ETHERNET VIRTUAL PRIVATE LINE SERVICE TECHNICAL DESCRIPTION

Service Description

Comcast Ethernet Virtual Private Line (EVPL) Service provides an Ethernet Virtual Connection (EVC) between two customer locations similar to Ethernet Private Line service but supports the added flexibility to multiplex multiple services (EVCs) on a single UNI at a customer's hub or aggregation site. The service is a reliable, more flexible, higher bandwidth and cost effective alternative to traditional TDM Private Lines, Frame Relay or ATM Layer 2 VPNs and IP VPNs.

EVPL offers three Classes of Service (CoS) including: Basic, Priority, and Premium. CoS options enable customers to select the CoS that best meets their applications' performance requirements. The service is offered with 10Mbps, 100Mbps, 1Gbps or 10Gbps Ethernet User-to-Network Interfaces (UNI) and is available in speed increments from 1Mbps to 10Gbps.

Comcast's Ethernet Network Service is Certified MEF Compliant.

Section 1. Technical Specifications

1.1 Ethernet User-to-Network Interface. The service provides bidirectional, full duplex transmission of Ethernet frames using a standard IEEE 802.3 Ethernet interface. Figure 1 lists the available UNI physical interfaces, their associated Committed Information Rate (CIR) bandwidth increments and the Committed Burst Sizes (CBS).

UNI Speed	UNI Physical Interface
10Mbps	10BaseT
100Mbps	100BaseT
1Gbps	1000BaseT or 1000BaseSX
10Gbps	10GBASE-SR or 10GBASE-LR

CIR Increments	CBS (bytes)
1Mbps	25,000
10Mbps	250,000
100Mbps	2,500,000
1000Mbps	25,000,000
10000Mbps	25,000,000

Figure 1: Available UNI interface types and CBS values for different CIR Increments

1.2 Service Multiplexing. The service enables customers to multiplex multiple services (EVCs) on a given UNI. A typical application for EVPL is to upgrade a hub and spoke topology where several remote (spoke) sites need to connect to a regional or central (hub) site. The hub site can have all remote site EVCs multiplexed on a single UNI eliminating the need for multiple ports on the customer's router or Ethernet switch. Note that when service multiplexing is used, the sum of CIR bandwidth for all EVCs multiplexed at the UNI cannot exceed the UNI port speed.

1.3 Class of Service Options. The service offers three classes of service. The CoS options allow for differentiated service performance levels for different types of network traffic. It is used to prioritize customer mission-critical traffic over lesser priority traffic in the network. The customer must specify a CIR for each CoS to indicate how much bandwidth should be assigned to it. Figure 2 lists the service performance objectives associated with On-Net (for distances within 250 network miles) and Off-Net Services. Only Basic or Priority CoS are permissible for On-Net and Off-Net services delivered via the HFC Network. Locations delivered via Off-Net Services will only guarantee the CoS value for the On-Net portion of the service. However, the end-to-end service will honor the committed performance tier metrics.

Performance Objective	Class of Service (CoS)		
	Premium	Priority	Basic
On-Net Services (< 250 miles)			
Latency (one way)	< 12ms	< 23ms	< 45ms
Jitter (one way)	< 2ms	< 10ms	< 20ms
Packet Loss (one way)	< 0.001%	< 0.01%	< 1%
Availability (On-Net Services delivered via Fiber)	> 99.99%	> 99.99%	> 99.99%
Availability (On-Net Services delivered via HFC Network)	Not Applicable	99.9%	> 99.9%
Off-Net Services delivered via Fiber			
Availability	> 99.95%	> 99.95%	> 99.95%
Off-Net Services delivered via Non-Fiber			
Availability	> 99.9%	> 99.9%	> 99.9%

Figure 2: CoS Performance Objectives

1.4 CoS Identification and Marking. Customers must mark all packets using 802.1p CoS values as specified in Figure 3 to ensure the service will provide the intended CoS performance objectives specified in Figure 2. Locations delivered via On-Net or Off-Net Services delivered via the HFC Network will only honor Basic or Priority CoS values. All other values will be treated as Basic.

CoS	802.1p
Premium	5
Priority	2-3
Basic	0-1

Figure 3: CoS Marking

1.5 Traffic Management. Comcast's network traffic-policing policies restrict traffic flows to the intended CIR for each service class. If the customer-transmitted bandwidth rate for any CoS exceeds the subscription rate (CIR) and burst size (CBS), Comcast will discard the non-conformant packets. For packets marked with a non-conformant CoS marking, the service will transmit them using the Basic service class without altering the customer's CoS markings.

1.6 Maximum Frame Size. The service supports a Maximum Transmission Unit (MTU) frame size of 1600 bytes to support untagged or 802.1Q tagged frame sizes. Jumbo Frame sizes can be supported on an Individual Case Basis (ICB). For On-Net Services delivered via the Comcast HFC Network, frame sizes may not exceed 1518 MTU size (1522 with a single VLAN tag). All frames that exceed specifications shall be dropped.

1.7 VLAN Tag Preservation. The service supports IEEE 802.1Q VLAN-tagged customer frames. All customer VLAN IDs and priority code points (IEEE 802.1p) for CoS conforming to the C-VLAN/EVC map are transmitted and received unaltered by the service. If a native VLAN is specified by the customer in the C-VLAN/EVC map, untagged frames are mapped to the native VLAN and transmitted over the corresponding EVC. Customers must coordinate their C-VLAN add/move/delete/changes with Comcast. Comcast may reserve one VLAN for network management purposes.

1.8 Standard number of EVCs per UNI: up to 20 for Off-Net Services and On-Net Services delivered via fiber. Additional EVCs are available, charges may apply. Only one EVC is permitted for On-Net Services delivered via the Comcast HFC Network.

1.9 Standard number of VLAN IDs per EVC: up to 20. Additional VLAN IDs are available, charges may apply. Only 1 VLAN ID is permitted for On-Net Services delivered via the HFC Network.

1.10 Ethernet Service Frame Disposition. All Frames are delivered conditionally through the network based on which EVCs they are sent to as specified in the VLAN ID to EVC map provided by the customer. Refer to Figure 4 for Comcast's service frame disposition for each service frame type.

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Service Frame Type	Service Frame Delivery
Unicast	Frames delivered conditionally
Multicast	Frames delivered conditionally
Broadcast	Frames delivered conditionally

Figure 4: Service Frame Delivery Disposition

1.11 Layer 2 Control Protocol (L2CP) Processing. Certain L2CP frames are discarded at the UNI, tunneled across the Comcast network or peered at (processed by) the UNI. Refer to Figure 5 for Comcast's L2CP disposition. For L2CPs with multiple disposition possibilities, the customer must specify to Comcast which disposition should be taken. The default disposition is to discard these L2CP service frames.

Destination MAC Address	Layer 2 Control Protocol	L2CP Frame Disposition
01-80-C2-00-00-00	STP, RSTP, MSTP	Discard (All UNIs)
01-80-C2-00-00-01	PAUSE	Discard (All UNIs)
01-80-C2-00-00-02	LACP, LAMP	Discard (All UNIs)
01-80-C2-00-00-02	Link OAM	Peer or Discard (disposition specified per UNI)
01-80-C2-00-00-03	802.1X	Discard (All UNIs)
01-80-C2-00-00-07	E-LMI	Discard (All UNIs)
01-80-C2-00-00-0E	LLDP	Discard (All UNIs)
01-80-C2-00-00-20 through 01-80-C2-00-00-2F	GARP, MRP	Tunnel (All UNIs)

Figure 5: L2CP Frame Disposition

Section 2. Monitoring, Technical Support and Maintenance

2.1 Network Monitoring. Comcast monitors all Comcast Services purchased by a customer on a 24x7x365 basis.

2.2 Technical Support. Comcast provides customers a toll-free trouble reporting telephone number to the customer Enterprise Technical Support (ETS) that operates on a 24x7x365 basis. Comcast provides technical support for service-related inquiries. Technical support will not offer consulting or advice on issues relating Customer Premise Equipment (CPE) not provided by Comcast.

2.3 Escalation. Reported troubles are escalated within the Comcast ETS to meet the standard restoration interval described in the Service Level Objectives. Troubles are escalated within the ETS as follows: Supervisor at the end of the standard interval plus one (1) hour; to the Manager at the end of the standard interval plus two (2) hours, and to the Director at the end of the standard interval plus four (4) hours.

2.4 Maintenance. Comcast's standard maintenance window is Sunday to Saturday from 12:00am to 6:00am local time. Scheduled maintenance is performed during the maintenance window and will be coordinated between Comcast and customer. Comcast provides a minimum of forty-eight (48) hour notice for non-service impacting scheduled maintenance. Comcast provides a minimum of seven (7) days notice for service impacting planned maintenance. Emergency maintenance is performed as needed.

Section 3. Service Level Objectives

Comcast provides Service Level Objectives for the service, including network availability, mean time to respond, and mean time to restore. The service objectives are measured monthly from the Comcast point of demarcation.

3.1 Availability. Availability is a measurement of the percentage of total time that the service is operational when measured over a 30 day period. Service is considered "inoperative" when either of the following occurs: (i) there is a total loss of signal for the service, (ii) output signal presented to the customer by Comcast does not conform to the technical specifications in Section 1.

3.2 Mean Time to Respond. Mean Time to Respond is the average time required for the ETS to begin troubleshooting a reported fault. The Mean Time to Respond objective is fifteen (15) minutes upon receipt of a fault notification or from the time a trouble ticket is opened with the ETS.

3.3 Mean Time to Restore. Mean Time to Restore is the average time required to restore service to an operational condition as defined by the technical specifications in Section 1 of this document. The Mean Time to Restore objective is four (4) hours for electronic equipment failure or six (6) hours for facilities failure from the time a trouble ticket is opened with the ETS.

Section 4. Customer Responsibilities

Comcast provides CPE for provisioning its services and the delivery of the UNI. Comcast will retain ownership and management responsibility for this CPE. As a result, the CPE must only be used for delivering Comcast services. Customers are required to shape their egress traffic to the contracted CIR.

Customers have the following responsibilities related to the installation, support, and maintenance of the Service.

4.1 Provide an operating environment with temperatures not below fifty-five (55) or above eighty-five (85) degrees Fahrenheit. Humidity shall not exceed ninety (90) percent at eighty-five (85) degrees Fahrenheit.

4.2 Provide secure space sufficient for access to one (1) standard, freestanding, equipment cabinet at each of the customer facilities, no further than fifty feet from the customer router or switch interface.

4.3 Provide outside cable entry conduit(s), entry cable ground point, and internal building conduit to allow Comcast the ability to rod/rope a fiber optic cable to the point of demarcation.

4.4 Locate and mark all private underground utilities (Water, Electric, etc.) along path of new underground placement not covered by utility companies.

4.5 Provide a pull rope in any existing duct that Comcast is to use and ensure existing duct is serviceable for Comcast use.

4.6 Obtain 'right-of-way' entry easement for Comcast facilities and equipment from property owners at each customer location.

4.7 The customer is responsible for coring of the building's outside wall and internal walls. Upon request, Comcast can perform this activity on an 'as needed' basis for an additional one-time fee.

4.8 Provide UPS AC power equipment, circuit sizing to be determined, if applicable.

4.9 Emergency local generator backup service, if applicable.

4.10 Provide access to the buildings and point of demarcation at each customer location to allow Comcast and its approved Contractors to install fiber for service installation. Provide access to each location for regular (8am - 5pm) and emergency (24 hour) service and maintenance of Comcast's equipment and facilities.

4.11 Provide, install and maintain a device that is capable of routing network traffic between the Service and the customer's Local Area Network (LAN).

4.12 Customer must provide a point of contact (POC) for installation, service activation and any maintenance activities.

Section 5. Definitions

5.1 Latency. Latency, also known as Frame Delay, is defined as the maximum delay measured for a portion of successfully delivered service frames over a time interval.

5.2 Jitter. Jitter, also known as Frame Delay Variation, is defined as the short-term variations measured for a portion of successfully delivered service frames over a time interval.

5.3 Packet Loss. Packet Loss, also known as Frame Loss, is the difference between the number of service frames transmitted at the ingress UNI and the total number of service frames received at the egress UNI.

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