VOLUME 1, SECTION 3.1 (continued):

INTERNET PROTOCOL SERVICE

3.1.4 Robust Delivery of Services

This section addresses the requirements of RFP Section L.34.1.4.4. The topics addressed are the Level 3 Team's ability to support additional traffic from Networx customers on our network, our congestion and flow control strategies, and our approach to providing robust access while ensuring resiliency and planning for growth.

3.1.4.1 TRAFFIC CAPACITY

[redacted]

The results of the analysis indicate that the Level 3 Network resources have more than enough capacity to carry the indicated traffic from the database. Growth and capacity planning is a critical aspect of Level 3's business. Traffic analysis is performed continuously, and reviewed continuously by our Network Architects.

The Government's Traffic Model has thousands of data points, and [redacted] was necessary. Level 3 has carefully examined the contents and grouped the service types that are being offered for the Networx contract.

Below is a very general comparison, but it is used to illustrate trends. [redacted]

[redacted] Traffic is influenced by a large number of factors, including, but not limited to, the following:

[redacted]

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

[redacted]

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

[redacted]

There are no specific build-outs being contemplated for the IPS in support of the Networx Program at this time. Currently, the Level 3 Network has plenty of capacity in the vast majority of areas [redacted] The locations that experience high traffic volumes, such as [redacted]. Since Level 3 owns the entire major network infrastructure, we have full control of planning and executing build-outs. Sections 3.1.4.2 and 3.1.4.3 of this volume discuss the Level 3 process for growth planning and network build-outs.

3.1.4.2 CONGESTION AND FLOW-CONTROL STRATEGIES

Many networks are designed as much by trial and error as they are from experience. Level 3 goes beyond this common approach by employing [redacted] Comprehensive testing is continuously performed, not just of new designs but also of the current design. Continuous improvement is sought out through [redacted].

These powerful tools and processes were created by Level 3. [redacted] These methods are what enable Level 3 to accurately meet precise standards. They also enable Level 3 to continuously raise the standards.

Level 3 owns and maintains the underlying fiber and transport network that provides capacity to the [redacted], which supports the IPS network. Because Level 3 controls the network all the way down to the [redacted] fiber, significant advantages can be realized. Owning and controlling all the network components from [redacted] enables Level 3 to be more responsive to network events, modifications, and customer needs, including handling [redacted] while maintaining quality service.

Level 3 capacity plans the network for [redacted]. Even with [redacted] occurring at [redacted] in the backbone, a large amount of [redacted] is deployed. [redacted]

[redacted]

More than [redacted] of Level 3's interconnection traffic runs through [redacted]. [redacted] provide the best possible performance between Level 3 and other Tier 1 backbones. Today, Level 3 has more than [redacted], and growing, of international peering capacity in more than [redacted] diverse peering cities. Level 3 peers with [redacted] of large IP providers representing all major traffic regions. Therefore, not only can the Level 3 IP network easily support off-net customer traffic bursts, it can [redacted]

Through [redacted], Level 3 has improved performance by localizing traffic throughout North America. [redacted]

[redacted]. As such, Level 3's current network policies enable for the

upgrade of peering circuits to aggressively meet current and future customer demand. This ensures ample time to provision additional capacity. These practices ensure that scalability is preserved at all our peering locations.

Level 3 has established peering presence at [redacted] sites. These sites carry the majority of peering traffic between Tier 1 ISPs. By entering into [redacted] here, Level 3 has the ability to upgrade capacity with key peers in specific locations for the immediate needs of its largest customers. Level 3 has its own [redacted] capacity into all of these facilities. [redacted]

[redacted].

[redacted]

[redacted]

3.1.4.3 ACCESS, RESILIENCY, AND GROWTH

[redacted]

The physical and transport layers are the materials for an IP backbone [redacted]

[redacted]

Many companies have designed and built their network by acquiring legacy systems, using multiple generations of hardware, or by leasing equipment and capacity. Complete network ownership, on the other hand, translates into having control over potential problems. [redacted] platforms constructed with consistent technologies means technicians have fewer variables when troubleshooting network components. This directly translates into more-efficient operations and reduced time to restore affected components.

Level 3 has built and solely operates its more than [redacted] core international network. [redacted] This completed network is optimized end-to-end for IP and is operated and managed by Level 3.

Another [redacted] in the network foundation can be caused by a lack of physical diversity throughout the network. If an Internet access provider has a network without [redacted]

[redacted].

[redacted]

The Level 3 IP platform can be accessed in more than [redacted] markets internationally via more than [redacted] on the continuously upgradeable Level 3 Network. IPS can be offered at any of these on-net points of demarcation. [redacted]

[redacted]

[redacted]

[redacted]

The ability to rapidly add transport capacity to an IP backbone is critical to the performance and reliability of a network. Many networks are not designed to scale rapidly to meet the growth of the Internet today. In fact, some networks take up to six months to add the transport capacity necessary to support their backbone. It is critical that the Government choose a service provider that is able to support both its short-term and long-term requirements.

Level 3 is best positioned to support the short-term and long-term capacity needs of the Government. Agencies will be able to provision additional transport capacity in real time via the [redacted]. Using this tool, transport provisioning cycle times can be realized from [redacted] to as few as [redacted], enabling Level 3 to scale its IP backbone unlike any other network's.

The IP [redacted] processes and tools build the foundation for a superior IP network. These processes and tools are regimented [redacted] in order to achieve a scalable backbone and edge network for best-of-breed service performance for Level 3 customers. The planning processes consist of [redacted] main steps:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

3.1.5 Optimization and Interoperability

This section addresses the requirements of Section L.34.1.4.5 of the RFP. The topics covered include our approach for optimizing engineering, methods to optimize the network architecture, handling large concentrations of diverse customer applications, and network interoperability.

3.1.5.1 Optimizing Engineering

IP and Optical Technology

The physical media for modern, high-capacity networks is generally optical fiber, because no other alternative has the capacity of this technology. Level 3, like many other network providers, believes that IP technology is how networks will continue to interconnect with customers in the future.

Historically, neither optical technology nor IP technology possessed all the attributes necessary to provide high-quality communications service. As a result, many providers' networks use other older technologies to meet these requirements. [redacted]

[redacted]

Many experts predicted that, over time, optical technology and IP would evolve to include these networking attributes and that this would further increase the advantages associated with IP. These predictions have proven correct. [redacted]

As IP and optical technology improved, the elimination of these extra "layers" of network and equipment represented a significant opportunity to lower the overall cost of service while increasing operational efficiency. Level 3 designed its network to permit this evolutionary improvement to occur at a cost much lower and at a faster deployment rate than many of its competitors.

Multiservice Backbone

[redacted] Other carriers are now moving to the multiservice model and are beginning the disruptive process of network integration and migration activities. Making the change to a multiservice backbone is a large undertaking and requires new models for engineering,

testing, planning, and operations. The Level 3 Network has had a multiservice backbone since [redacted] in 1998.

Testing

Testing at Level 3 is given great importance in the engineering and operations processes. It is continuously performed in Level 3's own extensive laboratory facilities. [redacted]

Regression and performance testing is performed on all features of the Level 3 Network. [redacted] New procedures and tools are tested before deployment, [redacted]

Many service providers use their in-band Internet backbone as their primary management network. Some have an out-of-band (OOB) network, usually dial-up, or very-low-bandwidth, switched data services, such as Frame Relay [redacted]

Capacity Planning and Network Optimization

Tools and processes used by Level 3 in its capacity planning and network optimization are described below.

Network Capacity Planning

[redacted] Our converged backbone runs [redacted] over the same network. [redacted] Therefore, Level 3 has invested heavily to ensure effective traffic management on our network.

Capacity Planning for a large IP network requires two essential pieces of information: [redacted]

Current Utilization of the Network

The current utilization of the network is obtained by [redacted]

[redacted]

[redacted]

Planned Additions to the Network

[redacted]

[redacted] New customers can produce a large jump in bandwidth suddenly that also needs to be accounted for. [redacted]

[redacted]

[redacted]

[redacted] The Capacity Planning group can [redacted] determine trends that might require Level 3 to add a new city, or add additional backbone paths to the network that will optimize the backbone. A new topology for the backbone can be loaded into the tool to investigate various changes to the network, and ensure that the results of the proposed modification will work as planned.

[redacted] We work closely with large customers such as the Government to ensure that planned needs are forecasted and provisioned on the network well in advance of the Government's requirements. In the past years, Level 3 has seen a great deal of growth, testing, and ensuring that our Capacity Planning processes can meet customer requirements. As numerous large bandwidth customers are added to our network, we continually work to ensure we are building as much scalability as necessary to maintain this growth. With our strong [redacted] backbone capabilities, we can meet any Government bandwidth requirements quickly and accurately.

3.1.5.2 Optimizing Network Architecture

Level 3 has designed the IPS network to be as effective as possible. Several methods are used to optimize the performance of the network including the following:

[redacted]

[redacted]

The Level 3 IP network can be accessed via more than [redacted] on the continuously upgradeable Level 3 Network. IPS can be offered at any of these on-net points of demarcation. Level 3 is continually adding new on-net buildings and new points of demarcation (within existing on-net buildings) onto its network. Unlike some competitors, Level 3 has [redacted] networks in [redacted] metropolitan networks, enabling Level 3 to easily add buildings and points of demarcation onto the network. [redacted]

In addition to providing access to [redacted], Level 3 is able to provide IPS to any domestic location. [redacted]

[redacted]

Internet Protocol was rapidly becoming the unifying protocol for enterprise data communications. In addition to the phenomenal growth of the Internet, the flexibility of the IP protocol model offered an accelerated approach to service creation. [redacted]

Service providers gained significant bandwidth efficiencies over a single network infrastructure. Statistically [redacted] networks attempt to blend multiple types of traffic and take advantage of complementary high- and low-intensity levels to offer best efficiencies. A single network infrastructure offers inherent advantages over separate networks designed for specific services. Higher bandwidth efficiency also minimizes the capital costs of maintaining a network, yielding further advantages for service providers, which in turn, benefit the customer.

[redacted]

[redacted]

[redacted]

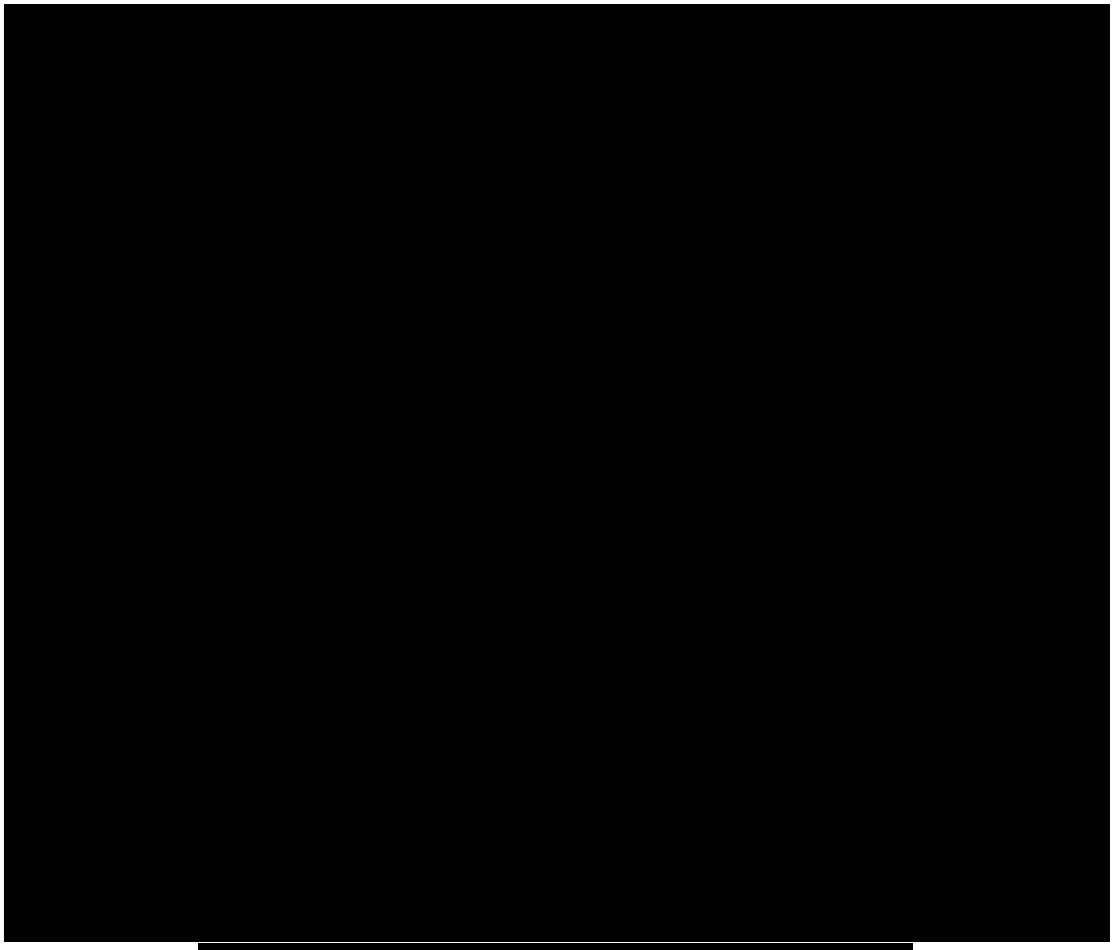
Level 3 delivers a scalable IPS solution to accommodate the Government's growing IP traffic, and it was built with this growth in mind. The Level 3 IPS network has the scale and geographic reach to handle the Government's traffic predictions and is flexible enough to accommodate unplanned growth, as well.

[redacted]

3.1.5.3 ACCESS WITH DIVERSE CUSTOMER APPLICATIONS

[redacted]

[redacted]



[redacted]

[redacted]

Completed in [redacted] the Level 3 Network is one of the world's newest and most advanced telecommunications infrastructures. The network spans [redacted] miles and delivers services to customers in major markets across the United States and Europe. It serves a substantial number of the world's largest and most sophisticated communications companies, including [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]

3.1.5.4 INTER-NETWORKING OVER A COMMON INFRASTRUCTURE

Level 3 continues to be the leading innovator in IP-based enterprise networks. [redacted]

[redacted]

[redacted]

This institutional practice of refining our services will benefit the Government community as we adapt the network in response to enhancements and upgrades in information technology applications.

The Level 3 fiber-optic infrastructure is designed to be continuously upgradeable to leverage new transport technology. Level 3 is currently designing a new transport network to leverage recent technological advances that will contribute to a steep decline in transmission cost, provide new services, and increase flexibility and manageability of offerings on the network.

[redacted]

Given the current market environment, transport networks must be easily reconfigured to support unplanned or changing service demands and eliminate fixed bandwidth allocation between customer sites. Level 3 has deployed next generation platforms that will enable us to rapidly provision any service from any node to any customer location without complex and costly re-engineering of the network[redacted]

[redacted]

Incorporating these standards into the Next Core architecture will result in greater flexibility in networking at lower costs and with less risk and simpler management. These advantages will continue to be supported by industry innovation in future years.