4.1.14. Internet Protocol Service (IPS) (L.34.1.4)

Qwest's Networx IPS offers a high quality, cost effective and global capability with a track record of success with federal agencies.

Qwest is ideally positioned to offer Internet Protocol Service (IPS) to Federal agencies through the Networx Program. Qwest offers a world-class backbone network, a full complement of access options, and in-depth experience garnered from successful service delivery to a broad set of Federal and commercial customers. We own and operate a Tier 1 global Internet backbone, built on top of our 10 Gbps-based private Multi-Protocol Labeled Switched (MPLS) core. This core network provides the foundation for many Networx services, in addition to IPS, thereby creating opportunities for service convergence from Day One of the Networx Program.

Qwest IPS also provides flexible access solutions for the Agencies - Fractional T-1 and T-1 through OC-192c dedicated access, Ethernet, ATM, Frame Relay, Broadband Wireless, Multimode Wireless LAN (MWLANS), Digital Subscriber Line (DSL), ISDN, Dial, Cable and Satellite. We support a wide range of service-enabling devices (SEDs) to connect Government users to the Internet. [redacted]

Qwest provides services to the world's largest ISPs ([redacted]), as well as numerous Federal agencies and Fortune 500 companies. Qwest already provides IP services to several Federal agencies, including [redacted]

[redacted] Qwest's iQ Networking family of services, of which IPS is an integral part, was recognized for our superlative service by the Network Computing Magazine's Best Value Award for Wide Area Networking (WAN) solutions in August 2005.

Figure 4.1.14-1 provides an easy reference to correlate narrative requirements to our proposal response.

Figure 4.1.14-1. Table of IPS Narrative Requirements

Req_ ID	RFP Section	RFP Requirement	Proposal Response
2111	C.2.4.1.3.2 (1)	User-to-Network Interface for IPS: UNI Type 1 Interface/Access Type: Asynchronous Transfer Mode Service Network-Side Interface: 1. T1 2. T3 3. OC-3c 4. OC-12c Protocol Type: IPv4/v6 over ATMS	4.1.14.3.1.3
2110	C.2.4.1.3.2 (2)	User-to-Network Interface for IPS UNI Type 2 Interface Type and Standard: Cable High Speed Access Payload Data Rate or Bandwidth: 320 Kbps up to 10 Mbps Signaling Type: Point-to-Point Protocol, Ipv4/v6	4.1.14.3.1.3
2109	C.2.4.1.3.2 (3)	User-to-Network Interface for IPS UNI Type 3 Interface Type and Standard: Circuit Switched Data Service Payload Data Rate or Bandwidth: 1. ISDN at 64 Kbps 2. ISDN at 128 Kbps 3. ISDN dial backup at 64 Kbps 4. ISDN dial backup at 128 Kbps Signaling Type: Point-to-Point Protocol, Ipv4/v6	4.1.14.3.1.3
2107	C.2.4.1.3.2 (4)	User-to-Network Interface for IPS UNI Type 4 Interface Type and Standard: Ethernet Interface Payload Data Rate or Bandwidth: 1. 1 Mbps up to 1 GbE (Gigabit Ethernet) 2. 10 GbE (Optional) Signaling Type: Ipv4/v6 over Ethernet	4.1.14.3.1.3
2106	C.2.4.1.3.2 (5)	User-to-Network Interface for IPS UNI Type 5 Interface Type and Standard: Frame Relay Service Payload Data Rate or Bandwidth: 1. 56 Kbps with 32 Kbps CIR 2. Fractional T1 (a) 128 Kbps with 64 Kbps CIR (b) 256 Kbps with 128 Kbps CIR (c) 384 Kbps with 128 Kbps CIR (d) 512 Kbps with 256 Kbps CIR (e) 768 Kbps with 384 Kbps CIR 3. T1 (a) 1.536 Mbps with 768 Kbps CIR (b) 1.536 Mbps with 1024 Kbps CIR 4. Fractional T3 (a) 3 Mbps (b) 6 Mbps (c) 12 Mbps (d) 24 Mbps (e) 45 Mbps 5. T3 Signaling Type: Ipv4/v6 over FRS	4.1.14.3.1.3
2105	C.2.4.1.3.2 (6)	User-to-Network Interface for IPS UNI Type 6 Interface Type and Standard: IP over SONET Service Payload Data Rate or Bandwidth: 1. OC-3c 2. OC-12c 3. OC-48c 4. OC-192c Signaling Type: IP/PPP over SONET	4.1.14.3.1.3
2104	C.2.4.1.3.2 (7)	User-to-Network Interface for IPS UNI Type 7 Interface Type and Standard: Private Line Service Payload Data Rate or Bandwidth: 1. DS0 2. Fractional T1 3. T1 4. Fractional T3 5. T3 6. OC-3c 7. OC-12c 8. OC-48c 9. OC-192c Signaling Type: IPv4/v6 over PLS	4.1.14.3.1.3
2103	C.2.4.1.3.2 (8)	User-to-Network Interface for IPS UNI Type 8 Interface Type and Standard: Voice Service Payload Data Rate or Bandwidth: Analog dialup at 56 Kbps Signaling Type: Point-to-Point Protocol, Ipv4/v6	4.1.14.3.1.3
2102	C.2.4.1.3.2 (9)	User-to-Network Interface for IPS UNI Type 9 Interface Type and Standard: DSL Service Payload Data Rate or Bandwidth: xDSL access at 1.5 to 6 Mbps downlink, and 384 Kbps to 1.5 Mbps uplink signaling Type: Point-to-Point Protocol, Ipv4/v6	4.1.14.3.1.3
2101	C.2.4.1.3.2 (10)	User-to-Network Interface for IPS UNI Type 10 Interface Type and Standard: Multimode/Wireless LAN Service Payload Data Rate or	4.1.14.3.1.3

Req_ ID	RFP Section	RFP Requirement	Proposal Response
		Bandwidth: See Section C.2.14.3.3.1 MWLANS User-to-Network Interfaces	
2100	C.2.4.1.3.2 (11)	User-to-Network Interface for IPS UNI Type 11 Interface Type and Standard: Wireless Access Payload Data Rate or Bandwidth: See Section C.2.16.2.3.3.1 Wireless Access Arrangement Interfaces	4.1.14.3.1.3
2099	C.2.4.1.3.2 (12)	User-to-Network Interface for IPS UNI Type 12 Interface Type and Standard: Satellite Access Payload Data Rate or Bandwidth: See Section C.2.16.2.4.3.1 Satellite Access Arrangement Interfaces	4.1.14.3.1.3

Figure 4.1.14-2 provides a list of ICB CLIN and Case Numbers.

Figure 4.1.14-2. Table of ICB CLIN and Case Numbers

CLIN	Case Number	Case Description
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

4.1.14.1 Qwest's Technical Approach to IPS Delivery (L.34.1.4.1)

The Qwest technical approach to providing a fully compliant IPS is based on our strong commitment to our customers, adherence to proven engineering practices, and a standards-based, global network. Qwest IPS combines our 10 Gbps-based private MPLS core network and reliable Internet access from dial-up to high-speed optical connections with a dedicated support organization to engineer, install, maintain and modify IPS for Federal customers. Our IPS offers significant benefits to agencies, including:

- High service quality derived from our Tier 1 network

- Service continuity stemming from a rich set of access options
- Reliable service delivery
- High levels of security provided by our corporate security organization
- Use of the standard TCP/IP protocol suite

Our extensive experience has also created an in-depth understanding of the problems we may encounter in the delivery of IPS, resulting in proactive operational support. Qwest offers a comprehensive approach to IPS for the Networx program.

The sections that follow describe our approach to service delivery and how our approach benefits the Government. We'll also describe how Qwest IPS will facilitate the Federal Enterprise Architecture (FEA) objectives, how Qwest proposes to address problems that may be encountered in providing IPS, and how our synchronization network architecture supports IPS.

4.1.14.1.1 Approach to IPS Delivery (L.34.1.4.1(a))

Qwest's approach to service delivery encompasses the people, operational processes and network platform necessary to deliver exceptional services.

Proven Engineering Practices

Qwest Operations and Engineering groups are committed to IPS by keeping the network robust and feature-rich. The network is monitored constantly and any maintenance work is carefully planned and performed off-hours when possible. Proven engineering and operational practices and guidelines are strictly followed. Additional details on Qwest Operations and Engineering's support the delivery of IPS can be found in Section 4.1.14.4.2, IPS Measures and Engineering Practices.

Once service is provisioned, operational support becomes a key element of service delivery. Qwest's operational support group ensures that our services meet performance goals. Qwest's [redacted] Network Operations Centers (NOCs) continually monitor Qwest IPS. Because Qwest's network is converged on MPLS technology, these centers support operations for all of the Qwest IP data services as well as traditional data services such as ATM and Frame Relay. Service convergence facilitates interoperation among services, and enables trouble management for the complex services. For example, our NOCs have an inherent ability to monitor Service Delivery Point to Service Delivery Point (SDP-to-SDP) IPS that includes Qwest ATM/Frame Relay access.

Qwest's NOCs proactively monitor the network and issue alerts on events affecting the Qwest global network to ensure that potential problems are resolved through rapid fault assessment and deployment. Each Qwest NOC is equipped with highly trained and experienced personnel who

understand the Government customers' network and internetworking equipment. All required network management information is available to both Qwest Networx program team members and Federal customers through the Qwest Control Networx Portal.

Qwest's NOC senior management continually reviews Key Performance Indicators (KPIs) and best practices to identify preventive steps to address customer issues, to ensure that performance issues are resolved promptly, and to validate the customers' network performance meets required standards. From a single, accountable, one-call-resolve support structure to convenient, quick, Web-based management and reporting tools, the Qwest Networx program and customer support teams will address all issues that affect service.

Standards-Based, Global Network

Domestically, Qwest's IPS service is provided over Qwest's 10 Gbps-based private MPLS core network. The MPLS core network architecture is based on Qwest TeraPOPs – a system of multiple, high capacity, router-based Points of Presence (POPs) located throughout CONUS. Each TeraPOP contains at least two core MPLS routers, directly connected with redundant and diverse 10 Gbps wavelength circuits to at least two other TeraPOPs. This architecture achieves both core element and backbone link redundancy. Design rules are in place to ensure that the failure of any backbone link does not negatively impact the delivery of MPLS packets on the backbone. The MPLS core network functions as a secure fast-forwarding network plane, as described in Section 3.0, Architecture. It contains no Internet routes itself, and is not visible outside of the Qwest network operations environment.

[redacted]

Unlike other providers who waited to deploy MPLS in their production network operations, Qwest has been using MPLS for more than 4 years to improve the operations of all of our IP-based transport services.

Qwest was one of the first to implement MPLS Fast Re-Route (FRR), a technology critical for high-performance IPS. By using MPLS FRR, backbone link failures or router failures do not require the traditional time, measured in seconds, for route tables to converge across the entire network before IP traffic is restored. MPLS FRR detects and re-routes the failed backbone link traffic over an alternative route in approximately 100 milliseconds, ensuring little impact to customer applications.

Qwest has converged data services on a common MPLS core, thus eliminating the need for the customer to have multiple access circuits to different networks and exceeding the service restoration rate of traditional IP over SONET networks. [redacted]

The high quality of the Qwest network is evidenced in its ability to provide connectivity for carrier quality voice services using VoIP technology. Qwest committed early to VoIP. In 2001, we became one of the first carriers to use the IP network to transport large volumes of long distance traffic. Qwest moves more than 4 billion minutes of toll-quality voice services as Voice over Internet Protocol (VoIP) traffic every month.

Complementing our MPLS core network, Qwest aggressively developed a broad set of network access capabilities that include both alternate modes of access and extensive reach to customer locations. Qwest has a rich set of capabilities and partners to deliver these access services. Our flexible access options include:

- [redacted]

[redacted]

Sections 1.2.1 and 1.4 of this volume provide further detail for each of these access capabilities.

Qwest's IPS platform also extends internationally. The IPS backbone spans the Asia Pacific region, Hawaii and CONUS, with approximately [redacted] public and private peering points providing more than [redacted] Gbps of public and private Internet peering. Outside of these regions, [redacted] Section 1.2.2 of this volume provides an overview of international carrier relationships. Section 4.1.14.3.4 discusses Qwest's international peering experience in further detail.

Commitment to Customers

Qwest staff rigorously lives up to our *Spirit of Service*™ motto by closely collaborating with our customers to identify requirements and deliver the services that best suit our customers' needs. Our operations teams and

infrastructure take full advantage of IP-based convergence to create one of the most efficient network platforms in the industry.

Our IPS strategy provides an Agency with many advantages, including ease of use, flexible access alternatives, and scalability. Our network and partners provide the underlying infrastructure to enable our service delivery capability, ensuring worldwide continuity of service for Agencies.

Qwest's approach to services delivery starts with our people. Qwest understands the Government's need to employ comprehensive and easy to use IPS all over the world. Our Networx program management staff and sales engineers will work closely with Agencies to ensure that we understand Agency requirements and configure IPS to suit the specific need. Qwest Operations will work with our Networx team to engineer, provision, and operate IPS service. Qwest Sales Engineers will work with Agencies to recommend appropriate SED and service configurations to meet their requirements.

Qwest takes complete responsibility for the provisioning of any IPS. This includes the ordering and installation of the SED, the ordering and provisioning of the requested access method, configuration of IPS, and complete testing and turn-up.

4.1.14.1.2 Benefits of Qwest's IPS Technical Approach (L.34.1.4.1(b))

Agencies will enjoy flexible access from any location to a converged IP MPLS network, and a simplified operational environment through the Qwest Control Networx Portal. Qwest tailors IPS to the specific application priorities of each Agency. ***Figure 4.1.14-3*** summarizes the benefits of our solution.

Figure 4.1.14-3. Qwest's IPS Features and Benefits

Feature	Benefit	[redacted]
High-Availability, High-Capacity 10 Gbps-based MPLS Core.	Improved performance in the event of router and backbone trunk circuit	[redacted]

Feature	Benefit	[redacted]
	failures.	[redacted]
Qwest's IPS supports local access types PL, ATM, and Frame Relay services. Flexible and standards-based access protocols include HDLC, PPP, FR, ATM, xDSL, T1, DS3, OC-x, and Ethernet.	Service continuity for customers and their interfaces and new interfaces to enable flexible access and new service types.	[redacted]
Private MPLS Core	Provides protection of infrastructure, reducing the impact of attacks and increasing core network availability.	[redacted]
Advanced Distributed Denial of Service (DDoS) detection systems and proactive measures	Significantly reduces the impact of DDoS attacks on our customers.	[redacted]
ILEC and CLEC Ethernet Access	Ethernet access enables Government access to IPS at higher and more flexible data rates as well as integrating with existing equipment. Ethernet access through a variety of partners expands the footprint of high-speed local access.	[redacted]
Qwest is among the top five Internet providers.	Excellent access to Internet customers around the world.	[redacted]
Extensive local dial-up and ISDN access combined with an application to ensure local calling, Wi-Fi and international roaming	Remote access for mobile and teleworkers.	[redacted]

Because the Internet has become a fundamental tool for Government information and communications, Qwest's IPS also supports the Federal Enterprise Architecture (FEA) objectives for improved utilization of government information resources, increased cost savings and cost avoidance, increased collaboration and interoperability, and reliability (***Figure 4.1.14-4***).

Figure 4.1.14-4. Qwest's IPS Support to FEA Objectives

FEA Objective	[redacted]
Improve utilization of Government information resources	[redacted]
Enhances cost savings and cost avoidance	[redacted]
Increases cross-agency and inter-government collaboration	[redacted]

4.1.14.1.3 Solutions to IPS Problems (L.34.1.4.1(c))

Qwest has extensive experience in the delivery of IPS services. We apply this experience to ensure the delivery of high quality IPS 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 unforeseen operational issues. ***Figure 4.1.14-5*** summarizes some of the key problems we have encountered and the solutions we apply to resolve issues.

Figure 4.1.14-5 Qwest's Approach to Common IPS Delivery Challenges

Problem	[redacted]
Customer needs assistance from Qwest to thwart security threats and denial of service (DoS) malicious actions.	[redacted]
Customer needs to modify their Internet Port network service.	[redacted]
Customer needs to modify (Move, Add, Change, Delete) their IPS at short notice.	[redacted]
Customer requires Class of Service (CoS)	[redacted]

Problem	[redacted]
prioritization on specific types of data traversing their IPS connections to fix problems with IP-based services such as VoIP or Video.	[redacted]
Customer's Primary Domain Name Services have failed and their e-mail is now bouncing back to the original sender.	[redacted]

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

[redacted]

[redacted]

[redacted]

[redacted]		
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

[redacted]

4.1.14.2.1 IPS Quality of Service (L.34.1.4.2(a))

Qwest's IPS [redacted] the Networx program performance metrics as shown in ***Figure 4.1.14-8***. Our performance metrics are consistent with the Networx definitions for each KPI.

Figure 4.1.14-8. Qwest Compliance with Government IPS Performance Metrics

Key Performance Indicator (KPI)	User Type	Performance Standard (Level/Threshold)	Acceptable Quality Level (AQL)	[redacted]
Av(Port)	Routine	99.95%	≥ 99.95%	[redacted]
	Critical	99.995%	≥ 99.995%	[redacted]
Latency (CONUS)	Routine	60 ms	≤ 60 ms	[redacted]
	Critical	50 ms	≤ 50 ms	[redacted]
GOS (Data Delivery Rate)	Routine	99.95%	≥ 99.95%	[redacted]
	Critical	99.995%	≥ 99.995%	[redacted]
Time to Restore	Without dispatch	4 hours	≤ 4 hours	[redacted]
	Without dispatch	8 hours	≤ 8 hours	[redacted]

[redacted]

[redacted]

4.1.14.2.2 Approach for Monitoring and Measuring IPS KPIs and AQLs (L.34.1.4.2(b))

Qwest monitors and measures the KPIs and AQLs using automated processes that pull data from the root source, summarize it, and display it using Web tools. These Web tools display actual results and provide a color-coded visual indicating whether performance goals have been achieved. Our approach is to completely automate the Web display of results from data collection. This ensures that the focus is on responding to performance issues, rather than on performance report generation. The automated reporting process eliminates any question of manipulating the performance data.

Measuring SDP-to-SDP Latency, Packet Loss and Jitter and the Role of SEDs

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Use of Statistical Sampling in lieu of Direct KPI Measurements

Qwest does not propose to use statistical sampling in lieu of direct KPI measurements. While our approach to KPI measurements does use probe measurements, the measurements are taken on the actual network data and are direct, unfiltered measurements, not statistical extrapolations.

The Use of Government Furnished Property (GFP)

If an Agency orders a Transport/IP/optical service in which they are employing a GFP device, Qwest will provide KPI monitoring and measurement of the delivered service in three ways:

1. Request the Agency provide SNMP capability to the device for the Qwest NOC
2. Request that the Agency buy a monitoring SED from Qwest
3. Coordinate with the Agency per Amendment 8 change for the following:

Qwest understands that the ordering Agency may (1) elect to not order such SEDs and/or (2) elect to not permit Qwest access to, or any use of, the agency's customer-premises equipment or software for such purposes.

Qwest further understands that in these situation(s) and unless otherwise agreed to by Qwest and the user Agency, Qwest, when directed by the user Agency or by GSA, will monitor, measure, and report the performance of the service for KPI/AQL and for SLA purposes either (1) on an SDP-to-SDP basis, by defining the SDP for performance metric measurement purposes for affected location(s) as being located at the connecting POP(s) of the location(s), or (2) on a POP-to-POP basis.

For network KPIs, we use Statistical Analysis System (SAS) to display the Network Reliability Scorecard. This includes the KPIs, the objectives, and clear graphical representation of objectives met or missed for each reporting

period. The scorecard is our tool to show both upper management and network management the current health of the network. The scorecard is reviewed daily at the executive level to ensure the proper attention and focus, and by our network management teams to ensure Service Quality Levels (SQL) are consistently met.

For all services that Qwest offers, we use the [redacted] trouble ticketing system. [redacted] is a trouble ticketing system that is an industry-leading off-the-shelf commercial application, which we have customized to make more effective for our needs. From this system, we collect many useful metrics that we use internally to evaluate and improve our processes including Time to Restore (TTR). The calculation for TTR uses the same business rules as the Government requires for its services.

The Qwest Infrastructure Group monitors IP Network utilization. The group also reports statistics to the Data Network Planning and Design group. This information is also distributed to internal databases and is available to customers through the Qwest Control Networx Portal. This portal provides Agencies with performance statistics to verify that customer-specified AQLs are met. Agencies may also submit a real-time performance query to the Qwest North America IP Network. [redacted]

For IPS, all of the required Networx AQLs (from Section 4.1.14.2.1) are assessed on an individual site basis, or on a site-pair basis where applicable. This data is used to ensure that the network systematically supports all Agency Data Network AQLs. Additionally, key network infrastructure interfaces (e.g., aggregation ports) are monitored for Packet/Cell Loss

(including errors and discards) and availability, ensuring that no Agency AQL issues are traceable to key Network Infrastructure Ports.

4.1.14.2.3 IPS Performance Improvements (L.34.1.4.2(c))

[redacted]

4.1.14.2.4 Additional IPS Performance Metrics (L.34.1.4.2(d))

In addition to measuring traditional Latency, Packet Delivery and availability, [redacted] Jitter is the key factor that inhibits the performance of real-time IP applications. As Jitter increases on VoIP and IP-based video traffic, these applications become less responsive due to a latency increase.

Jitter is the measurement of interpacket delay variance. Qwest measures Jitter by generating synthetic UDP traffic to measure Latency, using the monitoring infrastructure described above in Section 4.1.14.2.2. Qwest was the first provider to provide a Jitter SLA. Jitter is an especially important metric as the market moves to embrace mission-critical real-time IP applications.

4.1.14.3 Satisfaction of IPS Specifications (L.34.1.4.3)

Qwest's standards-based approach satisfies all of the Networx specifications for IPS. Qwest combines our IP/MPLS core network, comprehensive access methods, global peering capabilities, Networx SEDs, and international partner relationships to deliver all required IPS capabilities, features, and interfaces. Qwest's IP service infrastructure already serves many of the largest Federal Government agencies as well as some of the world's largest commercial enterprises.

4.1.14.3.1 Satisfaction of IPS Requirements (L.34.1.4.3(a))

The following three sections describe how Qwest will satisfy the capabilities, features, and interfaces requirements of the RFP.

4.1.14.3.1.1 Satisfaction of IPS Capabilities Requirements (L.34.1.4.3(a), C.2.4.1.1.4)

Qwest's IP/MPLS network infrastructure enables a broad range of technical service capabilities and Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for IPS. The following ***Figure 4.1.14-9*** summarizes Qwest's technical approach to supporting the IPS capabilities listed in RFP C.2.4.1.1.4, is intended to provide the technical description required per L.34.1.4.6(c), and does not limit or caveat Qwest's compliance in any way.

Figure 4.1.14-9. Qwest's Technical Approach to IPS Capabilities

ID #	Capability	[redacted]
1	Port Rates	[redacted]
2	Access Services Support	[redacted]
3(a)	Public Peering Arrangements	[redacted]
3(b)	Private Peering Arrangements	[redacted]
3(c)	IP Addresses and Domain Names	[redacted]
3(d)	Primary & Secondary DNS	[redacted]
4	BGP Support	[redacted]

ID #	Capability	[redacted]
		[redacted]

4.1.14.3.1.2 Satisfaction of IPS Features Requirements (L.34.1.4.3(a), C.2.4.1.2)

Our IPS supports all of the IPS features required for the Networx program. ***Figure 4.1.14-10*** summarizes our approach to supporting each required feature and is intended to provide the technical description required per L.34.1.4.6(c), and does not limit or caveat Qwest's compliance in any way. Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for IPS.

Figure 4.1.14-10. Qwest's Technical Approach to IPS Features

ID Number	Name of Feature	[redacted]
1	Dial-up backup of dedicated ports	[redacted]
2 (Optional)	Web Based Directory Services	[redacted]

4.1.14.3.1.3 Satisfaction of IPS Interface Requirements (L.34.1.4.3(a), C.2.4.1.3)

Qwest's IPS provides all IPS interfaces required. ***Figure 4.1.14-11*** identifies the specific SEDs we intend to employ (note that we may elect to use different SEDs that provide the same capability over time). We intend to support IPv6 when such services are offered commercially.

Qwest fully complies with all mandatory stipulated and narrative features, capabilities, and interface requirements for IPS. The text in the following table is intended to provide the technical description required per L.34.1.4.6(c) and does not limit or caveat Qwest's compliance in any way.

Figure 4.1.14-11. Qwest provided IPS Interfaces at the SDP

UNI Type	Networx Service	Network Side or Interface	Protocols	[redacted]
1	Asynchronous Transfer Mode Service	1. T1 2. T3 3. OC-3c 4. OC-12c	IPv4/v6 over ATMS	
2	Cable High Speed Access	320 Kbps up to 10 Mbps	Point-to-Point Protocol, IPv4/v6	
3	Circuit Switched Data Service	1. ISDN at 64 Kbps 2. ISDN at 128 Kbps 3. ISDN dial backup at 64 Kbps 4. ISDN dial backup at 128 Kbps	Point-to-Point Protocol, IPv4/v6	
4	Ethernet Interface	1. 1 Mbps up to 1 GbE (Gigabit Ethernet) 2. 10 GbE (optional)	IPv4/v6 over Ethernet	
5	Frame Relay Service	1. 56 Kbps with 32 Kbps CIR 2. Fractional T1 1. 128 Kbps with 64 Kbps CIR 2. 256 Kbps with 128 Kbps CIR 3. 384 Kbps with 128 Kbps CIR 4. 512 Kbps with 256 Kbps CIR 5. 768 Kbps with 384 Kbps CIR 3. T1 1. 1.536 Mbps with 768 Kbps CIR 2. 1.536 Mbps with 1024 Kbps CIR 4. Fractional T3 1. 3 Mbps 2. 6 Mbps 3. 12 Mbps 4. 24 Mbps 5. 45 Mbps 5. T3	IPv4/v6 over FRS	

UNI Type	Networx Service	Network Side or Interface	Protocols	[redacted]
6	IP over SONET Service	1. OC-3c 2. OC-12c 3. OC-48c 4. OC-192c	IP/PPP over SONET	[redacted]
7	Private Line Service	1. DS0 and Fractional T1 2. T1 3. Fractional T3 4. T3 5. OC-3c 6. OC-12c 7. OC-48c 8. OC-192c	IPv4/v6 over PLS	[redacted]
8	Voice Service	Analog dial-up at 56 Kbps	Point-to-Point Protocol, IPv4/v6	[redacted]
9	DSL Service	xDSL access at 1.5 to 6 Mbps downlink, and 384 Kbps to 1.5 Mbps uplink	Point-to-Point Protocol, IPv4/v6	[redacted]
10	Multimode/Wireless LAN Service	[redacted]		
11	Wireless Access	[redacted]		
12	Satellite Access	[redacted]		

Qwest's IPS solution complies with the technical standards and accepted industry standards required by the Networx Program, including industry standard configurations, interfaces and equipment. An abbreviated list of Qwest's ANSI and ITU standards supported includes LMI-User, LMI-network, Annex A-user, Annex A-network, Annex D-user, Annex D-network, and the ANSI extensions for LMI, UNI and NNI interfaces and ITU-T standards. In addition, Qwest IPS is compliant with many of the Layer 2 Frame Relay and MPLS Forum standards. Qwest participates in the American National Standards Institute (ANSI) and its Nanotechnology Standards Panel (ANSI-NSP), the Accredited Standards Committee (ASC), the SysAdmin, Audit, Network, Security Institute (SANS Institute), and the Center for Internet Security (CIS).

User-to-Network Interface for IPS - UNI Type 1 (Req_ID 2111; C.2.4.1.3.2 (1))

Qwest will provide ATM access to IPS including T-1, T-3, OC-3c and OC-12c interfaces [redacted] SEDs as shown previously in Figure 4.1.14.-11. See Section 4.1.7.3.1, Satisfaction of ATMS Requirements, for additional details.

User-to-Network Interface for IPS - UNI Type 2 (Req_ID 2110; C.2.4.1.3.2 (2))

[redacted] To meet the mandatory interface requirement for Remote Access, Qwest proposes [redacted] for users who require cable high speed access.

User-to-Network Interface for IPS - UNI Type 3 (Req_ID 2109; C.2.4.1.3.2 (3))

Qwest will provide circuit switched ISDN data circuits at rates of 64 and 128 Kbps where available, [redacted] Where the required ISDN service is not available, Qwest will work with the Government to implement alternate solutions such as DS-0 and Fractional T-1. See Section 4.1.2.3.1.

User-to-Network Interface for IPS UNI Type 4 (Req_ID 2107; C.2.4.1.3.2 (4))

Qwest will provide Ethernet access circuits at rates of 1 Mbps to 1 Gbps, where required, [redacted] Physical access methods include copper or fiber, Qwest's IP services offer Ethernet over Copper (EoCU), 10BaseT, 100BaseT, 1000BaseLX, and 100BaseSX.

User-to-Network Interface for IPS UNI Type 5 (Req_ID 2106; C.2.4.1.3.2(5))

Qwest will provide Frame Relay access to IPS at speeds of 56Kbps, fractional and full T-1, fractional and full T-3 using [redacted] as shown previously in Figure 4.1.14-11. See Section 4.1.6.3.1 Satisfaction of FRS Requirements for additional details.

User-to-Network Interface for IPS UNI Type 6 (Req_ID 2105; C.2.4.1.3.2(6))

Qwest has implemented a global IP over SONET/SDH network that offers the required bandwidths for the IPS service. OC-192c is offered over protected or unprotected 10 Gbps wavelength and uses [redacted] SEDs to deliver the Service. See Section 4.1.16.3.1, Satisfaction of SONETS Requirements, for additional details.

User-to-Network Interface for IPS UNI Type 7 (Req_ID 2104; C.2.4.1.3.2(7))

Qwest has implemented a Private Line network that offers the required bandwidths for the PLS service. OC-192c is offered over protected or unprotected 10 Gbps wavelength, using [redacted] SEDs as shown previously in Figure 4.1.14-11. See Section 4.1.5.3.1 Satisfaction of PLS Requirements for additional details.

User-to-Network Interface for IPS UNI Type 8 (Req_ID 2103; C.2.4.1.3.2 (8))

Qwest will provide analog (56 Kbps) dial access circuits using LEC handoff as shown in Figure 4.1.14-11. See Sections 4.1.1.3, Satisfaction of Voice Service Specifications, and 4.1.1.3.1, Satisfaction of Voice Service Requirements for additional details.

User-to-Network Interface for IPS UNI Type 9 (Req_ID 2102; C.2.4.1.3.2 (9))

Qwest will provide ADSL/SDSL access circuits at rates of 1.5 to 6 Mbps, where available, using SEDs as shown previously in Figure 4.1.14-11. Where the required service is not available, Qwest will work with the Government to implement alternate solutions such as DS-0, T-1, and Fractional T-3.

User-to-Network Interface for IPS UNI Type 10 (Req_ID 2101; C.2.4.1.3.2 (10))

Qwest will provide the multimode/wireless LAN service [redacted]

User-to-Network Interface for IPS UNI Type 11 (Req_ID 2100; C.2.4.1.3.2(11))

Qwest will provide wireless access to IPS at speeds of 19.2 kbps, 1.536 Mbps, 1.92 Mbps, 30.72 Mbps and 43.008 Mbps using SEDs as shown in Figure 4.1.14-11.

User-to-Network Interface for IPS UNI Type 12 (Req_ID 2099; C.2.4.1.3.2(12))

Qwest will provide satellite access to IPS at rates up to 19.2 kbps, 1.536 Mbps, 1.92 Mbps, 43.008 Mbps (T-3 or Air link interface) and 43 Mbps (USB 2.0) using SEDs as shown previously in Figure 4.1.14-11. Where the required service is not available, Qwest will work with the Government to implement alternate solutions such as T-3.

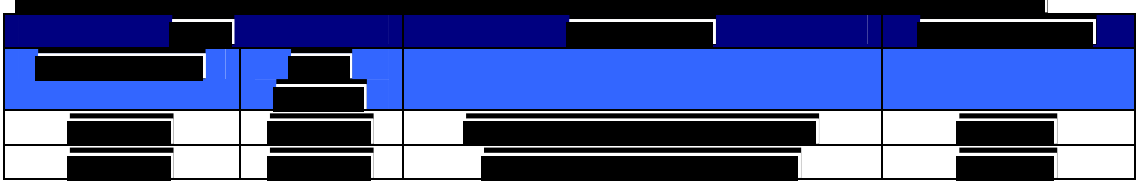
4.1.14.3.2 Proposed Enhancements for IPS (L.34.1.4.3(b))

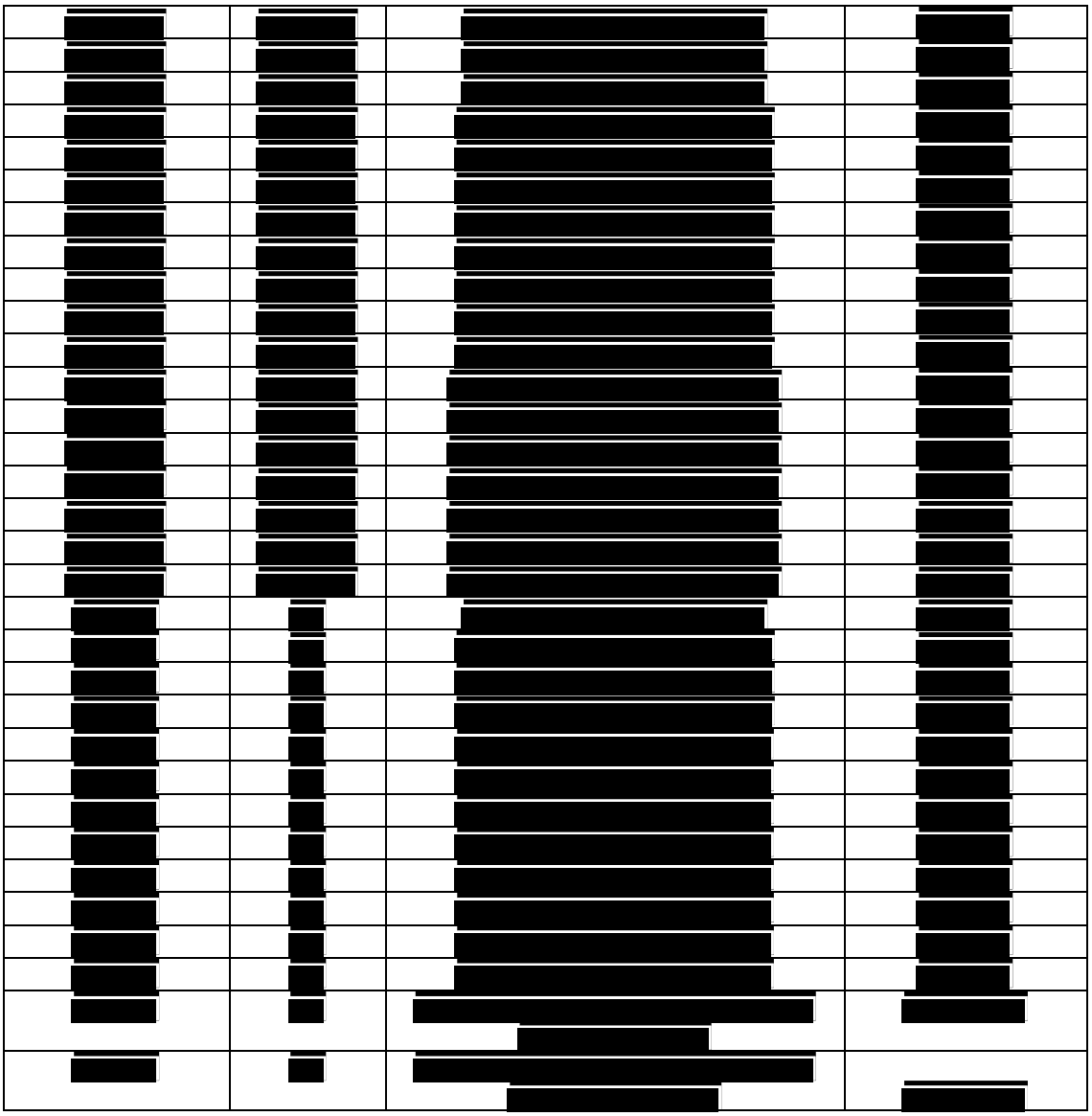
[redacted]

4.1.14.3.3 Network Modifications Required for IPS Delivery (L.34.1.4.3(c))

Qwest's current commercial IP services solutions support all Networx IPS requirements. We do not need to generate network or service delivery modifications for GSA Networx IPS.

[redacted]





4.1.14.3.4 Experience with IPS Delivery (L.34.1.4.3(d))

Qwest's IP services solutions have supported Federal, commercial, and educational enterprises for more than 20 years. [redacted]

[redacted]

Qwest provides IP transport services on a nationwide and global basis to a majority of the Fortune 500 US-based businesses and continues to exceed industry performance measurements for service, features, and availability. Qwest presently supports more than [redacted] dedicated IP access connections originating from Qwest's OC-192 IP/MPLS Network. [redacted]

4.1.14.4 Robust Delivery of IPS (L.34.1.4.4)

Qwest combines a robust technical design with well established, detailed and continuous planning, engineering, and operations to provide world-class IPS services to our customers. With a solid and proven network design, established procedures and tools for monitoring capacity and traffic, along with a well-trained and experienced operations group, the Qwest network ensures high performance IPS services to Agencies, both initially and as the usage of the network grows.

4.1.14.4.1 Support for Government IPS Traffic (L.34.1.4.4(a))

Qwest has examined the IPS traffic requirements forecast by the Government's traffic model and concluded that we can support the required traffic with minimal impact on the capacity or utilization of our network, and without any infrastructure build-out. Specifically, Qwest understands that the Networx traffic model indicates a forecast demand that includes:

- Approximately 3,000 CONUS IPS circuits ranging from DS0 to OC-12 access speeds

- Approximately 193 OCONUS IPS circuits ranging from fractional T1 to full T1 access speeds

Based on our current backbone utilization and capacity, these bandwidth requirements will not require any significant backbone upgrades. In addition, the total number of ports required does not represent a number significant to our normal edge router capacity planning. Qwest closely and continuously monitors its edge router capacity and backbone network links, and has an aggressive upgrade policy to minimize any effects of congestion on customer traffic flows.

4.1.14.4.2 IPS Measures and Engineering Practices (L.34.1.4.4(b))

The speed and size of Agencies' telecommunications systems can grow easily and transparently on the Qwest network. Qwest has a history of adapting rapidly to meet customer requirements. [redacted]

Qwest builds its network to provide high availability to our customers. Qwest's performance measures and engineering practices are designed to provide robustness of the access and backbone networks, to ensure resiliency, and to prepare for growth. Our design procedures, network modeling, and circuit route checks provide a high level of customer service.

[redacted]

[redacted]

[redacted] These organizations continually monitor network performance, and the capacity utilization of core network connections and our peering points, to ensure the highest performance for our customers. In addition, Qwest's centralized engineering team applies a consistent capacity management model to all data services.

4.1.14.5 IPS Optimization and Interoperability (L.34.1.4.5)

Qwest's Network Engineering and Planning organizations continually improve the technology and performance of Qwest IPS. [redacted] The core and edge model also provides our Networx IPS customers with significant interoperability with other Qwest-provided services, such as NBIP-VPNS, ATMS, FRS, and Qwest's VoIP services.

4.1.14.5.1 Optimizing the Engineering of IPS (L.34.1.4.5(a))

Qwest closely monitors the KPIs (Latency, Packet Loss and [redacted] and constantly optimizes network performance for our customers. Qwest's

approach to optimizing the engineering of IP-based and optical services begins with the collection and analysis of network performance data such as Availability, Packet Delivery Rate, Delay and [redacted] These data, along with historical growth rates, are input into network simulation models. The simulation results are compared to AQL targets. Based on the results, the Qwest engineers perform additional analyses and take steps to reroute traffic or add network resources as necessary to maintain AQLs.

For example, if analysis results show that AQL can be maintained by link metric adjustments, Qwest engineers will then update the configuration immediately. If additional equipment and/or new backbone links are required, the Qwest engineers will deploy new equipment and design and install new circuits.

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

We use a variety of methods to optimize our network architecture. The current Qwest network-based MPLS service offering is built on a nationwide OC-192 core IP/MPLS network. [redacted] Therefore, Qwest has the advantage of not having to accommodate pockets of legacy equipment in our MPLS network.

Even though we do not have legacy equipment in our network, we are constantly evaluating and optimizing the network architecture, primarily due to the following:

a) Services – what services are riding on the network for our customers

b) Network growth – what is the projected utilization of the network

c) Technology evolution – what new technology is available that will help us deliver better service to our customers

Architecture Optimization for Services

As Qwest is in the business of providing network services, the architecture and behavior of the network is predominantly based on the type of service being provided. Every product, before it is launched, is developed and tested against the current architecture. If the existing architecture does not support the product, it is modified and optimized. [redacted]

Architecture Optimization for Network Growth

The IPS network has been carrying a growing amount of traffic. As the volume of traffic grows, the network architecture will be reviewed to ensure that it remains scalable and can be continually improved to provide excellent service to our customers.

[redacted]

Architecture Optimization for Technological Advances

Over the years, the IPS network has evolved to a strategic network for Qwest and Qwest has always stayed ahead of the technology. As the equipment vendors have provided improved platforms with more features and functionality, Qwest evaluates them against the current architecture. With the help of this evaluation, Qwest can optimize any part of the network and grow with services and customer requirements. [redacted]

For Qwest, the architecture is dynamic and needs to be optimized by using all available means to meet customer requirements in a cost effective manner. We are a facility-based provider with our own fiber, transport and IPS network, and as shown in the examples above, we leverage technology and architecture at all layers of network to deliver and build the best of class network.

4.1.14.5.3 Access Optimization for IPS (L.34.1.4.5(c))

[redacted]

Qwest has designed, engineered and deployed multi-service edge switch routers with high-port density to provide a full suite of services for diverse customer applications. These multi-service edges are connected directly to the core routers via multiple high-speed uplinks for diversity and

redundancy. These intelligent edge routers allow Qwest to create new, differentiated service offerings, continue support for existing services, and optimize the network infrastructure. [redacted]

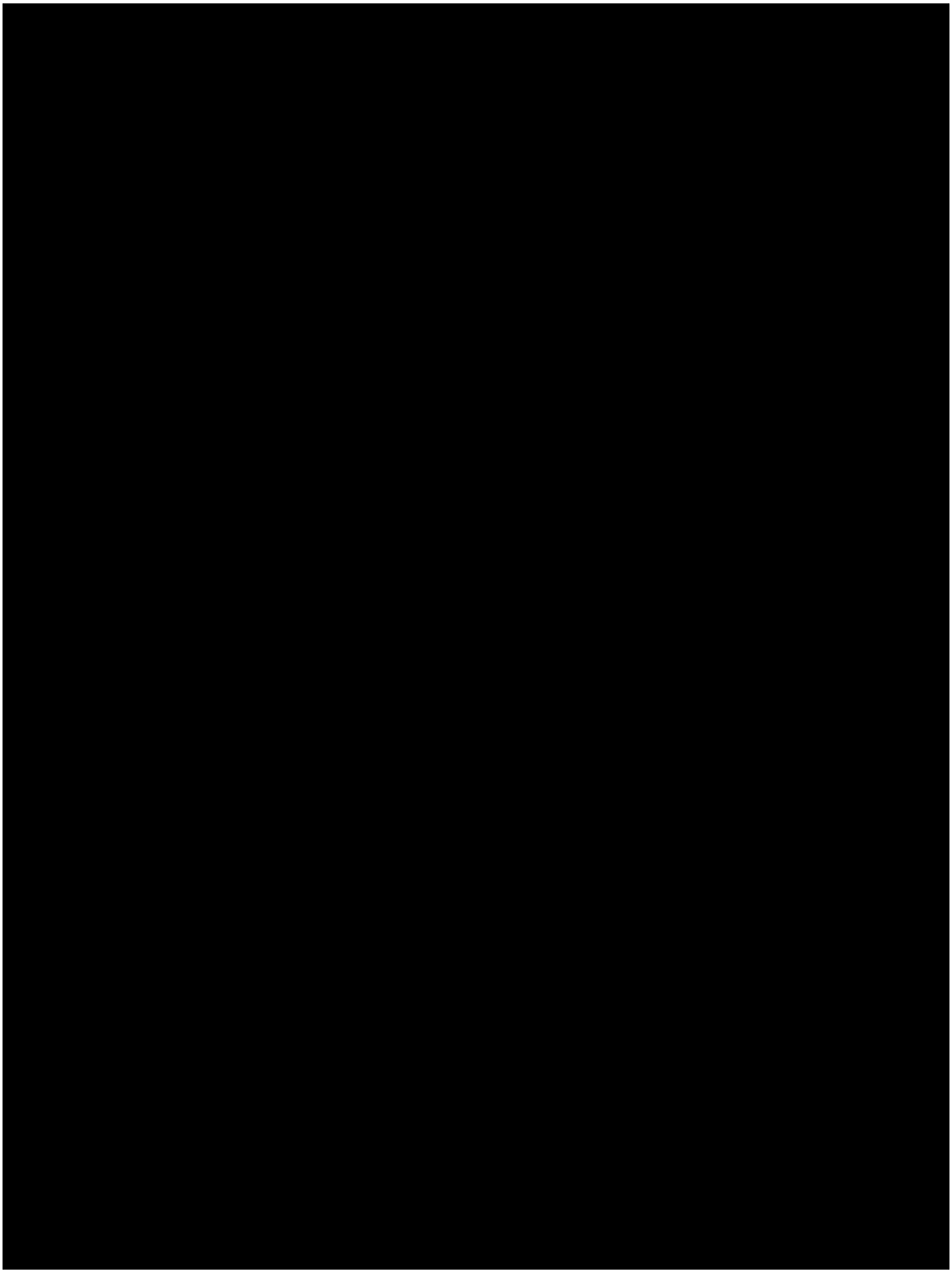
With these multi-service edges, the network has less equipment, fewer layers of equipment, and less complexity to operate and manage. Qwest will no longer have to add older IP routers and older Layer 2 switches that were built with limited services and port density and thus will improve performance. Further, technology advancement can be realized as older equipment at the POPs is being decommissioned and removed after traffic has been migrated over to the new multi-service edges.

4.1.14.5.4 Vision for IPS Internetworking (L.34.1.4.5(d))

Qwest is committed to the elimination of single-purpose, stovepipe networks that create planning, operations, and interoperability issues for our customers.

Qwest's service delivery model supports multiple types of customer requirements. Qwest's approach for network architecture evolution guides our investments and provides the overall direction for our technology evolution and services convergence. Qwest's service delivery model also allows us to assess the interoperability impacts of changes in the technical elements in each network area (e.g., Access, Service Control, Edge, Core, MPLS and Optical).

[redacted]



[redacted]

[redacted]

[redacted]

In summary, the Qwest backbone has been transformed from primarily serving Internet traffic into a general-purpose packet transport network with TDM-like quality characteristics, capable of serving multiple kinds of application traffic, including Internet, Layer 3 VPNs, Layer 2 VPNs, VoIP, Video over IP and Storage over IP.