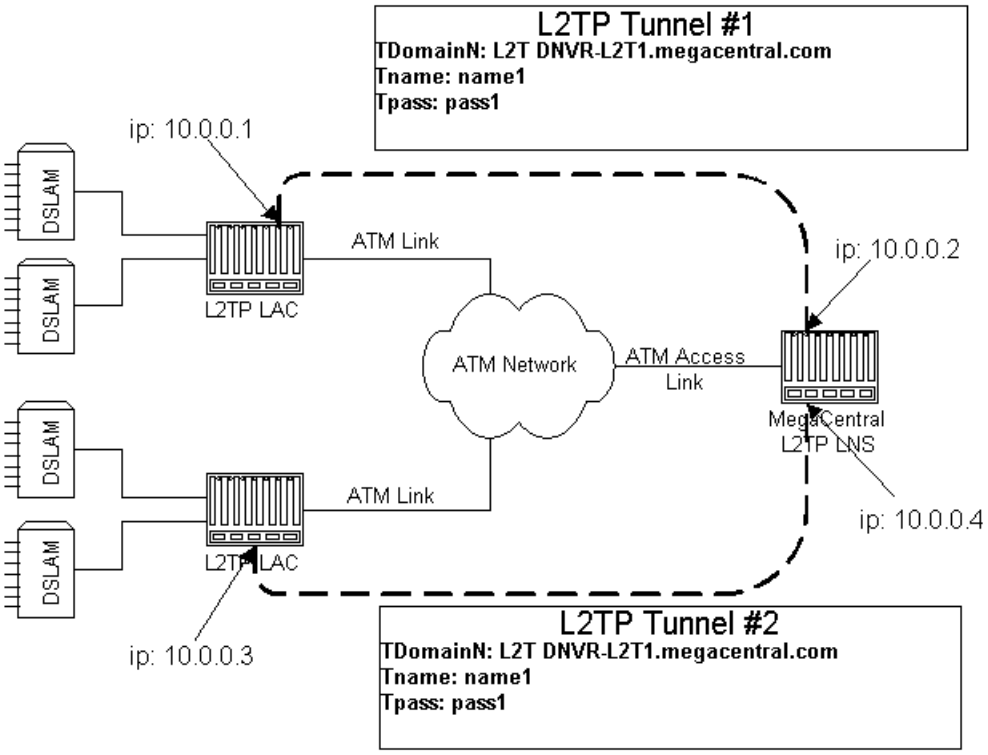

Figure 2- 7 Tunnel Naming

Qwest Corporation will assign the end point IP addresses for each PVC between the Qwest Corporation LAC and the Qwest DSL™ Host LNS. Those IP addresses will be private IP addresses and in the format of 10.x.x.x.

The default tunnel termination point will be the IP address associated with the first PVC we deliver to the Qwest DSL™ Host. The network 10.x.x.x address that we assign to the PVC that carries the tunnel is only required to terminate the tunnel at the edge of the ISP's network. This IP subnet does not need to be known throughout the ISP's network. If our pre-assigned network 10.x.x.x address overlaps with the ISP's addressing scheme we will try to resolve that issue by changing our addressing to a different network 10.x.x.x address. The Qwest DSL™ Host will also have the option to provide Qwest Corporation with an alternate IP address to terminate the tunnel. This IP address will come out of the Qwest DSL™ Host's registered address space.

Section 5.2.1 Incoming Call Establishment: Normal PPP session establishment will be initiated by the LAC when it detects a Subscribers attempt to establish a PPP session to their Qwest DSL™ Host.

Section 5.2.2 Outgoing Call Establishment: Although the LAC has the capability to respond to PPP session establishment from the LNS, this capability will not be enabled. This is because Qwest Corporation does not currently support the capability of a Qwest DSL™ Host to establish communication with a Subscriber.

Section 5.6 Session Teardown: Either the LAC or the LNS may initiate the disconnection of a PPP session across the tunnel.

Section 5.7 Control Connection Teardown: Either the LAC or the LNS may initiate the disconnection the tunnel.

As stated before, the Qwest Corporation aggregation device will function as the LAC. Point of fact, each of the aggregation devices will have the ability to have multiple LACs. Each of these LACs have limits that will limit both the number of PPP session and the number of tunnels that may be delivered to a Qwest DSL™ Host on a single PVC for any given LAC. Currently those limits are:

- 1800 PPP sessions per LAC
- 190 tunnels per LAC

These limits may be raised in the future as the equipment used by Qwest Corporation is improved.

In addition, Qwest Corporation will limit the number of tunnels on a single access link to a Qwest DSL™ Host. Those limits are:

- 3000 tunnels over a single OC3
- 1000 tunnels over a single DS3
- 100 tunnels over a single DS1

Qwest Corporation will also place a maximum limit on the number of PPP sessions on a single access link. Those limits are:

- 18000 PPP sessions over a single OC3
- 6000 PPP sessions over a single DS3
- 223 PPP sessions over a single DS1

In addition, it will be the responsibility of the Qwest DSL™ Host to inform Qwest Corporation of the limitations of their LNS. This so that during the provisioning process, Qwest Corporation does not create tunnels or assign subscribers to established tunnels that will exceed the limits or capacity of the Qwest DSL™ Host's LNS.

2.4.9 Data Link Layer (Tunnel Method Concentrated)

Qwest Corporation will offer an option were we will concentrate the tunneled traffic from multiple LACs in the Qwest Corporation network prior to handing that traffic off to the Qwest DSL™ Host. All of what was discussed in the previous section applies with following changes or exceptions.

The high level architecture for concentrated delivery of tunneled traffic appears in the figure below.

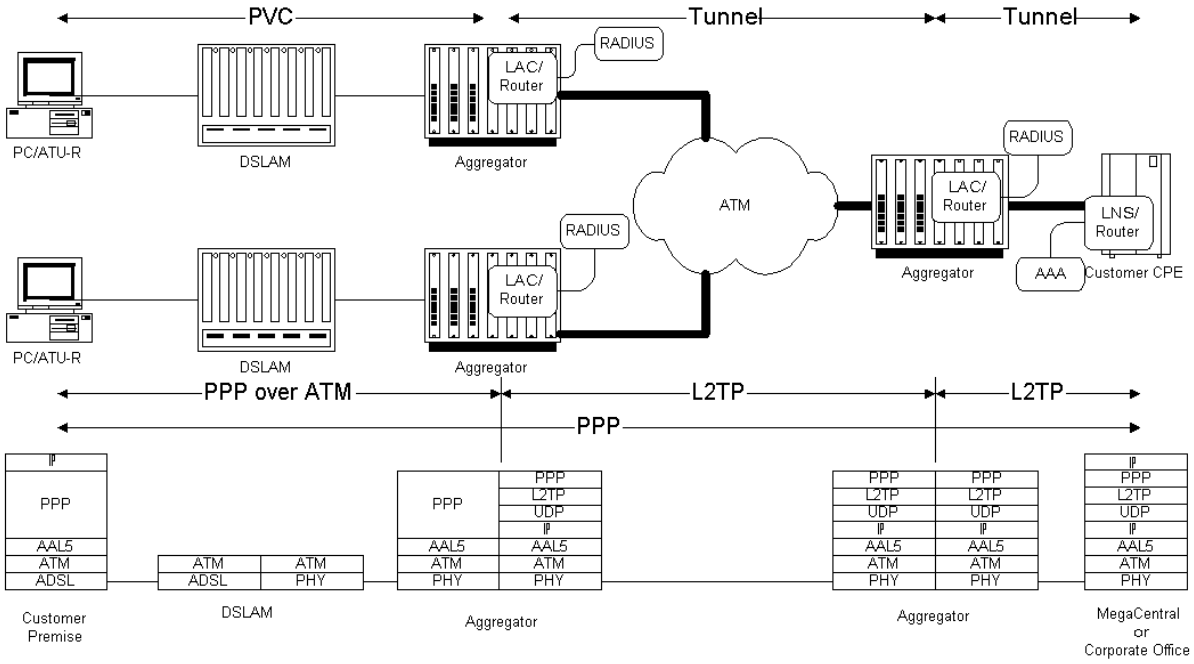

Figure 2- 8 L2TP Tunnel Concentration

As can be seen in the figure above, an additional aggregation device with LAC functionality has been inserted at the point in the network prior to the delivery of traffic to the Qwest DSL™ Host. In this configuration, each LAC is currently only capable of delivering 1000 PPP sessions to a Qwest DSL™ Host. This limit may be raised in the future with improvements to the equipment used by Qwest Corporation.

2.4.10 Management Plane

With the advent of modem pooled service, a management channel will exist between the DSLAM and the user's RADSL modem. Information about that channel is contained in section 5.2.3 of the interface specification from Cisco Systems™ previously referenced.

Note: Although the management channel is currently only used for the modem pooled service, future enhancements to the Qwest DSL™ service may require the use of the management channel for dedicated service.

The management channel can support a number of messages, but for the current implementation only two (2) messages will be supported. Those messages are DISPLAY and TERMINATE. In each of these message there will be a string of bytes that contain a message, in 7 bit ASCII format, that is destine to be displayed on the user's terminal.

The DISPLAY message will be sent to the user's modem when the session timer is about to expire. The text contained in the DISPLAY message is as follows:

Your allowed session time is nearly expired. Your modem will disconnect in 10 minutes.

The TERMINATE message will be sent to the user's modem when either the Idle timer or the Session timer has expired. The text contained in the TERMINATE message if the Session timer expires is as follows:

Your session has been disconnected due to session length. You will be able to reconnect in five minutes.

The text contained in the TERMINATE message if the Idle timer expires is as follows:

Your session has been disconnected due to inactivity.

The above messages are subject to change as the modem pooled service becomes more mature.

2.4.11 Microfilter Specifications

In Figure 2-3 a microfilter is shown to be in line with the telephone set. The specifications for this microfilter can be obtained from Cisco Systems™ by purchasing document number 78-6089-01, "EZ-DSL Microfilter Specification", January 29, 1999. Qwest Corporation will supply the customer with two (2) of these micro filters at no charge when they purchase their RADSL modem. Additional microfilters may be purchased for a nominal additional charge.

The customer does not need to place this microfilter in series with their telephone sets. However, it is recommended that the microfilter be placed in series with all telephone sets so ringing transients do not interfere with the RADSL signal. Ringing transients may cause sufficient noise in the RADSL signal to cause the modems to retrain. If the customer is in the middle of a data session, that data session will be interrupted and may resume once the modems retrain.

2.5 Qwest DSLÔ Host

Qwest Corporation provides an ATM cell transport service to the Subscriber, the interface to the Qwest DSL™ Host customer will be one of the ATM interfaces provided by Qwest Corporation in its' Cell Relay service. Technical information about these interfaces can be found in Qwest Corporation Technical Publication 77378, "Qwest ATM Cell Relay Service", Issue D or later.

Information particular to the ATM interface supporting Qwest DSL™ Host is found below.

- The ATM class of service for all Permanent Virtual Circuits (PVCs) provisioned on the interface will be Unspecified Bit Rate (UBR).
- In the case of the dedicated PVC method of delivery of Subscriber data to the Qwest DSL™ Host, there will be one VCC provisioned on the interface for each Subscriber connected to a Qwest DSL™ Host.
- The maximum throughput per VCC will be determined by the service rate to which the Subscriber subscribes.
- 1.5 Mbit/s., 45 Mbit/s and 155 Mbit/s ATM interface are available at this time.
- The nominal peak bandwidth on a 45 Mbit/s ATM interface will be 3-45 Mbit/s. This peak bandwidth will be provisioned in 3 Mbit/s increments; beginning with 3, 6, 9....up to a nominal 45 Mbit/s.
- The nominal peak bandwidth on a 155 Mbit/s ATM interface will be 3-155 Mbit/s. This peak bandwidth will be provisioned in 3 Mbit/s increments; beginning with 3, 6, 9.... up to a nominal 155 Mbit/s.

Note: A Qwest DSL™ Host using either the 45 Mbit/s or 155 Mbit/s ATM interface will only be allowed to have a maximum of 400 users (PPP sessions or VCs) for each 3 Mbit/s of bandwidth purchased.

- In the case of the dedicated PVC method, the locally significant VCC address for each subscriber will be provided to the Qwest DSL™ Host Customer at the time the subscriber service is provisioned in the Qwest network.
- Qwest DSL™ Host service will only be available in those LATAs where both the Qwest DSL™ Service and Cell Relay Service have been tariffed.
- Due to regulatory restriction on the transport of data between Local Access and Transport Areas (LATAs), the Qwest DSL™ Host must be in the same LATA as the Subscribers it servers.
- For those Qwest DSL™ Hosts who will receive customer traffic from customers using Qwest DSL™ IDSL, the Qwest DSL™ Host must be able to support both virtual circuit multiplexed PPP and Logical Link Control (LLC) encapsulated PPP payloads as described in Request for Comments (RFC) 2364, "PPP over ATM Adaptation Layer 5 (AAL5)".

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 T1.223-1991, *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. This chapter defines the NCI codes used with voice grade services.

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.

Network Channel Interface Code

Total Conductors		Protocol		Impedance	Delimeter	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.

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 when less than three characters are specified.

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.

3.3 DMT RADSL Interface for Subscribers

The DMT line coding version of Qwest DSL™ Services provides the subscriber with a Discrete Multi-Tone (DMT) Rate Adaptive Digital Subscriber Line (RADSL) interface. The valid NC/NCI codes for this interface are found below in Table 3-1.

Table 3- 1 Valid NC/NCI Code Combinations for DMT Subscriber

NCI Code	NC Code	Description
02DU9.01A	AC-H	DMT RADSL line with one POTS Channel and with up to 256 Kbit/s of data downstream and up to 256 Kbit/s upstream
02DU9.01A	AC-I	DMT RADSL line with one POTS Channel and with up to 640 Kbit/s of data downstream and up to 256 Kbit/s upstream
02DU9.01A	AC-C	DMT RADSL line with one POTS Channel and with up to 640 Kbit/s of data downstream and upstream
02DU9.01A	AC-J	DMT RADSL line with one POTS Channel and with up to 1.024 Mbit/s of data downstream and up to 1 Mbit/s upstream
02DU9.01A	AC-K	DMT RADSL line with one POTS Channel and with up to 4 Mbit/s of data downstream and up to 1 Mbit/s upstream
02DU9.01A	AC-L	DMT RADSL line with one POTS Channel and with up to 7 Mbit/s of data downstream and up to 1 Mbit/s upstream

The table on the next page shows the valid NC/NCI code combinations when the DSL service is provisioned on Fiber To The Curb (FTTC) architecture for Plain Old Telephone Service (POTS).

Table 3- 2 Valid NC/NCI Code Combinations for DMT Subscriber on FTTC

NCI Code	NC Code	Description
02DU9.00A	AC-H	DMT RADSL line with one POTS Channel and with up to 256 Kbit/s of data downstream and up to 256 Kbit/s upstream
02DU9.00A	AC-I	DMT RADSL line with one POTS Channel and with up to 640 Kbit/s of data downstream and up to 256 Kbit/s upstream
02DU9.00A	AC-C	DMT RADSL line with one POTS Channel and with up to 640 Kbit/s of data downstream and upstream
02DU9.00A	AC-J	DMT RADSL line with one POTS Channel and with up to 1.024 Mbit/s of data downstream and up to 1 Mbit/s upstream
02DU9.00A	AC-K	DMT RADSL line with one POTS Channel and with up to 4 Mbit/s of data downstream and up to 1 Mbit/s upstream
02DU9.00A	AC-L	DMT RADSL line with one POTS Channel and with up to 7 Mbit/s of data downstream and up to 1 Mbit/s upstream

3.4 CAP RADSL Interface for Subscribers

The CAP line coding version of Qwest DSL™ Services provides the subscriber with a Carrierless Amplitude/Phase Modulation (CAP) Rate Adaptive Digital Subscriber Line (RADSL) interface. The valid NC/NCI codes for this interface are found below in Table 3-3. CAP RADSL is grandfathered, but is supported for indeterminate amount time.

Table 3- 3 Valid NC/NCI Code Combinations for CAP Subscriber

NCI Code	NC Code	Description
02DU9.01C	ACCA	CAP RADSL line with one POTS Channel and with up to 256 Kbps of data Upstream and Downstream
02DU9.01C	ACCB	CAP RADSL line with one POTS Channel and with up to 512 Kbps of data Upstream and Downstream
02DU9.01C	ACCC	CAP RADSL line with one POTS Channel and with up to 768 Kbps of data Upstream and Downstream
02DU9.01C	ACCD	CAP RADSL line with one POTS Channel and with up to 1 Mbps of data Upstream and Downstream
02DU9.01C	ACCE	CAP RADSL line with one POTS Channel and with up to1 Mbps of data Upstream and up to 4 Mbps of data Downstream
02DU9.01C	ACCF	CAP RADSL line with one POTS Channel and with up to 1 Mbps of data Upstream and up to 7 Mbps of data Downstream

3.5 Qwest IDSLÔ Interface

The Qwest DSL™ IDSL service is based on well known Integrated Services Digital Network (ISDN) technology. Unlike traditional ISDN, the customer's loop facility is connected to a DSLAM instead of an ISDN switch. Also, with this service we must specify how the subscriber bonds the B and D channels of the physical transport and the protocol the network expects to see above the physical layer. Therefore, the NC/NCI codes to order this service are different than those used for traditional ISDN. Table 3-4 below has those codes and there explanation.

Table 3- 4 Valid NC/NCI Code Combinations for Qwest DSLÔ IDSL

NCI Code	NC Code	Description
02IS5.N	ADP-	2B1Q Signaling Format - U Interface per TR-NWT-000393, e.g., Basic Rate ISDN, Digital Subscriber Line (DSL). Customer provides NT function to the Service Provider, using the Point to Point Protocol (PPP) with 128 Kbps data payload.
02IS5.N	ADPA	2B1Q Signaling Format - U Interface per TR-NWT-000393, e.g., Basic Rate ISDN, Digital Subscriber Line (DSL). Customer provides NT function to the Service Provider, using the Point to Point Protocol (PPP) with 144 Kbps data payload.

3.6 ATM Interface for Qwest DSLÔ Host

With the new version of the Qwest DSL™ Service the Qwest DSL™ Host customer will be provided with an Asynchronous Transfer Mode (ATM) interface on either a DS1 (1.544 Mbit/s), DS3 (44.736 Mbit/s), or OC-3 (155.520 Mbit/s). Valid NC/NCI code combinations for these interfaces can be found in Qwest Corporation Technical Publication 77378, “Qwest Corporation ATM Cell Relay Service”, Issue D or later.

CONTENTS

Chapter and Section **Page**

4. Definitions

4.1 Acronyms

AAA	Authentication, Authorization and Accounting
AAL	ATM Adaptation Layer
ADSL	Asymmetrical Digital Subscriber Line
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
ATM	Asynchronous Transfer Mode
AVP	Attribute Value Pair
BER	Bit Error Rate
BIT	Binary Digit
bps	Bits Per Second (Now bit/s)
CAP	Carrierless Amplitude/Phase modulation
CCITT	Consultative Committee on International Telephone and Telegraph
CFA	Carrier Facility Assignment
CLEC	Competitive Local Exchange Carrier
CO	Central Office
COE	Central Office Equipment
CPE	Customer Premises Equipment
DCE	Data Circuit Terminating Equipment
DMT	Discrete Multitone
DTE	Data Terminal Equipment
DSL	Digital Subscriber Line
ESP	Enhanced Service Provider
EU	End-User
FDX	Full Duplex
FTTC	Fiber To The Curb
HDLC	High Data Link Control
HDSL	High Bit Rate DSL
IDSL	ISDN Digital Subscriber Line
IEEE	Institute for Electrical and Electronic Engineers
IOC	Inter-Office Channel

IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ISP	Internet Service Provider
ITU	International Telecommunication Union (formerly CCITT)
Kbit/s	kilobits per second (1,000 bit/s)
L2T	Layer 2 Tunnel
L2TP	Layer 2 Tunneling Protocol
L2_PDU	Layer 2_Protocol Data Unit
L3_PDU	Layer 3_Protocol Data Unit
LAC	L2TP Access Concentrator
LAN	Local Area Network
LATA	Local Access and Transport Area
LLC	Logical Link Control
LNS	L2TP Network Server
MAN	Metropolitan Area Network
MAU	Medium Attachment Unit
Mbit/s	Megabit per Second
NC	Network Channel
NCI	Network Channel Interface
NCTE	Network Channel Terminating Equipment
NE	Network Element
NI	Network Interface
POTS	Plain Old Telephone Service
PPP	Point to Point Protocol
PPSN	Public Packet Switched Network
PSN	Public Switched Network
PSTN	Public Switched Telephone Network
PVC	Permanent Virtual Connection
QAM	Quadrature Amplitude/Phase Modulation
RADSL	Rate Adaptive Digital Subscriber Line
RFC	Request For Comments
RTU-C	RADSL Terminating Unit Central office end

RTU-R	RADSL Terminating Unit Remote terminal end
SHDSL	Single Line HDSL
SVC	Switched Virtual Circuit
TIA	Telecommunications Industry Association
TOC	Table of Contents
UBR	Unspecified Bit Rate
UDP	User Datagram Protocol
VCC	Virtual Channel Connection
VCI	Virtual Channel Identifier
VDSL	Very High Bit Rate DSL
VF	Voice Frequency
VPI	Virtual Path Identifier

4.2 Glossary

Acronym

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

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.

Asynchronous Transfer Mode (ATM)

An information transfer method in which the information is organized into fixed length (53 octet) cells. It is asynchronous in the sense that the recurrence of cells containing user information is not necessarily periodic.

Asynchronous Transmission

Not synchronous: Data transmission in which the time of occurrence of specified significant instant of a data bit (usually the leading edge) is arbitrary, and occurs without necessarily having a fixed time relationship to preceding comparable instants.

Asymmetrical Digital Subscriber Line

A technology that allows for the delivery of simultaneous Plain Old Telephone Service (POTS) and high bit rate transport on the same pair of copper wires. The word asymmetrical refers to the high bit rate transport because the downstream (wire center to subscriber) bit rate is greater than the upstream (subscriber to wire center) bit rate.

Attachment Unit Interface Cable (AUI)

The cable, connectors, and transmission circuitry used to interconnect the Physical Signaling (PLS) and Medium Attachment Unit (MAU).

Availability

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

Attribute Value Pair (AVP)

The variable length concatenation of a unique Attribute (represented by an integer) and a Value containing the actual value identified by the attribute. Multiple AVPs make up Control Messages which are used in the establishment, maintenance, and teardown of tunnels.

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.

Basic Encoding Rules (BER)

The OSI language for describing transfer syntax.

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.

Bit Error Rate (BER)

The ratio of bits received in error compared to the total number of bits received. It is normally express as a number in scientific notation. For example, the BER of $1x10^{-6}$ would represent the ratio of 1 bit received in error for every 1 million bits received.

Bit Rate

The number of bits of data transmitted over a line in a given unit of time, usually one second.

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.

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.

Carrier Sense Multiple Access with Collision Detection (CSMA/CD)

Carrier Sense Multiple Access with Collision Detection is a method of controlling access to a shared transmission path, particularly in local area networks.

Carrierless Amplitude/Phase Modulation (CAP)

Carrierless Amplitude/Phase Modulation is form of line code used for Digital Subscriber Lines. It is a form of Quadrature Amplitude/Phase Modulation (QAM) that does not use a carrier frequency.

Central Office (CO)

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

Central Office Connecting Channel (COCC)

A tariff rate category which provides for connections, within the same Hub wire center, between the Private Line Transport Channel and other services provided by U S WEST. See FCC #5 for more information.

Channel

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

Character

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

Conditioning

Denotes an enhancement to the transmission performance of a voiceband channel. Parameter(s) affected are attenuation distortion, envelope delay distortion and noise.

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 same customer's premises.

Customer Premises Equipment (CPE)

All telecommunication equipment located at a customers location.

Customer Premises Equipment (CPE)

Customer telecommunications equipment, such as telephone sets, PBXs, modems and answering machines. The FCC regulations about CPE do not cover inside wire, coin-operated pay phones, some multiplexers, or voltage protection equipment.

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 U S WEST. 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.

Data Communications Equipment (DCE)

The equipment that provides the functions required to establish, maintain and terminate data transmission connections; e.g., a modem, as well as the signal conversion and coding required for communications between data terminal equipment and data circuit.

Data Terminal Equipment (DTE)

A generic term for customer terminal equipment that connects to the network through a modem or through digital Network Channel Terminating Equipment (NTCE), e.g., a computer or a PBX.

Digital Connectivity

Denotes central offices or customer premises that are connected with digital transport facilities.

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.

Digital Subscriber Line (DSL)

A generic term for a subscriber line that is conditioned to accommodate signals above the Voice Band. In earlier definitions this term was used strictly in conjunction with ISDN but has been expanded to define any subscriber line that can be used for any of the DSL Technologies available (e.g., ADSL, HDSL, etc.).

Downstream

Downstream refers to the direction that data is transmitted in relationship to the network and indicates that data is being sent from the network to the user.

End Office

A designation of a Qwest Communications Company 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 Communications Company 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 Communications Company’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 widely used data communication standard employing a bus topology and Carrier Sense Multiple Access with Collision Detection (CSMA/CD) as access control mechanism.

Exchange

A unit established by Qwest Communications Company for the administration of communications service in a specified geographic area that usually embraces a city, town, or village and its environs.

Facility Termination Point

Generic term for the point of termination, in the Wire Center, for a cable pair, optic fiber, micro-wave signal, etc.

Facilities

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

Fiber To The Curb

This term refers to an architecture for providing telephone service where fiber optic cable is connected to an Optical Network Unit (ONU) that provides the telephone services. The ONU is located in close proximity to the homes being served (typically less then 1000 feet). The copper drop to the home is the connection between the ONU and the home.

Flow Control

The function of managing the rate at which data is received/transmitted by a receiver/transmitter.

Foreign Exchange

Telephone company line arrangement where calls placed into the switched network, from a customer location, enter the network through a Central Office located in a Wire Center which is different than the one which normally services the customer location.

Full Duplex (FDX)

Simultaneous transmission in both directions between two points.

High bit rate Digital Subscriber Line (HDSL)

A technology to put two-way T-1 on a normal unshielded, bridged (but not loaded) twisted pairs (usually 2 pairs) without using repeaters.

Half-Duplex

Transmission in either direction between two points, but not simultaneously.

Half-Duplex Operation

Capability of transmitting and receiving signals, but only in one direction at a time.

Headroom

The difference, in dB, between the operating level and the overload level.

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.

Impedance Balance

A measure of the degree of equality of the two impedances that are connected to the two conjugate ports of a hybrid set (or equivalent circuit).

Integrated Services Digital Network (ISDN)

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

Interface Code

See Network Channel Interface

Internet Service Provider (ISP)

A service provider that provides access to the Internet. In addition, the ISP may provide services and information that can be only accessed by their subscribers.

Kilobit/Second (Kbit/s)

One thousand (1000) bits/second

L2TP Access Concentrator (LAC)

A node that acts as one side of an L2TP tunnel endpoint and is a peer to the L2TP Network Server (LNS). The LAC sits between an LNS and a remote system and forwards packets to and from each. Packets sent from the LAC to the LNS requires tunneling with the L2TP protocol. The connection from the LAC to the remote system is either local or a PPP link.

L2TP Network Server (LNS)

A node that acts as one side of an L2TP tunnel endpoint and is a peer to the L2TP Access Concentrator (LAC). The LNS is the logical termination point of a PPP session that is being tunneled from the remote system by the LAC.

Layer 1

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

Layer 2

Data Link Layer is the second layer of the Open Systems Interconnection (OSI) data communications model of the International Standards Organization (ISO). It provides for the transfer of data between directly connected systems and detects any errors in the transfer. It establishes, maintains and releases data links and provides procedures and methods for handling errors and flow control.

Layer 2 Tunneling Protocol [RFC2661]

L2TP extends the PPP model by allowing the L2 and PPP endpoints to reside on different devices interconnected by a packet-switched network. With L2TP, a user has an L2 connection to an access concentrator (e.g., modem bank, ADSL DSLAM, etc.), and the concentrator then tunnels individual PPP frames to the Network Access Server (NAS). This allows the actual processing of PPP packets to be divorced from the termination of the L2 circuit.

Layer 3

Network Layer. Provides routing and relaying through intermediate systems. Also handles segmenting, blocking, error recovery, and flow control.

Layer 4

Transport Layer. Provides the transparent transfer of software between end systems. It handles end-to-end control (for example, determining if all packets have arrived), multiplexing, and mapping.

Layer 5

Session Layer. Provides administration and control sessions between application processes and manages their data.

Layer 6

Presentation Layer. Provides representation, interpretation, format and code transformation of information communicated between or referred to by application processes. MEDIACC™ uses standard ASN.1 representations for all messages and data communicated remotely. It uses standard presentation encoding, decoding, and transfer syntaxes.

Layer 7

Application Layer. Provides a window between application processes in order to exchange meaningful information. Performs management functions.

Line

The transport facility (cable pair or carrier channel) between the Central Office and Network Channel Interface.

Line-Type Connection

Denotes a connection between a station at a customers premise and a Central Office (CO). These are connected on the dial tone side of the CO.

Link Access Procedure for Modems (LAP-M)

An error correction procedure defined in CCITT Recommendation V.42-1988.

Loaded Cable

Inductance, in the form of "Load Coils", is placed on longer metallic cables to improve the cable's voice transmission performance.

Local Access and Transport Area (LATA)

A geographic area for the provision and administration of communications service. It encompasses designated exchanges that are grouped to serve common social, economic and other purposes.

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 Exchange Carrier (LEC)

Any company or corporation engaged for hire in providing Access and intraLATA communications services.

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 Tandem Switch

A Local Exchange Carrier switching system that connects trunks to trunks between end offices within the same calling area.

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.

Loop

The facility which connects the Local Wire Center to the customer's location.

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.

Modulator/DEModulator (Modem)

A contraction formed from the words modulator and demodulator to describe electronic equipment having both of these capabilities. A modem is a Data Communications Equipment (DCE) device to convert business machine interface, e.g., RS232, to voiceband signals suitable for transmission over a telecommunications channel.

Multiplex

See multiplexer

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 Access Server (NAS)

A device providing local network access to users across a remote access network such as the PSTN. An NAS may also serve as an LAC, LNS or both.

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 U S WEST's responsibility for the provision of service ends.

Octet

An eight (8) bit byte

Ohm

The unit of electric resistance.

Open Systems Interconnection (OSI)

A seven-layer network architecture being used for the definition of network protocol standards to enable any OSI-compliant computer or device to communicate with any other OSI-compliant computer or device for a meaningful exchange of information.

Outside Plant

All telephone company materials (cable, utility vaults, poles, terminals, underground conduit, etc.) beginning in the Local Wire Center and ending at the Network Interface at the customer premises.

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 Communications Company 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.

Point To Point Protocol

PPP [RFC1661] defines an encapsulation mechanism for transporting multiprotocol packets across layer 2 (L2) point-to-point links. Typically, a user obtains a L2 connection to a Network Access Server (NAS) using one of a number of techniques (e.g., dialup POTS, ISDN, ADSL, etc.) and then runs PPP over that connection. In such a configuration, the L2 termination point and PPP session endpoint reside on the same physical device (i.e., the NAS).

Port

A place at which energy or signals enter or leave a device, circuit, etc.

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.

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.

Protocol Data Unit (PDU)

An International Standards Organization (ISO) term referring to a packet of information exchange between two entities via a protocol.

or

A unit that is exchanged between peer entities within a particular layer.

or

A data object exchanged by protocol machines, usually containing both protocol control information and user data.

Quadrature Amplitude/Phase Modulation

This is a form of modulation that is widely used in high speed modems. The digital information received by the modem is used to modulate a carrier frequency by both its' phase and amplitude.

Rate Adaptive Digital Subscriber Line

A Digital Subscriber Line (DSL) that is a form of an Asymmetric Digital Subscriber Line (ADSL) that will adjust its' downstream and upstream data rates based on the condition of the loop at the time the DSL modems train. If conditions change on the line (Noise Increases) the modems will retrain at new downstream and upstream data rates.

Route

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

RTU-C

RADSL Terminating Unit Central is the RADSL modem that is located in the network and the companion modem to the modem at the customer's location.

RTU-R

RADSL Terminating Unit Remote is the RADSL modem that is located at the customer location and is connected to a companion modem in the network to form the Digital Subscriber Line (DSL)

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].)

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 Communications Company 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.

Single Line HDSL

This is an HDSL line that is provided on a single twisted pair and provides 768 kbit/s transmission rate.

Transmission Control Protocol/Internet Protocol (TCP/IP)

A set of protocols developed by the Department of Defense to link dissimilar computers across many kinds of networks and connected to dissimilar LANs. IP corresponds to Open Systems Interconnection (OSI) network Layer 3 and provides the addressing needed to allow routers to forward packets across a multiple LAN inter-network. TCP is a transport layer, connection-oriented, end-to-end protocol. It provides reliable, sequenced, and unduplicated delivery of bytes to a remote or local user. TCP provides reliable byte stream communications between pairs of process in hosts attached to inter-connected networks.

Transmission Path

Denotes a path capable of transporting signals within the range of the service offering. A transmission path is comprised of physical or derived facilities consisting of any form or configuration of plant typically used in the telecommunications industry.

Tunnel

A Tunnel exists between a LAC-LNS pair. The Tunnel consists of a Control Connection and zero or more L2TP Sessions. The Tunnel carries encapsulated PPP datagrams and Control Messages between the LAC and the LNS.

Uniform Service Order Code (USOC)

The term "Uniform Service Order Code" denotes a three or five character alphabetic, numeric, or an alphanumeric code that identifies a specific item of service or equipment. Uniform Service Order Codes are used in Qwest Communications Company billing system to generate recurring rates and non recurring charges.

Upstream

Upstream refers to the direction data is received in relationship to the network and indicates that date is being received by the network from the user.

Very High Bit Rate DSL

This is a DSL similar to ADSL but the bit rates available in the downstream direction are typically in the range of 52 Mbit/s and the upstream bit rate is in the range of 6 Mbit/s. Like ADSL, POTS can be provided simultaneously on the same pair of copper wires.

Virtual Channel (VC)

A logical association between the end points of a link (e.g., an ISSI transmission path) that enables unidirectional transfer of ATM cells over that link.

Virtual Channel Identifier (VCI)

A locally significant number that identifies a virtual channel on an ATM link.

Virtual Path (VP)

A concept used to describe unidirectional transport of ATM cells belonging to virtual channels that are associated by a common identifier value.

Virtual Path Identifier (VPI)

A locally significant number that identifies a virtual path on an ATM link.

Voice band

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.

xDSL

This acronym is used as a term to describe the generic family of Digital Subscriber Lines where the letter "x" is replaced with one or two characters such as H, RA or A (e.g., HDSL, RADSL, etc.).

CONTENTS

Chapter and Section **Page**

5 References

5.1 IEEE Publications

10Base-T

ISO/IEC 8802-3: 1996 (ANSI/IEEE Std 802.3, 1996 Edition) Information technology--Local and metropolitan area networks--Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications. This publication is available from the IEEE directly (see Ordering Information).

Price: $135.00 IEEE Members: $94.50

100Base-T

IEEE Std 802.3u-1995 Supplement to ISO/IEC 8802-3:1993, *Local and Metropolitan Area Networks: Media Access Control (MAC) Parameters, Physical Layer, Medium Attachment Units, and Repeater for 100 Mb/s Operation, Type 100Base-T (Clauses 21-30).* This publication is available from the IEEE directly (see Ordering Information).

Price: $87.00 IEEE Members: $60.90

5.2 Internet Engineering Task Force (IETF) Requests for Comment (RFC)

RFC 768	User Datagram Protocol (UDP)
RFC 791, STD 5	Internet Protocol (IP)
RFC 1661	Point-to-Point Protocol (PPP) (Updated by RFC 2153)
RFC 1662	PPP in HDLC-like Framing
RFC 2364	PPP over AAL5
RFC 2661	Layer 2 Tunneling Protocol (L2TP)
RFC 2684	Multiprotocol Encapsulation over ATM Adaptation Layer 5

5.3 American National Standards Institute (ANSI) Publications

ANSI T1.224-1997 Information Interchange — *Structure and Representation of Network Channel (NC) and Network Channel Interface (NCI) Codes for the North American Telecommunications System.*

ANSI T1.601-1992 Telecommunications -*Integrated Services Digital Network (ISDN) - Basic Access Interface for Use on Metallic Loops for Application on the Network side on the NT (Layer 1 Specification).*

ANSI T1.413 –1998 Telecommunications-Issue 2 – *Network and Customer Installation Interfaces – Asymmetric Digital Subscriber Line (ADSL) Metallic Interface.*

5.3 Qwest Publications

PUB 77378 Qwest Corporation ATM Cell Relay Service, Issue E, October 2001

PUB 77399 Qwest Digital Data Service 2-Wire, Issue B, September 2001

5.4 Cisco Systems, Inc. Publications

Cisco Systems™ Document 78-6088-02 *Carrierless AM/PM Rate Adaptive Digital Subscriber Line, January 29, 1999*

Cisco Systems™ Document 78-6089-01 *EZ-DSL Microfilter Specification, October 2, 1998*

5.5 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.

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- Internet Engineering Task Force (IETF) Requests for Comment (RFC):

All RFCs are available on the internet at various web pages. One source is the RFC Editors Homepage at URL http://www.rfc-editor.org/

- American National Standards Institute (ANSI) documents from:

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Fax (212) 302-1286

ANSI has a catalog available which describes their publications.

- Qwest Technical Publications from:

  http://www.qwest.com/techpub

- Cisco Systems™ Publications from:

  Cisco Systems, Inc.
  170 West Tasman Drive
  San Jose, California 95134
  (408) 526-4000 or
  (800) 553-6387 (NETS)

5.6 Trademarks

Qwest DSL™	Trademark of Qwest Communications International Inc.
MegaBusiness	Servicemark of Qwest Communications International Inc.
MegaHome	Servicemark of Qwest Communications International Inc.
Qwest IDSL™	Trademark of Qwest Communications International Inc.
MegaOffice	Servicemark of Qwest Communications International Inc.
MegaValue	Servicemark of Qwest Communications International Inc.
Cisco Systems™	Trademark of Cisco Systems, Inc.
Qwest®	Registered Trademark of Qwest Communications International Inc.

QWEST DSL History Log

Line #	Version	Effective Date	Change				Level of Change	Reason/Source	CR or Notice #
			Sec #	Section Name	Sub-section	Update Activity			
1	j	June 02	2.4.6	Qwest DSL™ IDSL		Added information to show the difference in ISDN and IDSL technologies used for Qwest IDSL service.	1	Regulatory	