



Government Transport Networks: Minimize Lifetime Costs



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What You Will Learn

Public sector organizations are preparing to upgrade their transport networks to accommodate a surge in traffic from business video and network-based backups. This white paper, intended for network architects in federal, state, and local government, explains factors affecting total cost of ownership (TCO) for transport platforms:

- The platform with the lowest upfront capital outlay often does not have the lowest TCO over several years.
- Selecting a platform that supports a wide range of protocols and interfaces avoids the need for overlay networks that increase risk and operational expense.
- Platforms will have a longer lifespan if they can support 100 and 1000 Gigabit Ethernet and scale to tens of terabits per second of bandwidth.
- Cisco® optical network systems, introduced in 1999, minimize TCO because of their scalability, ease of management, and built-in support for the protocols and higher speeds likely to be used in the coming decade.

Today's Public Sector Transport Landscape

Transport architectures used in government range from leased DSL service to private national or global Dense Wave Division Multiplexing (DWDM) networks. Many of these transport networks now need upgrades because of unprecedented network traffic volume, the result of:

- **Pervasive video:** The public sector is increasing its use of telepresence for collaboration, communications, training, and citizen interaction. IP video surveillance is also increasingly popular, and in some deployments, video feeds from individual sites travel over the transport network for centralized monitoring.
- **Network-based backups:** Application virtualization makes it possible to transport workload over the network to a disaster recovery facility, supporting continuity of operations (COOP).
- **Telework:** Agencies are accelerating their telework programs to comply with the Telework Enhancement Act of 2010, strengthen COOP plans, enhance recruitment and retention by improving work-life balance, and in some cases decrease real estate costs. Teleworkers access voice, video, and data services over the network, increasing traffic.
- **Homeland Security:** Federal, state, and local government agencies use transport networks to collect, process, and disseminate intelligence information.
- **Healthcare:** Governments are delivering specialist care to rural areas using ultra-high-definition telepresence systems. Local healthcare agencies also use the transport network to collaborate with the Centers for Disease Control, National Institutes of Health, and other outside agencies.
- **Academic and scientific research:** Government researchers and scientists stationed throughout the world are accessing ever larger image files and unstructured "Big Data" for analysis, taxing transport networks.

The transport networks that underpin these services represent a significant portion of government IT costs. And yet agencies typically give less thought to planning transport networks than campus and data center networks. Instead, constrained budgets make it tempting to deploy the lowest-cost transport platform that meets current needs.

These upfront capital savings are short-lived however. The reason is that the lowest-cost platforms generally lack the flexibility to support different protocols and interfaces and higher network traffic volume. Therefore, connecting a new location or supporting a new program often requires an overlay network, increasing the number of devices and the associated management burden. In fact, many governments have acquired an assortment of transportation technologies, some possibly several generations old. Lack of a unified transport architecture is costly to taxpayers, increasing the cost of growth, management overhead, complexity, and risk.

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Designing a Strategic Transport Architecture

With proper planning, most public sector organizations can design a strategic transport architecture that supports current and planned programs with lower TCO than architectures that might cost less upfront. To illustrate, Table 1 and Figure 1 compare the costs of a leased 10 Gigabit Ethernet service to a private DWDM architecture using dark fiber, for a typical six-site metropolitan network. Although the DWDM solution costs 3.4 percent more than the leased Lambda service in year one, it costs \$2.2 million less by year five.

Table 1 – Lower Five-Year TCO for a Private DWDM Network than a Leased Lambda Service

	Private DWDM Network	Leased Lambda Service	Savings from DWDM Network
Year 1 (5 Wavelengths)	\$620,581 Capital Expense* \$398,551 Leased Dark Fiber \$222,000	\$600,000	-\$20,581
Year 3 (10 Wavelengths)	\$314,751 Capital Expense** \$92,751 Leased Dark Fiber \$222,000	\$1,200,000***	\$885,249
Year 5 (15 Wavelengths)	\$370,480 Capital Expense** \$148,480 Leased Dark Fiber \$222,000	\$1,800,000***	\$1,429,520
TOTAL 5-YEAR SAVINGS			\$2,294,188

* DWDM platform

** Additional transponders

*** For leased Lambda service, calculations assume that existing hardware has enough interfaces for all services through year 5.

Figure 1 – Increased Savings from a DWDM Network Over Time



Designing a strategic transport architecture requires two decisions: the network model and the platform.

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Deciding on a Network Model

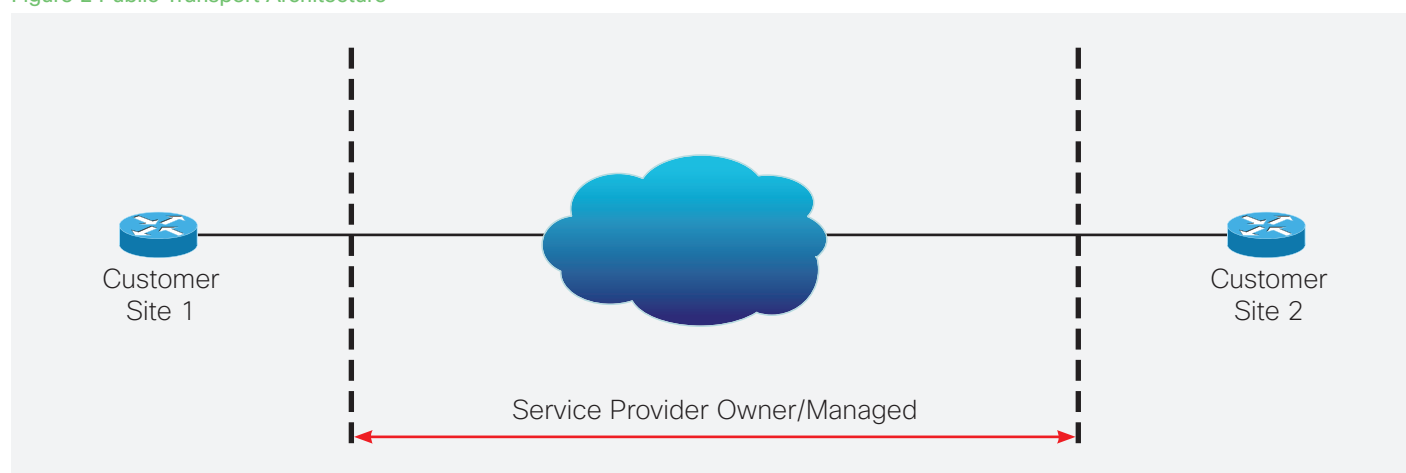
Depending on the agency's mission, resources, and size, the best network model could be public, managed service, private, or hybrid.

Public Network

In public networks, the service provider supplies all hardware and support to provision, operate, and maintain the transport system (Figure 2). The government IT team is responsible only for on-premises equipment, up to the demarcation point.

If you choose this model, find out which transport technology and delivery platform the service provider uses. For example, your Carrier Ethernet service might be delivered over dark fiber, DWDM, SONET, or Multiprotocol Label Switching (MPLS). Understanding the capabilities of each transport medium will help you choose a carrier that can support your agency's or department's mission.

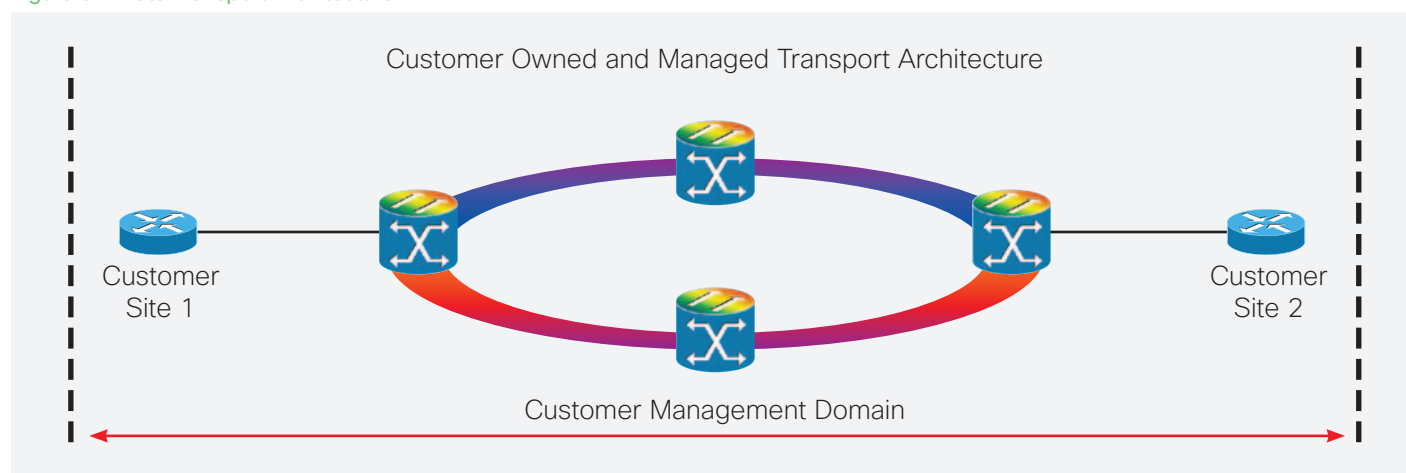
Figure 2 Public Transport Architecture



Private Network

In private networks, your organization owns, provisions, operates, and maintains all elements of the transport architecture (Figure 3). The IT team is responsible for all network devices, both inside and outside the plant.

Figure 3 Private Transport Architecture

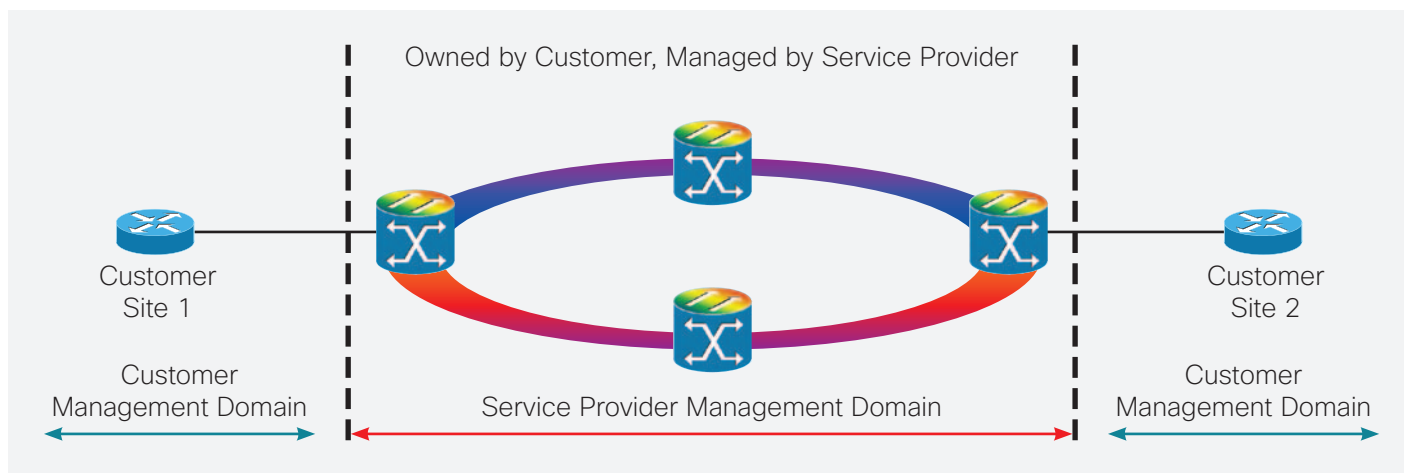


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Managed Private Network

A managed private network is similar to a public network in that the service provider architects, installs, operates, and maintains the transport architecture (Figure 4). The difference is that your department or agency owns the architecture, which is solely for your use.

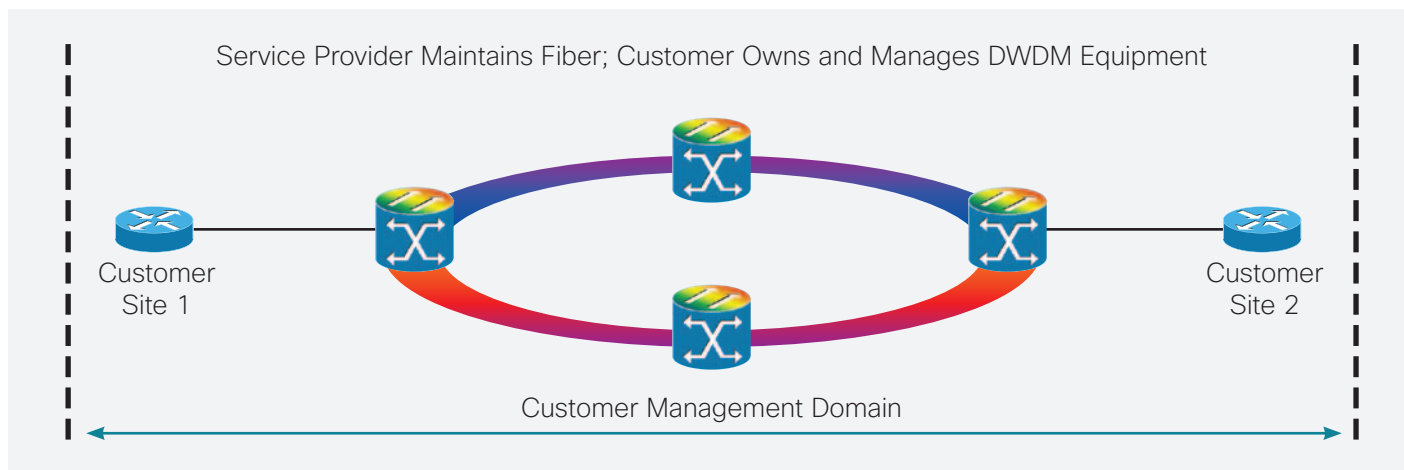
Figure 4 Managed Private Network Architecture



Hybrid Network

In hybrid transport networks, your IT team owns, installs, and maintains the network hardware, and the service provider provides either dark fiber or managed services (Figure 5). The most popular type of hybrid transport architecture is a privately owned Metro DWDM network operating over dark fiber leased from and maintained by a service provider.

Figure 5 Hybrid Transport Architecture



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Evaluating TCO for the Optical Transport Platform

As shown in Figure 1, a slightly larger initial capital investment can potentially save millions of dollars over the life of the transport architecture. To minimize TCO, consider the following when selecting an optical transport platform:

- **Will it support the transport technologies the organization might need in the coming decade?**

Examples include:

- Protocols: TCP/IP, Ethernet, Time-Division Multiplexing (TDM), Enterprise Systems Connection (ESCON), Fibre Connection (FICON), HD6000, InfiniBand, and Fibre Channel
- Interface on source equipment: Serial, DS1, DS3, OC-n, Ethernet
- Technologies: DWDM, Metro Ethernet, SONET
- Reconfigurable Optical Add/Drop Multiplexer (ROADM): Compared to OADM, ROADM scales with lower capital and operational expense
- Quality of service (QoS): Needed for IP-based voice, video, or media applications
- Reliability: Needed to transport mission-critical application traffic
- Ability to separate traffic into enclaves for secret, top-secret, and so on

- **Does it support the strategic direction of your organization's transport architecture, campus architecture, and data center architecture and applications?**

For example, if most current traffic is TDM, you could meet today's needs with a managed SONET service based on a packet-over-SONET (PoS) architecture with OC-n interfaces. But if you later upgrade the campus architecture from PoS to 10 Gigabit Ethernet and add a disaster recovery site, you would need to supplement the managed SONET service with a Carrier Ethernet service or 10 Gigabit Ethernet wavelengths. The three-year TCO for a DWDM architecture would likely be far lower despite its higher upfront costs.

- **What is the platform's projected lifespan?**

Newer transport technologies, such as DWDM and Cisco Carrier Packet Transport (CPT), typically have a longer lifecycle than established technologies such as TDM. Also, the public sector is escalating its use of video over IP for collaboration, communications, training, and physical security, and DWDM does a better job supporting this bursty traffic. Another factor affecting the lifespan of the platform is its ability to keep pace with increasing Ethernet speeds. DWDM supports 100 Gigabit Ethernet today, and 1000 Gigabit Ethernet is on the roadmap.

- **What are the support requirements?**

Public sector organizations cannot count on budget for staff increases to support a new transport architecture. Resource requirements decrease if the platform has an intuitive management interface, allows provisioning of all network elements from a single interface, and does not require specialized test equipment.

- **How much bandwidth can you add without a platform upgrade?**

Although SONET platforms typically cost less upfront than DWDM platforms, they often cost more to scale. When projecting future bandwidth requirements, be sure to account for bursty traffic and time-of-day surges for backups and the like. Metro DWDM systems support up to 80 wavelengths on each degree and up to 8 degrees on each network element, for a total of 640 wavelengths on each network element. Depending on whether you are using 10 GE, 40 GE, or 100 GE wavelengths, total capacity is 6.4 Tbps, 25.6 Tbps, or 64 Tbps, respectively. Government entities can start with one network element with a single degree and 10-Gbps bandwidth, and add more bandwidth in increments without a forklift upgrade.

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Why Cisco?

With more than 25 years of experience in DWDM, SONET/SDH, IP, and MPLS technologies, Cisco is uniquely qualified to help public sector organizations realize the benefits of a combined packet and transport system. The benefits of working with Cisco for optical transport networks include:

- **Experience:** Cisco has been providing optical transport platforms to the public and private sectors since 1999. Advising federal, state, and local governments on collaboration, borderless networks, and virtualization gives Cisco insight into emerging requirements for government transport networks.
- **Complete optical product portfolio:** Cisco's end-to-end product portfolio includes SONET, DWDM (metro, regional, and long-haul), and carrier packet transport.
- **Services:** To help your organization smoothly migrate to the new transport architecture, Cisco offers Transformative Services, including a pilot and field trials, planning, design, implementation, training and knowledge transfer, and operations optimization.
- **Technology innovation:** The Cisco Carrier Packet Transport (CPT) system is the industry's first standards-based packet optical transport system that unifies packet and transport technologies using Multiprotocol Label Switching-Transport Profile (MPLS-TP). Combining functions such as ROADM, TDM/OTN switching, Carrier Ethernet, and MPLS-TP in a single platform minimizes network elements and interconnect ports. Optimized for transport networks, the Cisco CPT product family also provides a migration path from governments' existing SONET architectures to MPLS-TP because it offers the same 50-millisecond protection switch times as SONET-to-packet transport.
- **Choice of interfaces:** Transport engineers can manage the Cisco CPT system with the traditional command-line interface (CLI) or the Cisco Transport Controller graphical user interface. Using either interface, engineers provision label-switched paths and pseudowires as they are accustomed to doing for SONET circuits.

Conclusion

Transport networks affect government operational costs at least as much as campus or data center networks, and carefully selecting the platform can result in significant savings. In summary, a well-planned transport architecture can help agencies avoid the considerable expense of upgrades as they accelerate adoption of business video and virtualization. In contrast, a platform with lower upfront costs may have a shorter lifespan and require IT teams to continually add overlay networks that increase costs and management complexity.

Cisco optical networking solutions minimize TCO. Scalable bandwidth and support for different interfaces and protocols extend platform life, and the intuitive management interface minimizes management overhead.

For More Information

To learn more about Cisco transport platforms, visit: www.cisco.com/go/optical.



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