4.1.2 NETWORK-BASED IP VIRTUAL PRIVATE NETWORK SERVICES (NBIP-VPNS) (L.34.1.4, C.2.7.3, M.2.1.2)

Qwest achieved an industry first with our Network-Based IP VPN services. Our Networx NBIP-VPNS uses the Qwest converged IP core to support any access method and deliver multiple classes of service.

Qwest's Network-Based Internet Protocol Virtual Private Network Services (NBIP-VPNS) are delivered using Qwest's Multi-Protocol Label Switching (MPLS)-based private IP network and Qwest integrated Secure Remote Access solutions. Qwest's NBIP-VPNS is ideal for seamless integration of customer sites with a variety of security and bandwidth requirements of up to OC-192. Qwest uses cutting-edge MPLS-based VPN, Label Switched Path (LSP) routing and Quality of Service (QoS) technology based on RFC 4364 standards defined by the Internet Engineering Task Force (IETF). In addition to a robust domestic capability, Qwest's NBIP-VPNS solutions connect VPN users from domestic and non-domestic locations using the Qwest network and our multiple international MPLS service provider suppliers with end-to-end Qwest responsibility.

Leading-edge Inter-Autonomous System (AS) MPLS connections into the Qwest private MPLS VPN network enhance Qwest's ability to provide seamless, standards-based MPLS VPNs around the world. Qwest currently provides world-class customer support, NBIP-VPNs access, and transport solutions and integrated router-based solutions to demanding Government and commercial customers such as [redacted]

4.1.2.1 Qwest's Technical Approach to NBIP-VPNS (L.34.1.4.1, C.2.7.3.1-2.7.3.1.3)

Qwest NBIP-VPNS enables the Government to create secure VPNs that range from dial-up voice and ISDN Internet access to dedicated high-speed optical connections. Qwest has dedicated support organizations, coordinated by the Qwest Networx CPO, to engineer, install, maintain, and evolve our delivered service to meet the Government's NBIP-VPNS requirements. Qwest delivers NBIP-VPNS using Provider Edge (PE) network routers. These routers are both physically and logically separated (at both forwarding and control planes) from Qwest's Public Edge IPS access routers and are used exclusively for NBIP-VPNS customer's MPLS private IP traffic. This PE platform leverages the tremendous backbone bandwidth of our 10 Gbps-based private MPLS core. Its "any access anywhere" design is completely in step with the Networx requirements for flexible, dedicated access. As required, Qwest supports a full range of wireline access and broadband access methods for this service. Qwest provides end-to-end engineering, monitoring, and trouble management to ensure service excellence for the NBIP-VPNS customer.

4.1.2.1.1 Approach to NBIP-VPNS Delivery (L.34.1.4.1(a))

Qwest's approach to NBIP-VPN service delivery encompasses the network platforms, people, and operational processes that deliver exceptional services. Qwest collaborates with our customers to identify requirements and deliver the services that best suit their needs. Our NBIP-VPNS architecture takes full advantage of MPLS-enabled convergence to create one of the most efficient network platforms in the industry. Our network and suppliers provide the underlying service delivery infrastructure, ensuring worldwide continuity of service for Agencies. Our NBIP-VPNS leverages the high-performance Qwest network widely in use by some of the most demanding Government customers today, [redacted].

Proven Engineering Practices

Qwest network planning and engineering organizations have created a highly robust, [redacted] Qwest continually monitors network performance and capacity utilization end-to-end to ensure the highest performance for all Qwest customers.

Standards-Based, Global Network

Domestically, Qwest's NBIP-VPNS uses Qwest's nationwide OC-192 private MPLS core network as its backbone. The OC-192 backbone is explained in greater detail in Section 3.3, *Approach to Networx Architecture*. As shown in [redacted]

[redacted]

[redacted]

Although they do not provide the NBIP-VPNS, [redacted]

Unlike other providers that have only begun MPLS deployment, Qwest has been successfully using MPLS for more than four years to support our IP-based transport services. Over this time, we have continuously expanded our use of MPLS as the state of this technology matured. For example, Qwest was one of the first to implement MPLS Fast Re-Route (FRR), a technology critical for high-performance Internet Protocol Services (IPS). [redacted]

[redacted]

[redacted]

Qwest ports create a NBIP-VPN CUG that enables a trusted private VPN and an integrated secure firewall gateway to pass traffic destined for public Internet access routes on a single interface. [redacted]

Qwest has extensive experience supporting real-time services on our MPLS-enabled network. We transport more than four billion minutes of toll-quality voice services as Voice over Internet Protocol (VoIP) traffic every month. Real-time Agency applications, such as VoIP and IP-based videoconferencing as well as access to Qwest's real-time services, are supported. [redacted]

[redacted]

Qwest uses our MPLS core to provide bandwidth for a completely private MPLS VPN network to build multiple VPNs based on IETF RFC 4364. [redacted]

Alternate access approaches supported by our NBIP-VPNS include Digital Subscriber Line (DSL) and dial access. Dedicated x Digital Subscriber Line (xDSL) access is provided by Qwest and teaming suppliers nationwide. Dial access for both voice services and ISDN BRI and PRI access is provided by Qwest's nationwide dial access network—with more than one million ports and local access across the country.

[redacted]

[redacted]

Internationally, Qwest NBIP-VPNS customers can access their domestic MPLS VPN network using the following methods:

- [redacted]
- [redacted]
- [redacted]
- [redacted]

Qwest extends our domestic nationwide NBIP-VPNS network footprint to the global community through extension of Qwest-owned PE access POP facilities and the utilization of dynamic suppliers that carry international MPLS VPN traffic. Qwest has deployed PE Access POPs in [redacted]

Qwest is able to deliver unparalleled global network reach through [redacted] Understanding that local knowledge is key, [redacted]

Qwest has peering arrangements that give our customers the benefit of a single service provider, thereby ensuring service consistency, while at the same time giving them the confidence that our regional suppliers understand their region better than anyone else. For example, [redacted]

Qwest's international carrier suppliers were chosen based on [redacted] Qwest has a dedicated carrier account management team and operations team aligned with each of our international carrier suppliers. We continuously monitor monthly, quarterly, and yearly KPI performance metrics. Qwest has designed and implemented service improvements and new access and features to remain competitive. Qwest's Global [redacted]

[redacted]

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

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

Qwest's secure remote access service provides a multi-faceted secure client, strong authentication, and a diverse access technology solution to the Federal Government. Secure remote access integrates seamlessly into the Qwest NBIP-VPNS solution:

- [redacted]
- [redacted]

As the first major operator in the U.S. to offer IP Network-based VPN services, Qwest has been designing high-performance, secure NBIP-VPNS and PBIP-VPNS solutions for Government customers and Fortune 500 financial, healthcare, manufacturing and high-technology companies since 1999. Qwest's engineering and program management expertise, as well as hands-on technical integration experience with all facets of dedicated, remote, and satellite-based NIPB-VPNS access solutions, reduces the Government's operational risks. Qwest's network technology management, architecture, planning, engineering, and operations organizations are all aligned to ensure network availability and feature flexibility.

Qwest will work with Agencies to recommend and help select the right SED to meet their requirements. Qwest takes complete responsibility for the provisioning of any NBIP-VPNS. This includes the ordering and installation of the SED, the ordering and provisioning of the requested access method, configuration of the NBIP-VPNS, and complete test and turn-up.

Once provisioned, a key element of service delivery involves the operational support that ensures the service meets performance goals. Qwest has [redacted] This provides unparalleled coordination, enabling enhanced trouble management for these complex services. For example, [redacted]

Qwest NOCs proactively monitor and alert on issues affecting the global MPLS/Internet access network and PE device realm, ensuring that potential problems are rapidly addressed. The Qwest NOCs are staffed with highly trained and experienced personnel who understand the Government's network and internetworking equipment.

NOC senior management continually reviews KPIs and best practices, verifying that appropriate preventive steps are taken to avoid problems and validate that customer service meets Acceptable Quality Levels (AQLs). [redacted] The portal accessible management tools enable dynamic management, including support for Agency-initiated adjustments of allocated bandwidth in near real time.

4.1.2.1.2 Benefits of Qwest's NBIP-VPNS Technical Approach (L.34.1.4.1(b))

Qwest NBIP-VPNS offers a converged networking service based on leading technologies [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]

Qwest's NBIP-VPNS facilitates the Federal Enterprise Architecture (FEA) objectives as summarized in ***Figure 4.1.2-5***.

Figure 4.1.2-5. Qwest's NBIP-VPN Support to FEA Objectives

FEA Objective	Qwest NBIP-VPNS Solutions
Improve utilization of Government information resources to focus on core Agency mission and service delivery to citizens by using the FEA.	[redacted]
Enhances cost savings and cost avoidance through a mature FEA, Government-wide.	[redacted]
Increases cross Agency and inter-Government collaboration.	[redacted]

4.1.2.1.3 Solutions to NBIP-VPNS Problems (L.34.1.4(c))

Qwest has extensive experience in the delivery of NBIP-VPNS, and we apply this knowledge to ensure the delivery of high-quality NBIP-VPNS 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.

Qwest's NBIP-VPNS will meet the individual service requirements requested by Agencies. Qwest's Networx CPO and NOC will ensure service delivery and continuing operations. ***Figure 4.1.2-6*** summarizes the typical problems we encounter in meeting NBIP-VPNS requirements and our solution.

Figure 4.1.2-6. Qwest's Approach to Common NBIP-VPNS Delivery Challenges

Problem	Solution
Customer needs to modify their NBIP-VPNS network service.	[redacted]
Customer requires CoS prioritization on specific types of data traversing their NBIP-VPNS connections for services such as VoIP or video.	[redacted]
Customer cannot establish an Internet-based remote access connection to their NBIP-VPNS.	[redacted]

4.1.2.1.4 Synchronization Network Architecture (L.34.1.4(d))

Time of Day Synchronization (IP Network)

Qwest has deployed [redacted]. NTP is a single, unbiased time reference that draws from multiple sources to accurately synchronize the computer network systems.

Transport Network Synchronization

Qwest uses [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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

[redacted]

Qwest's timing and synchronization architecture is compliant with all applicable standards, including:

- Telcordia GR-253, SONET Transport Systems, Common Generic
- Telcordia GR-436, Digital Network Synchronization Plan

4.1.2.2 Satisfaction NBIP-VPNS Performance Requirements (L.34.1.4.2, C.2.7.3.4-2.7.3.4.1)

The Qwest NBIP-VPNS solution meets or exceeds all performance requirements stated in this section. Qwest has proven network monitoring and measuring systems, procedures, and evaluation methods in place to measure compliance.

4.1.2.2.1 NBIP-VPNS Quality of Service (L.34.1.4.2(a))

The Qwest fiber network that supports NBIP-VPNS has tremendous backbone capacity and high availability. In general, most Service Delivery Point (SDP) outages are caused by either customer site power failures or local access facility failures. We have compiled statistics over the past four years on the performance of networks for similar requirements. It is our expectation that routine availability for Qwest-provided access solutions will exceed [redacted] well in excess of 99.9 percent requirement for routine traffic. With the addition of diverse access facilities and a network interface port configured to a geographically diverse POP, Qwest will meet the 99.99 percent availability requirement for critical applications.

Figure 4.1.2-9 summarizes our compliance with Networx requirements for NBIP-VPNS services:

Figure 4.1.2-9. Qwest Compliance with Government NBIP VPNS Performance Metrics

Key Performance Indicator (KPI)	Service Level	Performance Standard (Threshold)	Acceptable Quality Level (AQLs)	Qwest Performance Metric
Latency (CONUS)	Routine	70 ms	≤ 70ms	[redacted]
Latency (OCONUS)	Routine	150 ms	≤ 150ms	[redacted]
Availability	Routine	99.9%	≥ 99.9%	[redacted]
	Critical (Optional)	99.99%	≥ 99.99%	[redacted]
Time to Restore	Without Dispatch	4 hours	≤ 4 hours	[redacted]
	With Dispatch	8 hours	≤ 8 hours	[redacted]

All Qwest IP-based services are supported by a highly robust, highly available transport infrastructure. Qwest engineers monitor and manage end-to-end transport solutions. Qwest will support availability [redacted] Qwest will interface with the NOCs of our suppliers to monitor and manage the proposed NBIP-VPNS end to end to ensure high reliability and availability of the service to Agencies.

Qwest will support availability of 99.99 percent by provisioning the service across [redacted] utilizing redundant electronics, and selecting the appropriate configuration options on the IP/MPLS equipment. Proactive monitoring will help detect any defects, errors, and failure indications and initiate corrective action before the system fails.

4.1.2.2.2 Approach for Monitoring and Measuring NBIP-VPNS KPIs and AQLs (L.34.1.4.2 (b))

Qwest monitors and measures the KPIs and AQLs via an automated process that pulls data from the root source, summarizes it, and displays it via Web tools. These Web tools display actual results and indicate via red/green colorizing whether or not goals are met. Our approach is to completely automate displaying results from data collection to Web display so that the focus is on results rather than “report generation.” Further, our automated process ensures that business rules are established and there is no chance of manipulating the data.

For Network KPIs, we use the Statistical Analysis System to display the Network Reliability Scorecard with the KPIs, the objectives, and an indication of whether the objectives are 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, both at the executive level to ensure the proper attention and focus, and by our network management teams to ensure AQL levels are consistently met.

For all Networx services, we use [redacted] an industry-leading commercial-off-the-shelf trouble ticketing application that 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.

For the NBIP-VPNS, all of the AQL/KPI metrics listed in Figure 4.1.2-9 are assessed on an individual site or site-pair basis where applicable. This data is used to ensure that all Agency data network AQLs are systematically being supported by the network. Additionally, key network infrastructure interfaces (Aggregation Ports/Network to Network Interfaces, Trunk 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.

Qwest will ensure the services delivered to Agencies follow a stringent reporting, management, and network capacity strategy to verify that all AQLs are delivered at a consistent acceptable level. Qwest NOC network management systems collect performance data [redacted] The NBIP-VPNS performance data information is [redacted] This information is distributed to internal databases where it will be posted to the Qwest Control Networx Portal. This portal provides Agencies with performance statistics to verify that customer-specified AQLs are met.

Based on our past performance on similar programs, we expect actual network performance for NBIP-VPNS to exceed the performance targets set for Networx. Our network is designed to minimize the latency between

Agency SDP locations. Our current POP density and SDP-to-POP homing design is engineered to achieve [redacted]. In addition, it is Qwest's normal network planning [redacted]

Qwest will meet the Networx requirements for Outside Continental United States (OCONUS) latency of less than or equal to 150 ms average round trip transmission latency between Agency premise routers for an IP VPN, including CONUS and OCONUS sites. We will apply RFC 1242, RFC 2285, or alternative test standards to ensure that link capacities and performance parameters are properly tested and configured in order to avoid congestion and properly manage traffic.

Measuring SDP-to-SDP Latency, and the Role of SEDs

All of Qwest's IP-based services—which include IPS, NBIP-VPNS, PBIP-VPNS, Layer 2 Virtual Private Network Service (L2VPNS), Converged IP Services (CIPS), Content Delivery Network Services (CDNS), Voice Over Internet Protocol Transport Services (VoIPTS), and Internet Protocol Telephony Service (IPTelS))—[redacted]

[redacted]

[redacted]

[redacted]

Monitoring for Service Level Agreement (SLA) reporting operates as follows:

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

Qwest's approach consumes few resources [redacted]

Optionally, Qwest offers an alternate approach to support an Agency that does not want to allow [redacted]

[redacted] Qwest's solution was [redacted]

If an Agency orders a service in which the technical performance requirements are specified on an SDP-to-SDP basis (including performance requirements specified on an end-to-end and/or Agency premises-to-Agency premises performance requirement basis) and where Qwest requires the use of SEDs to meet the requirements and/or requires access to, or use of, the Agency's customer-premises equipment or software to meet the requirements, then 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 General Services Administration (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. If directed to use the latter method by the Agency, Qwest will comply with the following:

- For all IP-based network services, the applicable POP-to-POP performance requirements to be used will be those defined in Section C.2.4.1, *IPS*.
- For all other services, the service-specific SDP-to-SDP performance metrics will be applied on a POP-to-POP basis unless a stipulated POP-to-POP performance metric already applies for the associated service(s).

In summary, three options are available:

1. Standard SDP-to-SDP approach
2. Auxiliary SED for SDP-to-SDP monitoring approach
3. POP-to-POP approach

Use of Statistical Sampling in lieu of Direct KPI Measurements

[redacted]

The Use of Government Furnished Property

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

- [redacted]
- [redacted]
- [redacted]

4.1.2.2.3 NBIP-VPNS Performance Improvements (L.34.1.4.2(c))

Qwest proposes to meet required KPIs and AQLs for NBIP-VPNS. In the event an Agency has a specific business need or application problem, Qwest is willing to discuss service enhancements. Qwest will operate in good faith to engineer an NBIP-VPNS solution to serve unique Agency needs. Qwest is able to leverage our vast NBIP-VPNS product portfolio, which includes a variety of SED providers and specific NBIP-VPNS solutions. Through a special combination of vendor solutions and talented engineering capabilities, Qwest will serve all Agencies' business needs.

4.1.2.2.4 Additional NBIP-VPNS Performance Metrics (L.34.1.4.2(d))

Qwest proposes to offer the Government a jitter AQL. In addition to measuring traditional latency, packet delivery, and availability, Qwest was the first provider to offer a jitter AQL, an important metric as the market moves to embrace mission-critical real-time IP applications. Aside from throughput, jitter is the key limiting factor for good performance of real-time IP applications. Less jitter allows smaller buffers for VoIP and IP-based video systems. As jitter increases, applications increase the amount of buffering and thereby increase the effective latency of a communication path. This latency is an increase in the apparent round-trip delay, resulting in performance impacts on real-time (VoIP and IP-based video) applications. [redacted]

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

Qwest also proposes a packet delivery KPI and associated AQL, shown in ***Figure 4.1.2-13***. High packet delivery rates are critical for the performance of Agency applications, especially for real-time applications such as VoIP. Qwest delivers high packet delivery rates over our highly robust, highly available transport infrastructure. The core IP network is a high-availability, high-capacity 10 Gbps-based MPLS core that delivers extremely high packet delivery rates with low latency and jitter. [redacted]

[redacted]

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

Qwest's average POP-to-POP packet delivery performance is [redacted] Qwest sales engineering will work with Agencies to ensure that the access design of the network meets the Agency's requirements—that is, that there is no access bottleneck that will cause significant packet loss.

4.1.2.3 Satisfaction of NBIP-VPNS Specifications (L.34.1.4.3)

Qwest will support all capabilities and locations and will deliver design expertise and knowledge while complying with all technical service requirements specified by the Networx RFP. Qwest's NBIP-VPNS delivers a broad range of service features, functionality, and technical capabilities, all delivered from our standards-based MPLS VPN internetworking platform. Qwest's NBIP-VPNS solutions will connect VPN users from Asia, Europe, South America, Africa, Australia, and all U.S. territories by using Qwest's Global NBIP-VPNS interconnections and provider supplier networks. [redacted]

4.1.2.3.1 Satisfaction of NBIP-VPNS Requirements (L.34.1.4.3(a))

Qwest's NBIP-VPNS provide IP MPLS VPN Intranet and Extranet based on RFC 4364 standard (MPLS VPNs via iBGP VPN Virtual Route Forwarding (VRF)). Qwest supports BGP dynamic routing or static routing as requested by Agencies. [redacted]

Qwest's NBIP-VPNS infrastructure complies with the accepted industry standards design development efforts Secure Sockets Layer (SSL) and IPsec committees, and Layer 3 and Pseudo-Wire forums. Based on Qwest's iQ Networking Private and Enhanced Network-based MPLS IP VPN service, NBIP-VPNS solutions can connect Agency locations and trusted business suppliers via leased lines (DS-1, nxDS-1, DS-3, OC-3, OC-12, OC-48, OC-192), FR, ATM, international Inter-AS MPLS, Ethernet, and Internet based access for remote users via dial-up, and DSL, [redacted]

Qwest's NBIP-VPNS network uses route reflectors that exchange route information on a private out-of-band network. Route information is only exchanged between authorized sites that are members of a VPN.

[redacted]

[redacted]

[redacted]

[redacted] We support QoS for several modes, including [redacted]

Qwest's "any access approach" for our NBIP-VPNS includes the full QoS capability for several access methods, including:

[redacted]

Qwest supports the required access methods from the same location where available. Multiple modes of access will enhance the availability of services at a site. Since varied modes may often follow different paths to network aggregation points, this is the best option for diverse access.

[redacted] Qwest will work with Agencies to engineer this type of mobile authentication as the technology becomes available. Qwest owns and operates more than [redacted]. This service supports both voice-grade dial services as well as ISDN access for 56 Kbps to 128 Kbps (and more) digital access.

4.1.2.3.1.1 Satisfaction of NBIP-VPNS Capabilities Requirements (L.34.1.4.3(a), C.2.7.3.1.4)

Figure 4.1.2-14 summarizes our approach to the NBIP-VPNS required capabilities. Qwest fully complies with all mandatory stipulated and narrative capabilities requirements for NBIP-VPNS. The text in Figure 4.1.2-14 provides the technical description required per L.34.1.4.3(a) and does not limit or caveat Qwest's compliance in any way.

Figure 4.1.2-14. Qwest's Technical Approach to NBIP-VPNS Capabilities

ID #	Name of Capability	Qwest's Approach
1	Tunneling Standards	[redacted]
2	Encryption Levels	[redacted]
3	Authentication Services	[redacted]
4	Reserved	
5	IPv4 Support	[redacted]
6	IPv6 Support	[redacted]
7	QoS Support	[redacted]
8	Reserved	
9	Access QoS Support	[redacted]
10	Application-level QoS Support	[redacted]
11	Access Methods Supported	[redacted]
12	Fast Dial Access	[redacted]
13	Reserved	

ID #	Name of Capability	Qwest's Approach
14	Isolation of Traffic and Routing Information	[redacted]
15	Layered Security Architecture	[redacted] to enable Agency-owned [redacted]
16	NBVPN Management	[redacted]
17	Mobile User Support	[redacted]
18	Multiple VPN Support	[redacted]
19	Network Design and Engineering Services	[redacted]
20 [Optional]	Dynamic Bandwidth Adjustment Support	[redacted]
21	Secure Routing Service	[redacted]
22	Encryption, Decryption, Key Management Support	[redacted]
23	Support for Agency Security Mechanisms	[redacted]
24	Authentication Server Choices	[redacted]

Qwest's NBIP-VPNS solution's infrastructure complies with the accepted industry standards design development efforts, SSL and IPsec committees, and Layer 3 and Pseudo-Wire forums. Based on Qwest's private MPLS architecture, NBIP-VPNS solutions can connect Agency locations and trusted business suppliers via leased lines (DS-0, DS-1, nxDS-1, DS-3, OC-3, OC-12, OC-48, OC-192), FR, ATM, international Inter-AS MPLS, Ethernet, and Internet access based for remote users.

4.1.2.3.1.2 Satisfaction of NBIP-VPNS Feature Requirements (L.34.1.4.3(a), C.2.7.3.2-C.2.7.3.2.1)

Figure 4.1.2-15 summarizes our approach to the NBIP-VPNS required features. Qwest fully complies with all mandatory stipulated and narrative features requirements for NBIP-VPNS. The text in Figure 4.1.2-15 provides the technical description required per L.34.1.4.3(a) and does not limit or caveat Qwest's compliance in any way.

Figure 4.1.2-15. Qwest's Technical Approach to NBIP-VPNS Features

ID #	Name of Feature	Qwest's Approach
1	Class of Service (CoS)	[redacted]
2	High-availability options for CPE	[redacted]
3	Internet Gateway Service	[redacted]
4	Interworking Services	[redacted]
5	Key Management	[redacted]

ID #	Name of Feature	Qwest's Approach
6 [Optional]	Non-peered Private IP Network	[redacted]
7	Security services	[redacted]

4.1.2.3.1.2.1 ICB CLIN and Case Numbers

Table 4.1.2.3.1.2.1 Table of ICB CLIN and Case Numbers

CLIN #	Case Number	
219003	462241	NBIPVPNS Internet Gateway Service MRC ICB - CONUS - 200 Mbps
219003	462242	NBIPVPNS Internet Gateway Service MRC ICB - CONUS - 100 Mbps
219003	8524001	T1 Internet Gateway Service MRC for CFPB location @ 19651 Hornbaker Rd, Manassas, VA 20109

4.1.2.3.1.2.2 NBIP-VPNS Bandwidth on Demand

Centurylink is offering NBIP-VPNS Bandwidth on Demand:

[redacted]

CenturyLink Bandwidth on Demand scales as required within each subset of tiered bandwidth:

[redacted]

Ethernet access for higher bandwidths is delivered based on full pipe capacity—1 Gbps or 10 Gbps capacity. [redacted]

Port bandwidths are scalable in two ways:

[redacted]

[redacted]

Table 4.1.2.3.1.2.2 Table of Scalable NBIPVPN Ports

CLIN		Description	Charging Unit
MRC Routine	MRC Critical		
213403	NA	[redacted]	[redacted]

Table 4.1.2.3.1.2.3 Table of Bandwidth on Demand Temporary Port Bandwidth Increments

CLIN		Description	Charging Unit
MRC Routine	MRC Critical		
213494	NA	[redacted]	[redacted]

***Bandwidth on Demand CLINs can only be used in conjunction with scalable port and access CLINs.**

4.1.2.3.1.3 Satisfaction of NBIP-VPNS Interface Requirements (L.34.1.4.3(a), C.2.7.3.3-C.2.7.3.3.2)

Qwest also supports all interfaces for NBIP-VPNS, as shown in ***Figure 4.1.2-16***. Qwest fully complies with all mandatory stipulated and narrative features requirements for NBIP-VPNS. The text in Figure 4.1.2-16 provides the technical description required per L.34.1.4.3(a) and does not limit or caveat Qwest's compliance in any way.

Figure 4.1.2-16. Qwest Provided NBIP-VPNS Interface at the SDP

UNI Type	Networx Service	Network-Side Interface	Protocol	SED Make and Model
1	Ethernet Access	1. 1 Mbps up to 10 Gbps (Gigabit Ethernet) 2. 10 Gbps (Optional)	[redacted]	[redacted]
2	Private Line Service	1. DS-0 2. Fractional T-1 3. T-1 4. Fractional T-3 5. T-3 6. OC-3c (Optional) 7. OC-12c (Optional) 8. OC-48c (Optional) 9. OC-192 (Optional)	[redacted]	[redacted]
3	IP over SONET Service (Optional)	1. OC-3c 2. OC-12c 3. OC-48c 4. OC-192c	[redacted]	[redacted]

Note that the mandatory interfaces list mandates inclusion of SEDs that exceed the scope of the mandatory SED suites. Qwest has identified potential SEDs for each required interface.

In addition, as shown in ***Figure 4.1.2-17***, Qwest's NBIP-VPNS supports all interfaces for remote access.

Figure 4.1.2-17. Summary of Remote Access Interface Support for Qwest's NBIP-VPNS

UNI Type	Networx Service	Network-Side Interface	Protocol	Make and Model
1	Voice Service	Analog dial-up at 56 Kbps	[redacted]	[redacted]
2	DSL Service	xDSL access at 1.5 to 6 Mbps downlink, and 384 Kbps to 1.5 Mbps uplink	[redacted]	[redacted]
3	Cable High-Speed Access	320 Kbps up to 10 Mbps	[redacted]	[redacted]
4 (Optional)	Multimode/Wire-less LAN Service	MWLANS User-to-Network Interfaces: Air link: 2.4 GHz (Physical Interface is Type II PCMCIA card of handheld computers and card/chip in PDA).	[redacted]	[redacted]

UNI Type	Networx Service	Network-Side Interface	Protocol	Make and Model
5 (Optional)	Wireless Access	Wireless Access Arrangement Interfaces: Air link: 2.4 GHz (Physical Interface is Type II PCMCIA card of handheld computers and card/chip in PDA).	[redacted]	[redacted]
6 (Optional)	Satellite Access	Satellite Access Arrangement Interfaces: V.35, RS-449, RS-232, RS-530, T-1, T-3, E-1, and Air link.	[redacted]	[redacted]
7	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	[redacted]	[redacted]

4.1.2.3.2 Proposed Enhancements to NBIP-VPNS (L.34.1.4.3(b))

Qwest exceeds RFP QoS requirements by providing extensive priority queues and queuing methodologies. Qwest proposes to offer support for the critical service level for VPN availability of [redacted].

To enable the convergence of Agency applications, such as the use of private real-time applications like VoIP and IP-based videoconferencing, or access to Qwest's VoIP and video conferencing services, [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] to guarantee the availability of some minimum amount of bandwidth to other [redacted]

[redacted]

Agencies have the option to apply unique QoS policies on each port, as follows:

[redacted]

4.1.2.3.3 Network Modifications Required for NBIP-VPNS (L.34.1.4.3(c))

Qwest's current NBIP-VPNS solution will support all Networx requirements. Qwest does not need to generate network or service delivery modifications for this service.

Qwest provides Ethernet Port bandwidths (CONUS) of 1 Mbps, 10 Mbps, 100 Mbps, 1 Gbps and 10 Gbps.

Qwest is proposing to offer additional Ethernet CONUS port tiers for NBIP-VPNS to provide agencies with configuration flexibility and a cost savings option. Ethernet has the advantage of providing the customer a single interface with the ability to adjust bandwidth without having to add, subtract or change loops and ports. In Qwest's experience a customer will provision a 10 or 100 or 1000 meg loop and port, Qwest will then set the port to a fraction of the full capacity based on the customer's current need. [redacted]

Qwest provides additional Ethernet Port Bandwidth (CONUS) tiers as listed in Table 4.1.2.3.3 -1.

Table 4.1.2.3.3-1 Qwest Ethernet Port Bandwidths (CONUS)

MRC Routine	MRC Critical	Description	Charging Unit
213187	216191	Ethernet - 2 Mbps	Per port
213188	216192	Ethernet - 4 Mbps	Per port
213189	216193	Ethernet - 6 Mbps	Per port
213190	216182	Ethernet - 8 Mbps	Per port
213303	216183	Ethernet - 20 Mbps	Per port
213304	216184	Ethernet - 30 Mbps	Per port
213305	216185	Ethernet - 40 Mbps	Per port
213301	216186	Ethernet - 50 Mbps	Per port
213306	216187	Ethernet - 60 Mbps	Per port
213307	216188	Ethernet - 70 Mbps	Per port
213308	216189	Ethernet - 80 Mbps	Per port
213309	216190	Ethernet - 90 Mbps	Per port
213165	216194	Ethernet - 200 Mbps	Per port
213311	216195	Ethernet - 300 Mbps	Per port
213167	216197	Ethernet - 400 Mbps	Per port
213313	216199	Ethernet - 500 Mbps	Per port
213314	216221	Ethernet - 600 Mbps	Per port
213315	216222	Ethernet - 700 Mbps	Per port
213316	216223	Ethernet - 800 Mbps	Per port
213317	216224	Ethernet - 900 Mbps	Per port
213319	N/A	Ethernet – 3 Gbps	Per port
213216	N/A	Ethernet – 4 Gbps	Per port

MRC Routine	MRC Critical	Description	Charging Unit
[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]

4.1.2.3.4 Experience with NBIP-VPNS Delivery (L.34.1.4.3(d))

Qwest has been supporting Federal, commercial, and educational Wide Area Network solutions for more than 20 years. Qwest currently supports hundreds of VPN customers, which translates into more than 10,000 NBIP-VPNS circuit routes. Beginning in 1999, Qwest was one of the first Network Services Providers to deploy premises-based and network-based VPN solutions. Qwest revolutionized the service delivery experience of implementing and maintaining network-based IPsec VPNs for corporate clients through our initial network-based IPsec VPN services known as our Private Routed Network. Our IPsec VPN services expertise led to our production release of Qwest's iQ Networking MPLS-based VPNs in 2003.

Qwest's NBIP-VPNS solution has been certified and accredited [redacted]

[redacted]

Qwest was an early adopter of MPLS technology to provide high-quality L3VPNS with the same security profile as traditional Layer 2 methods, such as ATM and FR. By early 2002, Qwest deployed an RFC 4364 L3VPNS using Label Distribution Protocol signaling with MPBGPv4 for VPN route distribution. Since the release of this functionality, we have completed two upgrades on the MPLS L3VPN infrastructure. Phase 1 Qwest MPLS VPN services were offered on a peered PE router basis; PE resources were shared between VRF and the data control plane servicing Internet customers. The second phase modified the MPLS L3 VPN platform by integrating Private PE routers, which were not connected to the Internet and are inaccessible from PE routers managing Qwest IPS customers' Internet. These private PE routers are exclusively serving MPLS VPN customers.

Presently, Qwest delivers network-based MPLS VPN services to many of the major Fortune 1000 financial, manufacturing, healthcare, and high technology corporations. Qwest's customers, as well as third-party analyst reports such as [redacted], consistently praise our engineering and support services.

4.1.2.4 Robust Delivery of NBIP-VPNS (L.34.1.4.4)

Qwest's has examined the demand set requirements for NBIP-VPNS and has determined that Qwest's proven planning process meets all requirements. Qwest has strict engineering and design rules to ensure connectivity and robustness as well as systems and capacity needed to ensure network performance.

4.1.2.4.1 Support for Government NBIP-VPNS Traffic (L.34.1.4.4(a))

Qwest has examined the NBIP-VPNS traffic requirements of the Government's traffic model. 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 our edge router capacity and backbone network links and has an aggressive upgrade policy to minimize any effects of congestion on Agency traffic flows.

4.1.2.4.2 NBIP-VPNS Congestion and Flow Control Strategies (L.34.1.4.4(b))

Qwest uses virtually unlimited backbone bandwidth and aggressive capacity planning to manage congestion in our data and voice services networks. Qwest data networks have significant POP redundancy, [redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

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- [redacted]
- [redacted]

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[redacted]

[redacted]

4.1.2.4.3 NBIP-VPNS Measures and Engineering Practices (L.34.1.4.4(c))

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. For example, [redacted]

Qwest built our 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, ensure resiliency, and prepare for growth. Our design procedures, network modeling, and circuit route checks provide a high level of customer service.

These practices include application of network design rules, network capacity modeling for failure scenarios, and circuit route check to ensure redundant and diverse routing. In addition, the design of our network unifies technologies under a common service platform, where all NEs are designed with resiliency and growth in mind.

A consistent capacity management model is applied by a centralized engineering team for all data services. Qwest establishes design rules for both edge and backbone NEs. Using these rules as a guide, we gather usage statistics to verify network status and take corrective action as necessary. Every domestic and international edge aggregation device must have a minimum of two uplinks of the same speed to two different core backbone devices for diversity and redundancy. Edge aggregation devices are those devices that directly terminate customer circuits. Usage statistics are gathered on every edge aggregation circuit, and reports are generated using these samples for weekly review. The cumulative utilization of the two uplinks (200 percent maximum) from an edge aggregation device must be kept to less than 100 percent so that if there is a failure on one of the two uplinks, the device will still be able to support all traffic with no service impact. When the cumulative utilization of the two uplinks reaches 70 percent, then an engineering order will be placed to add additional uplink capacity. Such capacity upgrades are typically completed within 30 days.

[redacted]

Qwest engineers continuously model network capacity using current and forecasted traffic to ensure that Agency traffic is routed efficiently through the network. This assists with properly sizing backbone links.

We analyze how the traffic utilization patterns will be affected under abnormal network conditions and then take the appropriate action, such as adding new nodes or links. [redacted]

When placing an order to have a new backbone link added to the network, [redacted] The new circuit route information will then be entered into the order to be carried out by the Qwest provisioning team. Qwest Engineering audits existing backbone circuits several times a year to make sure that the backbone links are diverse.

[redacted] This takes into consideration the fact that multiple long-haul circuits may share a single conduit in some sections of the fiber network. [redacted] The new circuit route information will be entered into the order to be carried out by the Qwest provisioning team.

Qwest's Network Planning and Engineering organizations use strict engineering rules to create the highly robust private MPLS core, Public PE, and border router architectures that comprise the Qwest domestic and Asian IP network. These organizations continually monitor network performance and the capacity utilization of core network connections and our peering points to ensure the highest performance for Agencies.

4.1.2.5 NBIP-VPNS Optimization and Interoperability (L.34.1.4.5)

Qwest network engineering and planning have a history of improving the technology and performance of our NBIP-VPNS. Qwest evolved from a SONET-based OC-48c (2.5 Gbps) backbone with a few core routers to a private core/provider edge router architecture using 10 Gbps MPLS-based transport. [redacted]

4.1.2.5.1 Optimizing the Engineering of NBIP-VPNS (L.34.1.4.5(a))

Qwest closely monitors the KPIs (latency, packet loss, and jitter) and constantly optimizes network performance. 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 jitter. [redacted]

[redacted]

4.1.2.5.2 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. The Qwest Internet network consists of [redacted] Most of the network was built within the last five years, including all aspects from the optical layer to the IP NEs. 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:

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

f) Network Growth – what is the projected utilization of the network?

g) 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 is developed and tested against the current architecture before it is launched. If the existing architecture does not support the product, the network 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 is reviewed to ensure that it is still scalable and that it can be improved to continue to provide excellent service to customers.

As the IPS network started growing, our OC-48 backbone links were no longer sufficient to carry the traffic. Using our transport network, we changed the underlying architecture to use wavelength-based 10 Gbps circuits to connect the core routers. As our customers still required transparency to network outages, we implemented MPLS FRR to provide better protection on the network. We are now working on 40 Gbps solutions for the IPS network.

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 any and all the technology and methodology available to meet Agency requirements in a cost-effective manner. We are a facility-based provider with our own fiber, transport, and IPS network, as shown in the previous examples. We leverage technology and architecture at all layers of the network to deliver and build a best-of-class network.

4.1.2.5.3 Access Optimization for NBIP-VPNS (L.34.1.4.5(c))

Qwest's IP network capability has global coverage. [redacted] Qwest is able to offer efficient, cost-effective access to IPS. In addition, through supplier networks, Qwest supports access to an extensive list of countries.

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. [redacted]

[redacted]

4.1.2.5.4 Vision for Service 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]

[redacted]

An integrated service control system is required to enable service convergence that complements network convergence. Together, these capabilities define an adaptable, enabled, and integrated architecture for Qwest's future services that meet changing business needs. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

In summary, the Qwest backbone has been transformed from primarily serving Internet traffic to a general purpose packet transport network [redacted]