U S WEST, Inc.
Technical Publication

Modem Aggregation Service

77402
Issue B
April 2000

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1. Introduction

1.1 General

This document describes U S WEST Modem Aggregation Service (MAS) features, network interface specifications, performance specifications and responsibilities.

1.2 Reason for Reissue

This publication is being revised to:

- Update Sections 2.3 “Subscription” and 2.4 “Directory Number for Local Calling Area” to refer to the MAS Tariff for MAS Port ordering rules.
- Clarify the Call Connection Guarantee description in Section 4.1.

1.3 Purpose

The purpose of this document is to describe U S WEST MAS. Sufficient technical detail is furnished to allow a customer, such as an Internet Service Provider, Network Service Provider or Corporation that has teleworkers to understand what features are being offered and the network interface requirements. It is not the intent of this document to provide specific ordering information, but to describe the technical features of this service offering.

1.4 Applicability of Technical Specifications

The technical specifications presented in this document are applicable to U S WEST MAS only. It is not the intent of this document to describe the various types of transmission and switching equipment used to provide MAS. The service as described in this document pertains to the presently deployed transport and modem call termination technology. As further MAS hardware and software enhancements become available for network deployment, additional U S WEST MAS features will be offered to the customer.

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2. Description of Service

Modem Aggregation Service (MAS) is a network service that terminates both modem (analog) and Integrated Services Digital Network (ISDN) (digital) user Public Switched Telephone Network (PSTN) calls within designated U S WEST local calling areas. MAS aggregates the modem or ISDN traffic from one or more local calling areas onto a single Permanent Virtual Circuit (PVC) using Asynchronous Transfer Modem (ATM) or Frame Relay technology. The PVC and an ATM or Frame Relay access link within the U S WEST Local Access and Transport Area (LATA) connects the customer location to the MAS network.

MAS is designed for Internet Service Providers (ISPs), Network Service Providers (NSPs) and corporations that want to outsource dial-in solution access on behalf of the customer dial-in users. Typically, users are ISP subscribers or corporate teleworkers-telecommuters. When used by corporations, MAS enables remotely located teleworkers to communicate as a dial-in extension to the customer corporate network.

As depicted in Figure 2-1, at the most basic level, an order for MAS Service provides:

- The option of either a new or existing Directory Number for a local free calling area for users to dial into MAS customer location.
- A port subscription for the desired number of concurrent dial-in modem or ISDN user calls.
- Reports containing a modem port usage graph and call records.

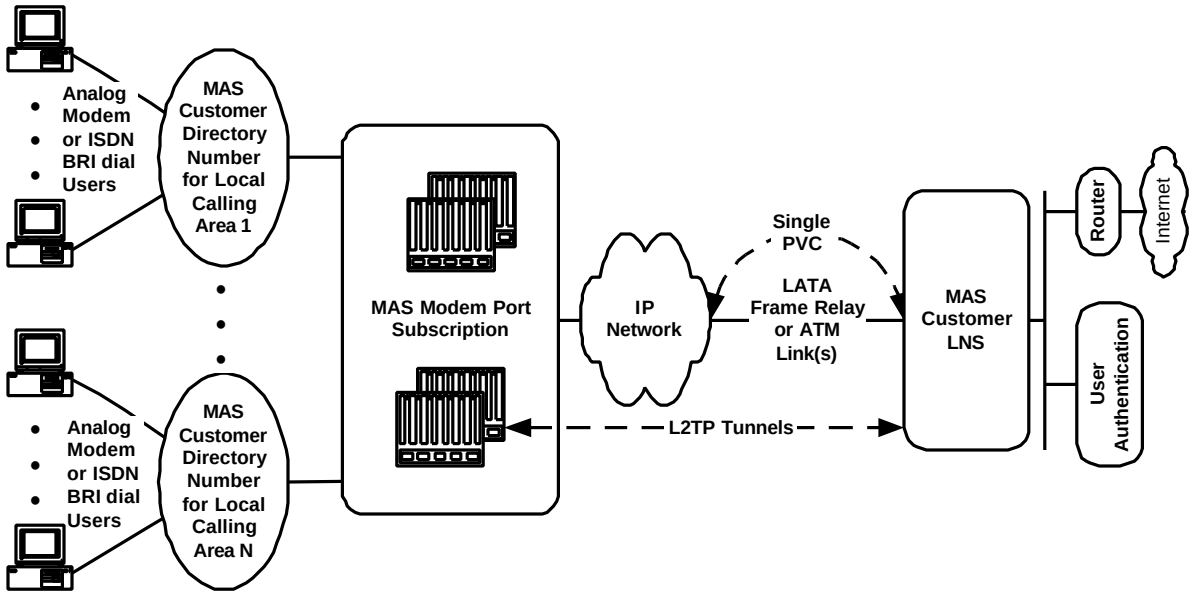

Figure 2-1: MAS Service Concept

In addition, the customer must order a single ATM UBRS (Unspecified Bit Rate Service) or Frame Relay PVC using the normal U S WEST ATM Cell Relay Service (CRS) or Frame Relay Service (FRS) definitions and pricing (see Sections 2.5 and 2.6 below). This PVC originates within the MAS infrastructure and terminates at the customers ATM or Frame Relay link location. The PVC traverses the ATM or Frame Relay link and aggregates all user calls from each MAS-served local calling area, in a LATA, within the disclosed U S WEST ATM CRS or FRS geographical coverage areas.

The customer must provide a device at their premises called an LNS (L2TP Network Server). The LNS terminates the ATM or Frame Relay link / PVC, L2TP (Layer 2 Tunneling Protocol) tunnels and user PPP (Point to Point Protocol) sessions.

2.1 Dial-in User Definition

The dial-in user is the person and computer system that dials into the customer location using a PAP (Password Authentication Protocol) or CHAP (Challenge Handshake Authentication Protocol) compatible PPP dialer using one or more analog telephone lines with modems or an ISDN BRI (Basic Rate Interface) line (Single Line ISDN service) and ISDN terminal adapter.

2.2 Port Definition

A MAS Port is either one analog modem call or one bearer (B) channel of an ISDN call. For users with Single Line ISDN (Basic Rate Interface) service and Multilink PPP (MLPPP) support, to obtain a full 128 kbit / s connection (two 64 kbit / s B channels), two MAS Ports are used.

2.3 Subscription

A MAS customer subscribes to the desired number of MAS Ports for each local calling area Directory Number (DN) according to the ordering rules defined in the MAS Tariff. At least one MAS Port subscription is needed per calling area. It is recommended that the MAS customer order the number of MAS Ports that is equivalent to their peak concurrent user call capacity requirements. Users receive a busy signal for any calls exceeding the subscribed-to number of MAS Ports.

2.4 Directory Number for Local Calling Area

A MAS customer orders one or more MAS DNs per local calling area. Each DN associates with the number of MAS Ports ordered and requires a separate order.

For each local calling area MAS subscription, there are two DN order options:

1. A new assigned DN; or
2. The ability to re-use the DN of the customers existing U S WEST service, such as Advanced DSS (Digital Switched Service), UAS (Uniform Access Solution) ISDN

PRI (Primary Rate Interface), Single Line ISDN or POTS (Plain Old Telephone Service) line modem pools. See Section 2.8 for a description of this MAS feature.

2.5 ATM Cell Relay Service

ATM Cell Relay Service is a MAS option for delivery of dial-in user traffic to the customer. In a coordinated order with a MAS order, an ATM CRS access link, CRS port speed option and UBRS PVC are purchased out of the ATM CRS tariffs and conform to the U S WEST Technical Publication 77378 "ATM Cell Relay Service" specifications. The MAS ATM option has the same geographical coverage area as ATM CRS as defined in U S WEST Network Disclosure 400 (ATM Cell Relay Service), accessible at:

http://www.uswest.com/disclosures/netdisclosure400.html

All ATM CRS Access Link types and Physical Layer options are available to MAS customers.

If there is an ATM CRS Access Link to the customer location for other purposes, the customer needs only to order an ATM PVC for their MAS dial-in user traffic. See Section 2.5.3 ATM UBRS PVC.

2.5.1 IntraLATA Link

The ATM Access Link must terminate within the same LATA, but not necessarily within the same city, as the local calling areas.

2.5.2 InterLATA Link

The customer can aggregate dial traffic from multiple LATAs by terminating their U S WEST ATM CRS Access Link as UNI (User to Network Interface) to their ATM InterLATA carrier.

2.5.3 ATM UBRS PVC

The customer connection to the MAS service is an ATM PVC. This PVC originates within the MAS infrastructure and terminates at the customer location. An ATM PVC is known by its VCC (Virtual Channel Connection) number (VCI/VPI (Virtual Channel Identifier/Virtual Path Identifier) combination). User PPP dial traffic from multiple calling areas aggregate onto the single ATM PVC. The customer may have PVCs for other traffic sharing the same ATM CRS Access Link.

MAS supports only the ATM CRS UBRS PVC class of service. UBRS is a "best effort" service. UBRS provides no guaranteed bandwidth. Traffic control for UBRS is based on the Peak Cell Rate (PCR). The U S WEST ATM switch port associated with the customer ATM Access Link may discard any cell exceeding the PCR. For further information on ATM CRS UBRS, see U S WEST Technical Publication 77378.

For each ATM Access Link type, there is no limit on the maximum number of MAS Ports per ATM UBRS PVC. However, it is recommended that the customer order

sufficient PVC bandwidth (PCR) and ATM port speed (physical link size) based on concurrent (peak traffic) MAS port requirements.

For an ATM PVC, for example, to use 10 kbit/s per MAS port and 100 MAS ports for a peak busy hour requirement, 1,000 kbit/s (1 Mbit/s) of ATM bandwidth is needed for the PVC. ATM UBRS can be ordered in PCR increments of 64 kbit/s (up to 23 increments) or in increments of 1 Mbit/s. Therefore, in this example, a one-Mbit/s ATM UBRS PVC is needed. In addition, a physical ATM link and Port size large enough to handle that peak traffic is needed. See Table 2-7 UBRS Cell Relay Port Information of the ATM CRS Technical Publication for the Cell Rates and Service Increments supported by UBRS for each ATM CRS Port type (i.e., 1.544 Mbit/s, 45 Mbit/s, 155 Mbit/s).

2.6 Frame Relay Service

Frame Relay Service is a MAS option for delivery of dial-in user traffic to the customer. In a coordinated order with a MAS order, a FRS access link, FRS port speed option and PVC is purchased out of the FRS tariffs and conform to all U S WEST Technical Publication 77372 “Frame Relay Service” specifications. The MAS Frame Relay option has the same geographical coverage area as FRS as defined in U S WEST Network Disclosure 401 (Frame Relay Service):

http://www.uswest.com/disclosures/netdisclosure401/index401.html

All FRS Access Link types and Physical Layer options are available to MAS customers. However, due to limited availability and the potential for lengthy order interval, purchase of DS3 (45 Mbit/s Access Link) FRS is not recommended. For 45 Mbit/s MAS service, DS3 ATM CRS is recommended instead.

If there is a FRS Access Link to the customer location for other purposes, the customer needs only to order a FRS PVC for MAS dial-in user traffic. See Section 2.6.3 Frame Relay PVC.

2.6.1 IntraLATA Link

The Frame Relay access link must terminate within the same LATA, but not necessarily within the same city, as the local calling areas.

2.6.2 InterLATA Link

The customer can aggregate dial traffic from multiple LATAs by terminating a U S WEST Frame Relay Service link as an NNI (Network to Network Interface) to a Frame Relay InterLATA carrier.

2.6.3 Frame Relay PVC

The customer connection to the MAS service is via a MAS customer Frame Relay PVC. This PVC originates within the MAS infrastructure and terminates at the

customer location. A Frame Relay PVC is known by its DLCI number (Data Link Connection Identifier). User PPP dial traffic from multiple calling areas aggregate onto the single MAS Frame Relay PVC. The customer may have PVCs for other traffic sharing the same FRS Access Link.

For each Frame Relay Access Link type, there is no limit on the maximum number of MAS Ports per PVC. However, it is recommended that the customer order sufficient Frame Relay Port Speed (physical bandwidth) and sufficient PVC bandwidth (CIR) based on concurrent (peak traffic) MAS port requirements. MAS supports all PVC CIR options defined in Table 2-1 of the FRS Technical Publication 77372.

For a Frame Relay PVC, for example, to use 10 kbit/s per MAS port and 100 MAS ports for a peak busy hour requirement, 1,024 kbit/s (or approximately 1 Mbit/s) of Frame Relay CIR (Committed Information Rate) bandwidth is needed for the PVC. In addition, a physical Frame Relay link and Port size large enough to handle that peak traffic is needed.

2.7 Customer LNS

To use MAS, the customer must have equipment on premise called an L2TP Network Server. The LNS is the industry name for a device that terminates L2TP tunnels and PPP sessions. The LNS must be capable of terminating a Frame Relay or ATM access link and multiple user PPP sessions over multiple L2TP-UDP-IP tunnels.

The MAS service transparently transports PPP traffic between the dial-in user and the customer location using L2TP tunnels. MAS network elements do not modify any user information enveloped by the L2TP/IP packet.

The LNS or associated security server (e.g., RADIUS: Remote Authentication Dial-In User Service) performs all user AAA (authentication, authorization, and accounting) functions (if any). These functions are totally transparent to the MAS service.

See Section 3.1, Customer Network Interface, for the LNS interface.

2.8 Re-Use of DN to Migrate from Other U S WEST Services

MAS provides an order option to enable transparent migration of users to MAS with zero downtime. The order option is known as a MAS DN Re-use Cutover. With this option, the customer can transparently cutover users that dial existing modem pools including Advanced DSS, UAS ISDN PRI, Single Line ISDN, and POTS service. Modem pools associated with an existing Direct Inward Dial (DID) number, Non-sequential Directory Number (NDN) or Telephone Number (TN) can be transparently migrated to MAS.

After a DN cut-over to MAS is complete, all calls to the DN originating or entering the DN-associated local calling area are directed to the customer MAS ATM or Frame Relay location.

2.9 Emailed Reports

MAS includes daily, weekly, monthly and yearly e-mailed reports. The reports contain a port usage graph, formatted user call history with call variables and a comma-separated file containing user call records and call variables. The daily, weekly and monthly report MAS port usage is averaged over intervals of five, 30 and 120 minutes, respectively. The call record report includes calling number, answer time/day, disconnect time/day, disconnect cause, call duration, input/output bytes, modem speed and modem protocol.

SECURITY NOTE: These reports are sent over the Internet to MAS customers as clear-text, non-encrypted attachments to clear-text e-mailed messages. U S WEST does not protect the privacy of this information during transmission over the Internet. Customers that do not wish to receive e-mailed reports can contact the MAS Customer Service Center to request no e-mailed reports.

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3. Network Interface Specifications

This Chapter defines the network interface specifications required for successful customer use of MAS. Network interface specifications are defined for both the MAS Customer Network Interface and the Dial-in User Network Interface. The MAS customer premise equipment (LNS) must conform to the MAS Customer Network Interface specifications. To be compatible with MAS, the dial-in user customer premise equipment (e.g., PC with dialer software and modem or ISDN terminal adapter) must conform to the Dial-in User Network Interface specifications.

Figure 3-1 depicts both the required MAS Customer Network Interface and Dial-in User Network Interface and the protocol relationships between them.

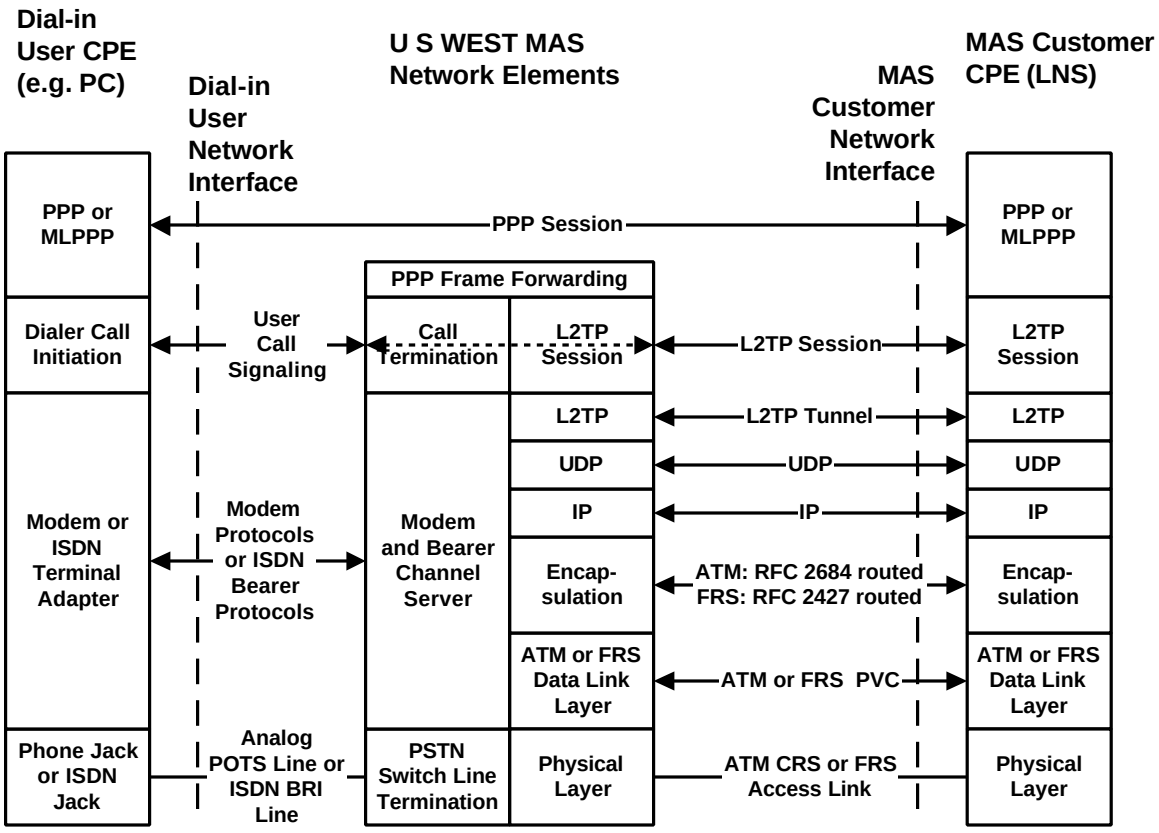

Figure 3-1: MAS Customer and Dial-in User Network Interfaces

3.1 Customer Network Interface

As overviewed in Section 2.7, Customer LNS, of this document, MAS requires the customer to have a device called an LNS located on the customer premise.

The MAS Customer Network Interface exists in two types:

- ATM Cell Relay Service Network Interface Option.
- Frame Relay Service Network Interface Option

The customer premise equipment (CPE) must support one of these network interface options. In addition, the LNS must conform to the IP Encapsulation, UDP (User Datagram Protocol), IP (Internet Protocol) and L2TP (Layer 2 Tunneling Protocol) specifications identified in this section.

3.1.1 ATM Cell Relay Service Network Interface Option

With respect to the U S WEST ATM Cell Relay Service option, MAS supports all physical layer access link options, electrical interfaces, port options, network interface jack types, jack pin assignments, Network Channel Interface (NCI) codes, Network Channel (NC) codes, service configurations, ATM layer interface, PVC management, UBRS network traffic control procedures, performance specifications and maintenance responsibilities defined in the ATM Cell Relay Service Technical Publication number 77378.

MAS supports *only* the Unspecified Bit Rate Service PVC Service Class.

For those ATM Cell Relay Service options supported by MAS, the CPE must conform to the corresponding technical specifications identified in ATM Cell Relay Service Technical Publication number 77378.

3.1.2 Frame Relay Service Network Interface Option

With respect to the U S WEST Frame Relay Service option, MAS supports all service features, physical layer access link options, electrical interfaces, fractional port options, network interface jack types, jack pin assignments, NCI codes, NC codes, service configurations, data link layer interface, PVC management, performance specifications and maintenance responsibilities defined in the Frame Relay Service Technical Publication number 77372.

The CPE must conform to the corresponding technical specifications identified in Frame Relay Service Technical Publication number 77372.

3.1.3 IP Encapsulation Specification

The CPE must support the following IP packet encapsulation standards:

- For a MAS ATM PVC, IETF RFC 2684, IP routed format must be supported.
- For a MAS Frame Relay PVC, IETF STD55 (RFC 2427) “Multiprotocol Interconnect Over Frame Relay”, IP routed format must be supported. Only the following sections of this standard apply to MAS-CPE interoperability:

  a) Section 3 Frame Format;

b) Section 4.1 Routed Frames – Format of Routed IP Datagram (NLPID 0xCC);

c) Section 6 Fragmentation;

d) Section 8 IP over Frame Relay (both NLPID value indicating IP = 0xCC and NLPID value indicating SNAP where PID = 0x0800 (IP).

3.1.4 IP Specification

For both MAS Frame Relay and MAS ATM customer network interfaces, the customer CPE must support the IP Version 4 protocol as specified in IETF STD0005 (RFC 791), IP: Internet Protocol. The CPE must support the entire specification to be interoperable with MAS.

3.1.5 UDP Specification

For MAS interoperability, the CPE must support the IETF User Datagram Protocol (RFC 768) standard.

3.1.6 L2TP Specification

To be interoperable with MAS, the CPE must support the following L2TP specifications:

- Dynamic L2TP tunnel establishment from L2TP tunnels that originate within the MAS network. The tunnels do not originate from the dial-in user premise equipment.
- Have capacity to support the establishment of at least 8 tunnels per calling area served by the LNS.
- L2TP tunnel authentication with a “shared secret” that is made available with the MAS subscription. This “secret” is only to known to the MAS customer and the U S WEST MAS Customer Service Center.
- L2TP session establishment and encapsulation of multiple concurrent PPP user data streams. For each user call accepted there is a corresponding L2TP session establish. This relationship is shown in Figure 3-1.
- L2TP Tunneling Protocol (IETF RFC 2661) standard compatible as qualified below:

  a) Section 2.0. The network between MAS and the LNS is Frame Relay or ATM.

  b) 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 is hidden. MAS does not support the hiding of values of AVPs currently.

c) Section 4.4.5. Proxy LCP and Authentication AVPs. This section describes Attribute Value Pairs (AVP) and methods for negotiating LCP and user authentication. MAS does partial LCP negotiations and forwards the result to the LNS. MAS does not forward the authentication (PAP or CHAP) to the LNS. The authentication is discarded, which causes the client to re-negotiate authentication with the customer LNS. There are no known incompatibilities with this method, as PPP is structured to re-negotiate this automatically. Note: This is not a consideration for compulsory tunneling based on Called or Calling Station ID.

d) Section 5.2.2 Outgoing Call Establishment. MAS does not support Outgoing Call Establishment.

e) Section 5.4 Using Sequence Numbers on the Data Channel. This section describes a method for enabling and disabling sequence numbers for the data channel. Sequence numbers are defined in the L2TP header for control messages and optionally for data messages (see Section 3.1). These are used to provide a reliable control message transport (see Section 5.4) and optional data message sequencing. MAS sends payload with sequence numbers, however, it will accept payload with or without sequence numbers.

3.2 Dial-in User Network Interface

To be interoperable with MAS, the dial-in user customer premise equipment (e.g., PC with dialer software and modem or ISDN terminal adapter) must conform to the Dial-in User Network Interface specifications defined in this section.

3.2.1 Modem Protocol Support

The dial-in user equipment must be compatible with any of the Modem Protocols supported by MAS, as shown in Table 3-1 below.

Table 3-1: MAS Modem Protocols

Classification	MAS Supported Protocols
Modem Modulation Protocols	V.90 (56 Kbps) K56Flex (transmit up to 56 Kbps, receive up to 33.6 Kbps) V.34+ (33.6 Kbps) V.34 (28.8 Kbps fall forward/backward) V.32bis (14.4, 12, 9.6, 7.2 Kbps fall forward/backward) V.32 (9.6, 4.8 Kbps fallback) V.23 (transmit 75 bps, receive 1200 bps) V.23 (transmit 1200 bps, receive 75 bps) V.22bis (2.4 Kbps) V.22 (1.2 Kbps) V.21 Bell 103 Bell 212
Modem Error Correction and Framing Protocols	V.42 MNP 2-4 LAPM
Compression Protocols	V.42bis MNP 5

3.2.2 ISDN Protocol Support

The dial-in user equipment must be compatible with any of the ISDN Protocols supported by MAS:

- 56 or 64 Kbps automatic bit-rate detection
- Data-over Voice ISDN support
- V.120/I.465 terminal adaptation
- V.120/V.110 rate adaptation

3.2.3 User Dialer Protocol Support

As illustrated in Figure 4-1, MAS supports only dial-in user systems that support the following PPP protocol standards:

- PPP (IETF RFC 1661) or
- MP or PPP Multilink Protocol (IETF RFC 1990)

MAS supports only dial-in user systems that support the PAP or CHAP user authentication protocol s defined in the PPP Authentication Protocols standard (IETF RFC 1334).

3.3 E-mailed Reports Customer Interface Requirements

MAS reports are attached to e-mailed messages that are sent to customers. To receive the MAS reports, the customer e-mail client software must support MIME-type Version 1.0. If customer e-mail client software is Eudora or Pine, it needs to be explicitly set to MIME-type Version 1.0.

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4. Performance Specifications

4.1 Call Connection Guarantee

U S WEST guarantees that, for each local calling area subscription to N number of Modem Aggregation Service (MAS) Ports, that N number of calls to a valid Directory Number will always be connected. For example, if the customer orders 480 MAS ports, U S WEST guarantees that the customer will always get 480 successful *call* connections to MAS modems. A successful MAS call is defined as the point in time when MAS answers the "ringing" call by doing a voice path cut-through to the users telephone line. This is the brief point in time when the "ringing" goes silent and immediately before modem training negotiation occurs. This guarantee excludes the Modem Connection Success Rate for reasons sited in Section 4.2.

4.2 Modem Connection Success Rate and Modem Connect Speed

Although U S WEST provides a *call* connection guarantee (see Section 4.1), U S WEST does not guarantee or warranty the likelihood that a successful MAS *modem* connection with the users modem will occur. Also, U S WEST does not guarantee or warranty that a particular modem connect speed will be obtained with a user modem. Modem connect speeds and the probability of successful modem connection varies widely across user local loops and modem equipment.

4.3 User Busy Signals

A user busy signal (also known as Busy Tone) is an audible tone heard at the rate of 60 impulses per minute (60 IPM). If users receive a Busy Tone when dialing a MAS DN, this means that the customer exceeded their MAS Port subscription limit for the DN. In other words, for the point in time the Busy Tone is heard, the number of dial-in user call sessions for the called DN is greater than the number of MAS Ports the customer has ordered.

4.4 Call Setup Time

MAS defines Call Setup time as the time from when all the user dial digits are received at the ingress central office PSTN switch and the time that the call is answered (the switch "cuts through" the voice path between the user line and the PSTN trunk).

U S WEST does not guarantee or warranty the Call Setup Time, since the time it takes to answer a call is also dependent on factors outside of our control. These factors include the LNS L2TP tunnel setup time (if a tunnel has not been previously setup) and the L2TP call-session setup-processing time.

Calculations for MAS Call Setup time range from 653 msec to 1,053 msec. Therefore, the MAS objective for call setup time is less than 1,100 msec.

NOTE: These numbers do not include any time involved with session setup after the call has been connected (e.g., modem training and negotiation time, PPP session

creation time, PPP user authentication time and PPP network layer (e.g. IP) protocol negotiation time).

4.5 ATM Cell Relay Unspecified Bit Rate Service

U S WEST does not guarantee or warrant the delivery of ATM cells, since the ATM Cell Relay UBR (Unspecified Bit Rate) Service does not guarantee any minimum bandwidth.

MAS supports the ATM Cell Relay Service Performance Specifications that apply to Unspecified Bit Rate Service as defined in the ATM Cell Relay Service Technical Publication 77378.

4.6 Frame Relay Service

U S WEST does not guarantee or warrant that Frame Relay frames will be delivered, since frames are subject to being discarded under conditions of Frame Relay network congestion.

MAS supports all Frame Relay Service Performance Specifications defined in the Frame Relay Service Technical Publication 77372.

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5. Responsibilities

5.1 Customer Responsibilities

The customer is responsible for the maintenance of all equipment and cable beyond the Customer Network Interface (as defined in Section 3.1 of this document). Examples of such equipment include routers, LNS, RADIUS server and LAN hub or switch.

In the case of MAS service trouble, the customer or their responsible agent is responsible for sectionalizing the trouble and verifying that the trouble is not in the customer-owned equipment or cable before calling the MAS Customer Service Center.

In order for U S WEST to provide a state of the art MAS network, maintenance and upgrades for MAS nodes will be required. The customer will be required to allow U S WEST to perform necessary maintenance. U S WEST will notify affected customers via a written notice, email message or telephone contact prior to a maintenance date.

If the service trouble is isolated to the customer owned equipment or cable, the customer or its responsible agent is responsible for clearing the trouble and restoring the service to normal operation.

In the case of service outage or chronic, systemic degraded service, the customer should contact the MAS Customer Service Center at 1-888-333-1681. Examples of degraded service include lower than expected average modem connect success rates, lower that expected average modem connect speeds and fast busy signals experienced by dial-in users. The customer must determine that the degraded service is chronic and affects multiple dial-in users, not just one user, before calling the MAS Customer Service Center.

Joint testing between the customer and/or its responsible agent and U S WEST personnel may sometimes be necessary to isolate the trouble.

For MAS ATM Cell Relay Service customers, the customer responsibilities related to the physical ATM access link equipment (e.g., router/LNS) are defined in Section 8, Maintenance, of ATM Cell Relay Service Technical Publication 77383.

For MAS Frame Relay Service customers, the customer responsibilities related to the physical Frame Relay access link equipment (e.g., router/LNS) are defined in Section 8, Maintenance, of Frame Relay Service Technical Publication 77372.

5.2 U S WEST Responsibilities

U S WEST is responsible for all equipment and cable on the U S WEST side (i.e., network side of the Customer Network Interface at the customer location, and also for managing and maintaining the transmission facility between the Serving Wire Center and the customer location.

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6. Definitions

6.1 Acronyms

AAA	Administration, Authentication and Accounting
ATM	Asynchronous Transfer Mode
AVP	Attribute Value Pair
BRI	Basic Rate Interface
CHAP	Challenge-Handshake Authentication Protocol
CIR	Committed Information Rate
CPE	Customer Premise Equipment
CRS	Cell Relay Service
DID	Direct Inward Dial
DLCI	Data Link Connection Identifier
DN	Directory Number
DS1	Digital Signal Level 1 (1.544 Mbit/s)
DS3	Digital Signal Level 3 (44.736 Mbit/s)
DSS	Digital Switched Service
FRS	Frame Relay Service
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
L2TP	Layer 2 Tunneling Protocol
LATA	Local Access and Transport Area
LCP	Link Control Protocol
LNS	L2TP Network Server
MAS	Modem Aggregation Service
MLPPP	Multi-link PPP Protocol
MODEM	Modulator/DEModulator
MP	Multi-link PPP Protocol
NC	Network Channel
NCI	Network Channel Interface
NDN	Non-sequential Directory Number
NLPID	Network Layer Protocol Identifier

NNI	Network to Network Interface
NPA	Numbering Plan Area
NSP	Network Service Provider
NXX	N = Numbers 2 - 9, X = Numbers 0 - 9
PAP	Password Authentication Protocol
PID	Protocol Identifier
POTS	Plain Old Telephone Service
PPP	Point to Point Protocol
PSTN	Public Switched Telephone Network
PRI	Primary Rate (ISDN) Interface
PVC	Permanent Virtual Circuit
RADIUS	Remote Authentication Dial-In User Service
RFC	Request for Comment
SNAP	SubNetwork Attachment Point
TA	Terminal Adapter
TCP/IP	Transmission Control Protocol/Internet Protocol
TN	Telephone Number
UAS	Uniform Access Solution
UBRS	Unspecified Bit Rate Service
UDP	User Datagram Protocol
UNI	User to Network Interface
VCC	Virtual Channel Connection
VCI/VPI	Virtual Channel Identifier/Virtual Path Identifier

6.2 Glossary

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.

Attribute Value Pair (AVP)

In the L2TP standard, 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 tear-down of L2TP 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.

Bits/second (bit/s)

Bits per second, e.g., 56,000 bit/s. In data transmission, it is the number of binary zero and one bits transmitted in 1 second.

Call

The sequences of events begun when an End-User makes a request for service and provides an address code (see also Directory Number). A call is concluded when communication between the End-Users has terminated.

Challenge Handshake Authentication Protocol (CHAP)

Challenge Handshake Authentication Protocol [IETF RFC1994], a PPP cryptographic challenge/response authentication protocol in which the cleartext password is not passed over the line.

Committed Information Rate (CIR) bit/s

The rate at which the network agrees to transfer information, under normal conditions, during a time interval Tc.

Customer Network 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.

Data Link Layer

See Layer 2.

Data Link Connection Identifier (DLCI)

The Data Link Connection Identifier is located within the address field of a frame relay packet, and is used to identify each PVC.

Dial-in User

The person and computer system that dials into the MAS location using a PAP or CHAP compatible PPP dialer using one or more analog telephone lines with modems or an ISDN BRI line (Single Line ISDN service) and ISDN terminal adapter.

Directory Number

A 10-digit address (e.g. telephone number) used for signaling a call through the PSTN. A Directory Number (DN) is associated with a particular service (e.g., MAS, ISDN PRI, Advanced DSS, BRI, 1FB, 1FR). A Directory Number may point to one or more physical circuits or may be logical, as in the case of Modem Aggregation Service (MAS). For MAS, a Directory Number is associated with a pool of available physical modems or ISDN Bearer channel terminations within a U S WEST Local Calling Area.

DS1 Clear Channel

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

Encryption

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

Frame Relay Access Link

A Frame Relay access channel used to access the designated geographical U S WEST Frame Relay Service Serving Area.

Frame Relay Port

A termination point on the Frame Relay Module for the FRS Access Link(s).

Integrated Services Digital Network (ISDN)

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

Kilobit/Second (kbit/s)

One thousand (1000) bits/second.

L2TP

Layer 2 Tunneling Protocol as defined IETF RFC 2661.

L2TP Network Server (LNS)

A node that acts as one side of an L2TP tunnel endpoint and is a peer to MAS. The LNS is the logical termination point of a PPP session that is being tunneled from MAS. The LNS has the functions: PPP session termination, IP routing and sometimes user IP address assignment. The LNS does not contain the modems to perform modem call and/or ISDN call termination functions.

L2TP Session

L2TP is connection-oriented. The LNS and LAC maintain state for each Call that is initiated or answered by a LAC. An L2TP Session is created between the LAC and LNS when an end-to-end PPP connection is established between a Remote System and the LNS. Datagrams related to the PPP connection are sent over the Tunnel between the LAC and LNS. There is a one to one relationship between established L2TP Sessions and their associated Calls. See also: Call.

L2TP Tunnel

An L2TP 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.

Layer 1

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

Layer 2

Data Link Layer. Provides the transfer of frames between directly connected systems and may or may not detect errors in the data transfer, depending on the Layer 2 protocol being used. Establishes, maintains and releases the direct connection between two nodes; handles error and flow control.

Line

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

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 Calling Area

The set of NPA-NXXs (Area Codes and Prefixes) where calls can originate from and be considered local traffic.

Local Loop

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

MAS Port

1) One analog modem call to a Modem Aggregation Service Directory Number; or

2) One bearer (B) channel of an ISDN call Modem Aggregation Service Directory Number.

For users with Single Line ISDN (Basic Rate Interface) service and MLPPP support, to obtain a full 128 Kbps connection (two 64 Kbps B channels), two MAS Ports are needed.

Megabit per Second (Mbit/s)

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

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.

Network

The interconnected telecommunications equipment and facilities.

Network Channel (NC) Code

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

Network Channel Interface (NCI) Code

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

Network Interface (NI)

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

Numbering Plan Area (NPA)

Area Code (digits one, two and three (left to right)) of a 10-digit Directory Number as in NPA-NXX-NNNN.

NXX

Digits four, five and six (left to right) of a 10-digit Directory Number as in NPA-NXX-NNNN. The N refers to the numbers 2 through 9. The X refers to numbers 0 through 9.

Password Authentication Protocol (PAP)

A username/password authentication protocol defined in IETF RFC 1334, which uses a simple, 2-way handshake method for a user system to establish its identity. After the PPP link is established, a username/password pair is repeatedly sent by the user system to the authenticator until the authentication is acknowledged or the connection is terminated. Passwords are sent over the circuit “in the clear” and there is no protection from playback or repeated trial and error attacks.

Point-To-Point

A circuit connecting two (and only two) points.

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.

Remote Authentication Dial-In User Service (RADIUS)

RADIUS is a distributed security system that is designed to prevent unauthorized access to networks and network services. RADIUS is designed to simplify user authentication process by separating the security functions from the communications functions. A RADIUS system consists of an authentication server, client and RADIUS protocol between the client and server. The authentication server is called a RADIUS server. The client is either a NAS or an LNS (see Glossary). The RADIUS protocol is defined in IETF RFC 2138. The RADIUS server performs user authentication. Once authenticated, the RADIUS client provides user access to the allowed network services.

Throughput

The total capability of equipment to process or transmit data during a specified time period.

Transmission Control Protocol/Internet Protocol (TCP/IP)

End to end protocol suite commonly used today for Internet or corporate Intranets communications between computer systems as defined in IETF RFCs 793 (TCP) and 791 (IP), respectively.

Unspecified Bit Rate Service (UBRS)

An ATM Cell Relay Service “best-effort” service designed to support a connection carrying information flowing at uneven rates. The ATM Forum refers to this type of traffic as Unspecified Bit Rate (UBR) traffic. It is intended for non-real-time traffic applications that are very tolerant to delay, delay variation and cell loss. For further information, see the ATM Cell Relay Service Technical Publication 77378.

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7. References

7.1 Internet Engineering Task Force (IETF) Documents

RFC 768	*User Datagram Protocol (UDP)*
RFC 1334	*PPP Authentication Protocols (PAP and CHAP)*
RFC 1661	*Point-to-Point Protocol (PPP)*
RFC 1990	*Multilink Point to Point Protocol (MP or MLPPP)*
RFC 2138	*Remote Authentication Dial In User Service Protocol (RADIUS)*
RFC 2661	*Layer 2 Tunneling Protocol (L2TP)*
RFC 2684	*Multiprotocol Encapsulation over ATM Adaptation Layer 5 (obsoletes RFC 1483)*
STD 5 (RFC 791)	*Internet Protocol (IP)*
STD 55 (RFC 2427)	*Multiprotocol Interconnect Over Frame Relay (obsoletes RFC 1294 and RFC 1490)*

7.2 International Telecommunications Union (ITU) Documents

V.21	*300 Bit/s Duplex Modem*
V.22	*1200 Bit/s Duplex Modem*
V.22bis	*2400 Bit/s Duplex Modem*
V.23	*600/1200 Baud Modem*
V.32	*9600 Bit/s Duplex Modem*
V.32bis	*14,400 Bit/s Duplex Modem*
V.34	28,8*00 Bit/s Duplex Modem*
V.34+	*33,600 Bit/s Duplex Modem*
V.42	*Error-correcting Procedures for DCEs using Synchronous-to-asynchronous Conversion*
V.42bis	*Data Compression Procedures for DCEs using Error Correcting Procedures*

V.90 *56,000 Bit/s Duplex Modem*

V.110 *ISDN Rate Adaptation Protocol*

V.120 *ISDN Rate Adaptation Protocol*

7.3 U S WEST Technical Publications

PUB 77378 *ATM Cell Relay Service.* Issue D, March 1998

PUB 77372 *Frame Relay Service.* Issue F, October, 1997

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