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## The Network Dilemma - So Many Choices

### How do you Select the Right One?

Customer network needs have grown and changed dramatically over the last several years. The complexity of software applications now requires greater bandwidth to satisfy the increase in application and data size. Corporations are continually adding remote offices to better serve their clientele, but in so doing, increasing their need for solutions to handle the voice and data needs of those remote sites. Telecommuting from home has enabled companies to increase worker productivity and decrease other overhead expenses, but has also added to the challenges that the IT department faces in ensuring that all the tools of the trade are at the disposal of the worker at home. The networking options that are available to solve the IT needs of a company seem to be as numerous as the number of companies themselves.

So, how do you, in all good “telecom conscience,” begin to propose a solution that fits the customer you are working with? Should you propose an MPLS solution? It is a newer technology that can allow for tremendous growth and efficient use of network bandwidth. Or, do you recommend an Ethernet solution? Ethernet seems to be on the cover of every telecom publi-



cation out there and is an environment that IT personnel feel comfortable in. Or, should you offer frame relay or private line? Is the only answer VPN over the Internet? Or, is that never the answer? Wait! Let’s think this through...

Each technology has its place, depending on the customer. What will work for one customer will not necessarily meet the needs of another customer. Asking the right questions of the customer will allow you to engineer a proposal that meets their unique requirements and helps you make the sale.

To illustrate which questions to ask and how, we have put together a few case studies to show not only which network solution worked, but how the customer, their equipment vendor and the network provider came to that decision.

## Case Study No. 1

Ethernet Private Line Solution replaces Frame Relay

### Customer statistics:

- Healthcare industry
- Eight remote sites all needing connectivity back to a host site
- Host site is currently the central repository of data
- The sites are all within a 100-mile radius of each other
- The patient data being shared among sites is highly sensitive and security is of utmost importance
- Uptime is critical from 8am to 6pm
- Customer currently is using frame relay with PVCs from remote sites pointing at the host site. The remote sites run at speeds of 256K.
- Customer has IT staff at the host site that must maintain the remote sites. There is no permanent IT staff at the remote sites.
- Customer budget is limited. They will not be able to add IT staff to support network applications.
- Customer needs to add additional data applications that are run over the new network

### How did we arrive at the end proposal?

First, we looked at the advantages and disadvantages of different network types and compared them to the needs of this customer. The list looked something like this:

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### Frame Relay Advantages

- Customer can reuse the routers that are in place at the remote sites.
- Customer is familiar with the technology.
- Customer will not have to pay for overlapping networks. Upgrades to the existing frame network should make billing simple.

### Frame Relay Disadvantages

- Cost for the overall network increases dramatically when trying to achieve full T1 Port and CIR rates for each site.
- Additional equipment must be purchased for the host site to handle the additional bandwidth coming in.
- There is a single point of failure at the host. If primary access into host site goes down, all sites lose connectivity.

### MPLS Advantages

- Customer will likely be able to reuse their existing routers.
- MPLS will allow any site to communicate directly with any other site.

### MPLS Disadvantages

- MPLS port and loop rates were higher than expected. Had the network been more geographically diverse, this factor would have been less noticeable, but for sites that were all close together, and yet some distance from the closest POP, the pricing was out of line.
- The host site required considerably greater bandwidth than a T1 in order to guarantee that the host would not be over-utilized. This again drove cost up.
- MPLS requires greater IT overhead to manage all of the routers at each site. The customer was looking to decrease the IT burden, not increase it. This obstacle can be easily dealt with by offering a fully managed network solution.

### Internet VPN Advantages

- The pricing to deliver dedicated Internet T1s to each site was competitive.

### Internet VPN Disadvantages

- Security concerns. While proper configuration with firewalls, routers and encryption might meet security requirements, this requires tremendous IT overhead.
- Potential speed issues because traffic would run over the Internet.

### Private Line Advantages

- Full T1 pipes from host to each remote provide the bandwidth the customer needs without any bottleneck at the host.
- A pricing promotion in that geographic area made the network pricing very attractive.
- No single point of failure.
- Excellent Service Level Agreements (SLAs) are available for private line.

### Private Line Disadvantages

- Routers with CSU/DSUs are still required at each site. To decrease IT overhead, the network needs to be in a fully managed environment, which adds to the monthly costs.

### Ethernet Private Line Advantages

- Full T1 pipes from host to each remote provide the bandwidth the customer needs without any bottleneck at the host.
- A pricing promotion in that geographic area made the network pricing very attractive.
- No single point of failure.
- No need for routers at all of the remote sites, which allows the customer to reduce IT overhead.
- Ethernet conversion boxes at each site allow American Telesis another means to test and manage the network with very minimal monthly costs in the network.
- Ethernet allowed customer to use a simple IP scheme so that all sites can easily communicate with all of the other sites without additional burden at the host site.
- Excellent Service Level Agreements (SLAs) are available for private line.

**When we compared all the options, Ethernet Private Line gave the customer the most bang for their buck with the fewest concerns. The new Ethernet Private Line network provided 6 times the bandwidth (256Kb\*6 = 1,544Kb) into each site with excellent SLAs, no single point of failure and for the same price they were paying for their existing frame relay network. The one concern the customer had, in moving from their existing frame network to a new Ethernet Private Line network from American Telesis, was the potential for duplicate billing on two networks while the transition was completed. American Telesis was able to work with the customer to mitigate this concern.**

## Case Study No. 2

### MPLS Solution replaces existing Private Line Network

#### Customer statistics:

- Fortune 100 Company
- 20 domestic sites and 1 international site
- Domestic sites are spread throughout the country
- 4 server locations – not one single host
- Data traffic 24 hours a day
- Current network configuration is a managed T1 network. They are looking for speed increases ranging from 6Mb to 45Mb at each site.
- The current network is far too slow. Customer is sending huge files between sites and downloads are taking as much as 15 hours to complete.

#### How did we arrive at the end proposal?

Again, we first looked at the advantages and disadvantages of different network types and compared them to the needs of this customer. The list looked something like this:

#### Frame Relay Advantages

- Can accommodate diverse geographic locations.
- Can be fully meshed so that all sites can talk to all other sites.

#### Frame Relay Disadvantages

- Monthly pricing is very high when delivering 6Mb, 12Mb or 45Mb pipes into each site.
- The equipment necessary to handle the multi-megabit pipes is cumbersome to manage.

#### MPLS Advantages

- The fully meshed environment allows all sites to send to all other sites as needed. This accommodates the multiple server sites easily. This also allows the four server sites to share information easily.
- The equipment/routers necessary to handle the 6Mb, 12Mb or 45Mb speeds at each site are readily available and can easily fit into a managed service environment that the customer is accustomed to.
- Utilization reports on the overall network can be made available to the customer in real time so that bottlenecks can be spotted quickly and adjustments can be made with ease.
- Additional network growth is easily accommodated. If a site needs to increase from 6Mb to 12Mb, or if a new site needs to be added in another region,

MPLS allows for these upgrades with no interruption to the existing network.

- The backbone is a private network.

### **MPLS Disadvantages**

- There is the potential to send more data to one site than it can handle at that moment. However, in a careful study of the customer's current traffic patterns, they feel that this potential problem can be avoided.

### **Internet VPN Advantages**

- A fully meshed environment allows all sites to send to all other sites as needed. This accommodates the multiple server sites easily. This also allows the four server sites to share information easily.
- Utilization reports on the overall network can be made available to the customer in real time.
- The equipment/routers necessary to handle the 6Mb, 12Mb or 45Mb speeds at each site are readily available and can easily fit into a managed service environment that the customer is accustomed to.
- Additional network growth is easily accommodated. If a site needs to increase from 6Mb to 12Mb, or if a new site needs to be added in another region, MPLS allows for these upgrades with no interruption to the existing network.

### **Internet VPN Disadvantages**

- Traffic is sent over the public Internet infrastructure. The file sizes being sent out by the customer are very large. Using the Internet dramatically increases the potential for added latency in the network. The customer cannot be guaranteed that file transfer speeds will always be as fast as they would like.

### **Private Line Advantages**

- Excellent Service Level Agreements (SLAs) are available for private line, guaranteeing the customer the speed increases they need.
- American Telesis can provide the managed network service options that the customer is requesting.

### **Private Line Disadvantages**

- The customer requires large bandwidth into four server sites, not just one server site, adding to the number of private lines necessary to support the network architecture and thus driving up the costs of the network.

### **Ethernet Private Line Advantages**

- Excellent Service Level Agreements (SLAs) are available for Ethernet Private Line, guaranteeing the customer the speed increases they require.
- Offering Ethernet hand-offs at each site reduces the customer equipment costs.
- American Telesis can provide the managed network service options that the customer is requesting.

### **Ethernet Private Line Disadvantages**

- The customer requires large bandwidth into four server sites, not just one server site, adding to the number of private lines necessary to support the network architecture and thus driving up the costs of the network.

**When we compared all of the options, MPLS fit the customer environment most closely. The new MPLS network provided from 4 to 28 times the bandwidth into each site and accommodated the requirement for many sites to communicate with many other sites. MPLS also allowed the customer to easily make adjustments to their network as needs at each site changed.**

## **Case Study No. 3**

### **New Private Line Network Implementation**

#### **Customer statistics:**

- Financial Markets
- Fortune 500 Company
- 25 domestic sites
- The 25 sites are spread throughout the northeast
- 2 primary locations feed data to 23 remote sites
- Traffic is very latency sensitive
- Redundancy into each remote site is critical – each remote site needs 1.5Mb of traffic from each host site.

#### **Frame Relay Advantages**

- The long haul portions of the network would be protected in the frame environment, maximizing uptime for the customer.

#### **Frame Relay Disadvantages**

- Frame relay was not built for latency sensitive applications; it was built for intermittent bursty traffic.
- Frame implementation at the speeds required is expensive.

### **MPLS Advantages**

- The ability to redirect traffic delivery from one primary location to the other primary location in the event of a failure.
- The ability to easily add new remote sites.

### **MPLS Disadvantages**

- The overhead necessary to make the routing work in an MPLS network will slow the traffic down a little bit. This creates latency concerns for the customer.

### **Internet VPN**

- Latency and security concerns rule out Internet-based solutions as an option.

### **Private Line Advantages**

- Excellent environment for latency sensitive data – strong SLAs to meet the customer needs.
- The ability to control multiple local access vendors and IXC routes provides customer with the diversity in paths that they require.
- Private line pricing has come down dramatically in the past few years and the network pricing is very competitive.

### **Private Line Disadvantages**

- Requirement of CSU/DSU and router on each endpoint. While this is often a disadvantage, for this customer it gives them the tools to monitor, manage and test the network in the way they would like.

### **Ethernet Private Line Advantages**

- Excellent environment for latency sensitive data – strong SLAs to meet the customer needs.
- The ability to control multiple local access vendors and IXC routes provides customer with the diversity in paths that they require.
- Private line pricing (the backbone for our Ethernet Private Line option) has come down dramatically in the past few years and the network pricing is very cost competitive.
- Reduced equipment expenditure at remote sites because the Ethernet can connect directly to the Local Area Network (LAN) at each remote.

### **Ethernet Private Line Disadvantages**

- Customer requires extra monitoring and testing capabilities at each remote site to watch for any latency issues or errors in the circuits. They would need to put

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routers into each remote, regardless of the handoff at the customer, so the addition of a conversion box at the remote sites is simply an extra piece of equipment to manage.

**In this case, the traditional private line network works most efficiently for the customer. The ability to select multiple IXC routes, the availability of multiple local vendors, and the existence of SLA guarantees afforded a private line SONET backbone to best meet the customer's needs.**

*As you work with your clients, keep some of these varying scenarios in mind. Through your discussions, you will begin to uncover details about their requirements that will direct you to different solutions. There is no "one size fits all" answer to telecommunication needs. American Telesis can help you find that one right solution for your client.*

### NETWORK GLOSSARY:

**CSU/DSU (Channel Service Unit / Data Service Unit)** – a device, located at the customer premise, that is used to terminate an incoming digital channel. It must be on each end of a private line, whether the private line is 56K, T1 or T3. It performs certain line coding and line conditioning functions that must occur in order for data to pass between the two customer sites. One can think of it as a modem, however it passes data at much greater speeds and doesn't need a dial up function.

**Ethernet** – a Local Area Network (LAN) standard. Ethernet is used to connect computers, printers, servers, etc., within the same building or campus, via twisted pair copper at speeds of 10Mbps or 100Mbps.

**Ethernet Private Line** – an extension of a LAN to a WAN through the use of private lines to interconnect the offices. At each office, the private line is converted to Ethernet so that the customer can use a standard Ethernet cable to connect the incoming circuit to their existing LAN switches.

**Frame Relay** - a private telecommunications

### Questions to ask for Network Applications

- What is their business? What do they do? This is important for security, QoS, etc. A hospital will have far greater security concerns than a small business sharing email files.
- What kind of data do they need to transmit? (voice, video, data) Is data transmission constant, bursty or latency sensitive?
- What is driving your customer to request this service? Are they looking to reduce costs, add applications, increase security?
- Do they know their bandwidth requirements? What are those bandwidth requirements at each of the sites?
- What are they using today? What are the shortcomings in what they use today? What do they WISH it could do?
- What type of equipment do they already have? Do we need to be able to reuse it?
- Where are the sites? Include the NPA-NXX for each site and addresses whenever possible.
- Does every office need to communicate with every other office or do they all just need to connect to one or two major sites?
- Do they need Internet access in any of the locations?
- What are the growth projections? Do they intend to add new sites, or new applications?
- Do they have any concerns or issues in their current network?
- What are their disaster recovery concerns?

service designed for cost-efficient data transmission for intermittent traffic between customer sites in a wide area network (WAN). Frame relay puts data in a variable-size unit called a frame and leaves any necessary error correction (retransmission of data) up to the customer end-points, which speeds up overall data transmission.

**Fully meshed** – a network environment in which all sites can directly send traffic to any and all other sites.

**Hub and Spoke** – a network environment in which each remote site points back at only the host site. The host is considered the hub and the remote sites are considered the spokes.

**LAN (Local Area Network)** - the means by which computers, servers, printers and other devices inside a building, communicate with one another. The connectivity between devices may be via coaxial cable, Ethernet or wireless.

**MPLS (MultiProtocol Label Switching)** - a key

networking protocol that gives service providers control over the traffic flowing through their networks. It can be used to carry many different kinds of traffic, including IP packets, as well as native ATM, SONET, and Ethernet frames. It allows for different access methods, such as DSL, T1 or T3 loops or Ethernet access. With the extra control that service providers have, they can now offer QoS to accommodate different traffic types.

**Private Line** – a direct circuit dedicated to the use of an end user for the purpose of directly connecting the two sites. A private line is always on and available. There is no potential for delays because there is no dial-up time or potential congestion in the network of the carrier.

**QoS (Quality of Service)** – in the analog telephony world, it is the measure of the telephone service to a subscriber. Is the call loud enough? Is it crystal clear? In the digital world, it is a measure of error rates, loss rates, delay, etc. A greater QoS means more sensitive traffic should pass through without any hiccups. For example, voice traffic is very sensitive to delays or errors on a line, while data traffic is less sensitive. That is because data packets can be resent, delivered and sorted back into the correct order, but voice must be delivered in the order in which it was sent.

**SLA (Service Level Agreement)** – an agreement between a service provider and the user that specifically define the nature of the service being provided. Within the agreement is a set of measurements that the service must live up to. These measurements might include restoration times for outages, average availability of the services and latency. The agreement also typically defines trouble-reporting procedures and penalties for not meeting the level of service demanded.

**VPN (Virtual Private Network)** – in essence, it is utilizing a part of someone else's network (a phone company, an Internet provider or a carrier) and carving out a space for your traffic. There are many ways to create a VPN. Dial tone, DSL Internet access, dedicated Internet access or dedicated facilities can all be used to create the network. In fact, these options can all be used together to create a network. VPN offerings vary widely between providers. Some providers create VPNs over the Internet while other providers will secure the VPN on a private network.

**WAN (Wide Area Network)** – a computer and/or voice network that spans an area outside of a building or campus, requiring some sort of lines to connect the sites. These lines might be leased lines, dial tone, or Internet access lines.