

4.1.16 Synchronous Optical Network (SONET) (L.34.1.4)

Qwest's Networx SONETS leverages our next generation optical infrastructure to deliver a highly reliable, proven capability for the support of Federal Agency needs.

Qwest's SONET Services (SONETS) provide dedicated duplex transmission connectivity between two or more designated end points, over which Agency's service applications traverse at Agency-specified bandwidths. Qwest Synchronous Optical Network Services (SONETS) ride the multi-ring Qwest Four-Fiber Bi-Directional Line-Switched Ring (BLSR) SONET network to provide highly reliable transport from Optical Carrier level (OC)-3 through OC-48 with transmuxing and concatenation capabilities as required. [REDACTED]

Qwest complies with all of the SONETS performance requirements. Qwest's proven monitoring and measurement systems, procedures and evaluation methods enable us to exceed the Government's Service Delivery Point (SDP)-to-SDP availability requirements [REDACTED]

The Qwest network supports all capabilities, features and interfaces required for Networx SONETS. Qwest's SONETS service portfolio includes all bandwidths specified by the Government, including T-1, T-3, E-1 and E-3; SONET services that include [REDACTED] and Synchronous Digital Hierarchy (SDH) services that include Synchronous Transport Module (STM)-[REDACTED]. Qwest supports all of the capabilities, features and interfaces required for SONETS service. Qwest SONETS is a low-risk solution for the Agencies, because our network capacity will easily accommodate forecasted SONETS traffic loads now and in the future. Qwest

has many years of experience providing SONETS, and currently provides SONETS to numerous Fortune 500 clients and Government Agencies [REDACTED]

[REDACTED]

Figure 4.1.16-1 provides an easy reference to correlate the narrative requirements to our proposal response.

Figure 4.1.16-1. Table of SONETS Narrative Requirements

Req ID	RFP Section	RFP Requirement	Proposal Response
6447	C.2.5.2.2.1 (1)	The following SONETS Services features in Section C.2.5.2.2.1 are mandatory unless marked optional: 1. Bandwidth On Demand (BoD). The contractor shall provide Agencies with the ability to increase or decrease bandwidth in increments of at least 1 Mbps without interrupting service. The contractor shall indicate available increments. [OPTIONAL]	4.1.16.3.1.2

4.1.16.1 Technical Approach to SONETS Delivery (L34.1.4.1)

Qwest’s approach to providing a fully compliant SONETS is based on our adherence to proven engineering practices and a standards-based network. The sections that follow describe our approach to service delivery and how our approach benefits the Government. We’ll also describe how Qwest’s SONETS will facilitate the Federal Enterprise Architecture (FEA) objectives, how Qwest proposes to address problems that may be encountered in providing SONETS, and how our synchronization network architecture supports SONETS.

Qwest delivers SONETS using the Qwest domestic network and local access providers. Qwest will engineer, monitor and manage the proposed SONETS end-to-end to ensure scalability, interoperability, and high availability of the service to Agencies. The service provides required capacity and bandwidth for transport of Agencies’ voice, video, and data traffic, using and conforming to Institute of Electrical and Electronics Engineers (IEEE), Optical Internetworking Forum (OIF), American National Standards Institute

(ANSI), Telcordia and International Telecommunication Union (ITU) standards. The Qwest SONETS portfolio includes all required bandwidths and associated interfaces.

4.1.16.1.1 Approach to SONETS Delivery (L.34.1.4.1(a))

Qwest has the required technical knowledge and resources including pre-sales engineering, network planning, provisioning, operations groups, and field support to engineer and implement an optimum solution for the SONETS requirements of Agencies.

Standards-Based, Global Network

Qwest delivers SONETS by providing solutions using the Qwest network, International partners, and local access providers. The service provides required capacity and bandwidth for transport of Agencies' voice, video, and data traffic, and conforms to IEEE, OIF, ANSI, Telcordia, and ITU standards. Qwest's SONETS includes all required bandwidths and associated interfaces.

Qwest's fiber-optic network is built on [redacted] transmission equipment. [redacted]

[redacted] Other topologies can be supported using appropriate Service Enabling Devices (SEDs). [redacted]

[redacted] Qwest's 4F-BLSR network is configured [redacted] to reduce end-to-end delay, maximize utilization, and improve installation intervals. [redacted]

[REDACTED]

[REDACTED] the Qwest SONET network robust against multiple failure conditions. This includes the capability to do scheduled span-switches to allow non-service interrupting maintenance of fiber and optical amplifiers. Qwest supports all mandatory protection mechanisms on the network and tributary side using appropriate SEDs or adjunct network elements to provide those protection methods that are not already incorporated into the networks.

Qwest's SONET network is deployed on a footprint of Points of Presence (POPs) distributed throughout the U.S. (**Figure 4.1.16-2**). Hundreds of POPs and thousands of aggregation points expand the network reach in the U.S. Multiplexing and concatenation (standard and virtual) are standard features of the network that are included in the current network deployment with no modifications required to deliver the specified service



features and requirements. All services are comprised of local access, backbone network, wavelengths, and appropriate SEDs. Qwest's SONETS is fully interoperable with various SEDs, other access and long haul providers providing needed flexibility for both SDP-to-SDP and Point of Presence (POP)-to-POP solutions as specified in the requirements. Qwest's SONETS seamlessly carries a variety of protocols including Asynchronous Transfer Mode (ATM), Frame Relay (FR), Internet Protocol (IP), and Ethernet. These services are delivered transparently from end-to-end.

The service provides required capacity of bandwidth for transport of Agencies voice, video and data traffic that originates and terminates on a physical connection at an SDP. Qwest's SONETS consists of [REDACTED] [REDACTED] as well as SONET to SDH conversion. Qwest's SONETS supports and exceeds all required user network interfaces (UNIs) including [REDACTED] [REDACTED] [REDACTED]

Qwest's established relationships with many service providers enable us to offer and implement cost-effective, end-to-end SONETS to Agencies everywhere. [REDACTED]

[REDACTED] Our relationships include Interexchange Carriers (IXCs) Local Exchange Carriers (LECs), Incumbent LECs (ILECs), Competitive LECs (CLECs) and Alternate Access Providers (AAPs).

Qwest has many options at its disposal for delivering service for the last mile through local access partnerships, on-net facilities, and custom configurations or builds. Qwest has interconnection agreements and physical

connectivity with CLECs and ILECs and fiber providers to deliver outstanding service to anywhere required by the RFP.

Proven Engineering Practices

Qwest's approach to providing a fully compliant SONETS is based on our adherence to proven engineering and operational practices and a standards-based network. Qwest delivers SONETS using the Qwest domestic network and local access partners. Qwest will engineer, monitor, and manage the proposed SONETS end-to-end to ensure scalability, interoperability and high availability of the service to Agencies.

Qwest is committed to SONETS by keeping the network robust and feature-rich. [REDACTED]

[REDACTED] Additional information on Qwest's Operations and Engineering support for the delivery of SONETS can be found in Section 4.1.16.4.2, SONETS Measures and Engineering Practices.

Commitment to Customers

To ensure scalability, interoperability, and high availability, Qwest engineers, monitors (including in-service monitoring), and manages end-to-end SONETS solutions. Qwest will manage the proposed SONETS from its Network Operations Center (NOC) [REDACTED]

[REDACTED]. Qwest will interface with the NOCs of its partners to monitor and manage the proposed SONETS end-to-end to ensure high reliability and availability of the service to Agencies.

4.1.16.1.2 Benefits of SONETS Technical Approach (L.34.1.4.1(b))

Key features and benefits of the Qwest SONETS network are summarized [REDACTED]

[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]

As shown in **Figure 4.1.16-4**, Qwest’s SONETS supports the FEA Objectives. Qwest’s SONETS support the FEA objectives by providing cost effective connectivity using standardized, replicable solutions for IT infrastructure to connect applications, Government employees, and citizens.

Figure 4.1.16-4. Qwest’s SONETS Support to FEA Objectives

FEA Objectives	Qwest Solution
Improve utilization of Government information	Qwest SONETS facilitates connecting users anywhere to information resources using a scalable, flexible, standards-

FEA Objectives	Qwest Solution
resources to focus on core Agency mission and service delivery to citizens by using the FEA	based network
Enhance cost savings and avoidance	Provides inexpensive connectivity using standardized, replicable solutions and interfaces
Increase cross-Agency and inter-Government collaboration	Qwest SONETS enables Agencies to enhance collaboration, connectivity, and cost-effectiveness, contributing to the transformation of the Federal Government into a citizen-centered, results oriented, market-based organization as set for the in the President's Management Agenda (PMA)

4.1.16.1.3 Solutions to SONETS Problems (L.34.1.4.1(c))

Qwest has extensive experience in the delivery of SONETS services and we apply this knowledge to ensure the delivery of high quality SONETS to Agencies. Extensive pre-deployment laboratory system and integration testing identifies the majority of problems, and Qwest's proactive network and configuration management/fault management systems and methods are leveraged to quickly resolve unforeseeable operational issues. **Figure 4.1.16-5** summarizes some of the key problems we have encountered and the solutions we apply to resolve issues.

[Redacted]

[Redacted]	[Redacted]
[Redacted]	[Redacted]
[Redacted]	[Redacted]
[Redacted]	[Redacted]
[Redacted]	[Redacted]

4.1.16.1.4 Synchronization Network Architecture (L.34.1.4.1(d))

[Redacted content]

[Redacted content]

[Redacted content]

[Redacted text block]

[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]
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4.1.16.2 Satisfaction of SONETS Performance Requirements (L.34.1.4.2)

Qwest complies with all of the Networx SONETS performance requirements. Qwest has proven monitoring and measurement systems, procedures, and evaluation methods [REDACTED]

4.1.16.2.1 SONETS Quality of Service (L.34.1.4.2(a), C.2.5.2.4.1)

Qwest meets or exceeds all of the AQLs for SONETS, as shown in

[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

To ensure high availability, Qwest monitors (including in-service monitoring) and manages end-to-end SONETS solutions. Qwest will support

availability ISM at the SONET layer from our Network Operations Center (NOC) [REDACTED]

[REDACTED] Qwest will interface with the NOCs of its partners to monitor and manage the proposed SONETS end-to-end to ensure high reliability and availability of the service to Agencies.

Qwest will support critical availability [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] Monitoring of the SONET overhead data is non-intrusive and does not require disruption of the circuit being monitored. The objective is to proactively monitor and detect remote defect, error, and failure indications and to initiate corrective action before the system fails. [REDACTED]

[REDACTED]

4.1.16.2.2 Approach for Monitoring and Measuring SONETS KPIs and AQLs (L34.1.4.2(b))

For SONETS, the Network Elements (NEs) capture and maintain performance data on equipment and circuits. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Results are calculated and displayed on the network scorecard.

[REDACTED]

[REDACTED]

Qwest monitors all NEs of the SONETS and Service Enabling Devices (SEDs) on a 24x7x365 basis [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Qwest maintains a central data repository for key network performance information [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] The calculation for TTR uses the same business rules as the Government requires for its services.

4.1.16.2.3 SONETS Performance Improvements (L.34.1.4.2(c))

Qwest offers the Agencies superior levels of network availability that will minimize productivity losses associated with interruption of network services. [REDACTED]

[REDACTED] Qwest's use of 4F-BLSR architecture provides exceptional reliability and availability in the backbone. Further, this superior network design eliminates many single points of failure.

[REDACTED]

4.1.16.2.4 Additional SONETS Performance Metrics (L.34.1.4.2(d))

[REDACTED]

Qwest will operate in good faith to engineer an SONETS solution to serve unique Agency needs. Qwest is able to leverage our vast SONETS product portfolio which includes a variety of SED providers and specific SONETS

solutions. Through a special combination of vendor solutions and talented engineering capabilities Qwest will serve an Agency's business needs.

4.1.16.3 Satisfaction of SONETS Specifications (L.34.1.4.3)

Qwest's network supports all of the capabilities, features and interfaces required for Networx SONETS. Qwest provides dedicated duplex transmission connectivity at customer-specified bandwidths. Our SONETS service supports all bandwidths and interfaces specified by the Government.

Qwest's SONET services include [REDACTED]

[REDACTED] Qwest's SDH services

include [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

4.1.16.3.1 Satisfaction of SONETS Requirements (L.34.1.4.3(a))

Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for SONETS. The following three sections explain how Qwest will support the capabilities, features, and interfaces requirements of the RFP. It is intended to provide the technical description required per L.34.1.4.3(a), and does not limit or caveat Qwest's compliance in any way.

4.1.16.3.1.1 Satisfaction of SONETS Capabilities Requirements (L.34.1.4.3(a), C.2.5.2.1.4)

Qwest's SONETS provides dedicated duplex transmission connectivity between two or more designated end points, over which Agencies' service applications traverse at customer-specified bandwidths. Qwest's SONETS rides the Qwest 4F-BLSR network to provide highly reliable transport from DS1 up through OC-48.

Qwest's 4F-BLSR network includes more than 140 SONET rings incorporating more than 1,400 add drop multiplexers (ADMs). The network is connected to multiple metro networks in every major US city. Qwest has many options for delivering service in the last mile, through local access partnerships, on-net facilities and custom builds. Qwest has interconnection agreements and physical connectivity with CLECs, ILECs, and fiber providers to deliver outstanding service everywhere Agencies require service.

[REDACTED] provides a brief description of Qwest's technical approach that will enable Qwest to fully meet Government's feature requirements for SONETS.

[REDACTED]

[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]

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[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]
		[REDACTED]
+	[REDACTED]	[REDACTED]
+	[REDACTED]	[REDACTED]
+	[REDACTED]	[REDACTED]

4.1.16.3.1.2 Satisfaction of SONETS Features Requirements

(L.34.1.4.3(a), C.2.5.2.2)

[REDACTED] provides a brief description of Qwest's technical approach that will enable Qwest to fully meet Government's feature requirements for SONETS.

[REDACTED]

+	[REDACTED]	[REDACTED]
+	[REDACTED]	[REDACTED]
	[REDACTED]	[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]

**4.1.16.3.1.3 Satisfaction of SONETS Interface Requirements
(L.34.1.4.3(a), C.2.5.2.3)**

[REDACTED] is a listing of interfaces that the RFP requires. Qwest has added a column to show SEDs that may be used to enable Qwest to fully meet the Government's interface requirements for the SONETS.

[REDACTED]

[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]
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[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]	[Redacted]

4.1.16.3.2 Proposed Enhancements to SONETS (L.34.1.4.3(b))

Qwest’s deployed state-of-the-art SONET network is fully capable of meeting the current and future SONET and SDH Service requirements of Agencies.

Qwest continuously evaluates new technologies in its laboratories [REDACTED] [REDACTED] for potential deployment in the network to support new and emerging services and applications. This approach keeps Qwest current with Agency demands and service requirements. Qwest will work with the Government to identify any emerging service needs of Agencies and take appropriate measures to satisfy these new requirements promptly.

Qwest plans a number of potential service enhancements. [REDACTED]

4.1.16.3.3 Network Modifications Required for SONETS Delivery (L.34.1.4.3(c))

[REDACTED]

Qwest has significant spare capacity to meet the current and future requirements of Agencies. As a part of network lifecycle, Qwest refreshes the technology of the network, and Agencies will continue benefit from the next generation of technology. [REDACTED]

[REDACTED]

[REDACTED] These functionalities will benefit Agencies by introducing new services and features. These functionalities will be implemented:

[REDACTED]

[REDACTED]

[REDACTED]

4.1.16.3.4 Experience with SONETS Delivery (L.34.1.4.3(d))

Qwest’s has a long history of providing SONETS to Federal Agencies. Qwest is both a Regional Bell Operating Company and an IXC. This perspective provides unique insight into the provision of local access and delivery of service to customers in both market segments. In the federal arena, [REDACTED]

[REDACTED] have trusted their networking needs to us for many years. Qwest SONETS helped accelerate the pace of progress for the broad [REDACTED] activities within the [REDACTED] by providing advanced communications and networking support [REDACTED].

4.1.16.4 Robust Delivery of SONETS (L.34.1.4.4)

Qwest can easily accommodate the SONET traffic levels forecast by the Government. Qwest’s maintains and preserves a secure, well-run, and robust network. We have well defined processes for managing network availability, capacity and growth, and will assure Agencies robust and resilient access and backbone networks that will accommodate all of their telecommunications requirements now and in the future.

4.1.16.4.1 Support for Government SONETS Traffic (L.34.1.4.4(a))

Qwest has analyzed the traffic data provided by the Government. [REDACTED]

[REDACTED]

[REDACTED] Qwest has enough

available capacity to meet current and future Government requirements.

In the event that Government demand exceeds current forecasts, Qwest’s SONETS network has sufficient capacity to support this growth. [REDACTED]

[Redacted]

4.1.16.4.2 SONETS Measures and Engineering Practices (L.34.1.4.4(b))

[Redacted]

Qwest has a well documented and disciplined configuration and change management processes that provides for end-to-end coordination and service assurance for all routine maintenance activities. Qwest routinely performs maintenance and constantly monitors all equipment to ensure it is in proper working order. Qwest also controls access to the sites and oversees contractor work to ensure everything is completed per Qwest standards.

When work needs to be performed on traffic carrying systems, all affected customers are notified, the work is performed off hours during a pre-defined maintenance window, and the work is outlined in great detail, with step-by-step procedures for the individuals performing the work. Furthermore, Qwest ensures that all equipment has the proper spares allotted based on an established Network Sparing Policy.

Qwest has deployed 4F-BLSR to provide virtually interruption-free service to its customers, even during failure incidents or fiber cuts. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] This proactive monitoring and management minimizes downtime in the network.

Qwest closely monitors the network's utilization to develop trended growth patterns. The trended growth data is a key driver for additional capacity. In addition, Qwest evaluates new technologies and re-affirms the validity of its current architecture to assure continuous, smart network evolution to stay ahead of customer growth and application needs. In addition, Qwest's centralized engineering team applies a consistent capacity management model to all data services.

4.1.16.5 SONETS Optimization and Interoperability (L.34.1.4.5)

[REDACTED]
[REDACTED]
[REDACTED] This minimizes stranded or wasted capacity, and ensures efficiencies and higher quality services.

Qwest optimizes its network architecture at the local, metro, and national level. Our remote concentration and high bandwidth transmission facilities allow Qwest to aggregate local traffic into centralized locations, and transport the traffic to major Qwest Transport POPs. [REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

Qwest optimizes local access on our CONUS Point-to-Point SONETS and PLS by continually re-grooming local access nodes and direct access systems to provide connectivity to our POP sites.

Qwest's attention to standards compliance benefits the Government by ensuring that SONET standard equipment will interface seamlessly, not only with the Qwest network, but also with other carriers' networks and other non-

SONET networks (for example, ATM and FR). Qwest's standards-based SONETS already interoperates with hundreds of other carriers' networks and thousands of customer networks through industry-standard interfaces. SONETS interworking capability enables seamless communications among devices that support dissimilar protocols such as ATM, FR, and IP.

4.1.16.5.1 Optimizing the Engineering of SONETS (L.34.1.4.5(a))

Qwest ensures that our state-of-the-art network is engineered for maximum efficiency and utility. [REDACTED]

[REDACTED]

Qwest also optimizes individual optical circuits to ensure that the most efficient route is chosen—generally the shortest and most direct route—with minimal switching. Circuits are switched between different systems only when absolutely necessary. These practices ensure optimal network efficiency, and minimize latency and points of failure on an Agency's circuits.

Qwest optimizes its fiber infrastructure to limit signal-degrading factors such as attenuation, dispersion, and reflection. Qwest uses various amplification technologies, power balancing, dispersion compensation, and fiber splicing to optimize use of the available spectrum, permitting Qwest to provision the maximum amount of optical services on each fiber. Our optimization methods increase network efficiency and reduce costs.

4.1.16.5.2 Methods Applied to Optimize the Network Architecture (L.34.1.4.5(b))

[REDACTED] These facilities allow Qwest to aggregate traffic to centralized locations, then

transport traffic to major Qwest Transport POPs in each market using high bandwidth transmission facilities.

In metro markets, Qwest has multiple networks that expand out to customer premises and end offices. [REDACTED]

[REDACTED]

[REDACTED]. This

translates to better application performance and increased reliability.

The total network includes more than [REDACTED] OC-192 SONET rings incorporating over [REDACTED] ADMs at Transport POPs. The network is connected to multiple metro networks in every major city of the country.

Qwest's uses high bandwidth transmission facilities and remote concentration to optimize its state-of-the-art 4F-BLSR network through aggregation and backhaul.

4.1.16.5.3 Access Optimization for SONETS (L.34.1.4.5(c))

Qwest optimizes local access on its SONETS and PLS by continually re-grooming local access nodes and direct access systems to provide connectivity to its POP sites. Continual grooming is necessary because customer needs and concentrations change continuously. As needs change,

Qwest re-grooms circuits to optimal hub sites. Over time, Qwest's local access sites migrate closer and closer to customer locations. Eventually, as traffic levels reach appropriate thresholds, Qwest may choose to build facilities into a new site. Agencies will benefit from greater efficiencies and can look forward to shorter intervals for many access services.

4.1.16.5.4 Vision for SONETS Internetworking (L.34.1.4.5(d))

Qwest anticipates significant advances in SONETS over the next several years. While some applications served by SONETS will migrate to IP/MPLS transport, many will continue to require the predictable, high availability performance associated with traditional SONETS. [REDACTED]

[REDACTED]

