

Based on a recent sampling of repair data, EoC has a 20% lower failure rate than T1 in the field. Should one or more pairs fail, the circuit bundle will keep on working, although it may slow down until repairs are made. In a T1, if one pair fails the circuit would be down hard.

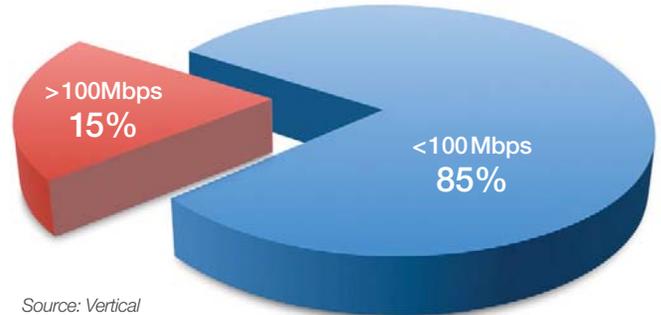
3. True or False: EoC has more overhead than fiber?

As with most technology, the answer is, “it depends.” All data communication protocols add extra bits, or “overhead” to the application data. Like an envelope with an address, these bits tell the network where the data needs to go. Ethernet adds overhead, IP adds more overhead, VoIP adds even more overhead, and so on. More overhead means less bandwidth is left over for the application data.

EoC uses a bonding protocol to transmit data over multiple pairs that adds a little bit of extra overhead. How much depends on the mix of customer packet sizes. If mostly large data packets are sent, the overhead is the about the same as Ethernet over

fiber. Lots of small packets, on the other hand, will incur more overhead. So the actual EoC overhead will vary from one customer to another depending on the mix of applications. Contact your TSC if you need help in understanding a customer’s bandwidth requirement based on the mix of applications.

U.S. Ethernet Customer Installations by Port Speed



Source: Vertical Network Systems — ENS

Most Ethernet ports are 100Mbps or less

4. Is EoC as reliable as T1?

Yes, in fact, based on a recent sampling of repair data, EoC has a 20% lower failure rate than T1 in the field.

5. What makes EoC more reliable?

First, EoC has built in redundancy because TelePacific always deploys one or more extra pairs in the circuit. Second, EoC technology is “rate adaptive” so it always seeks to maintain the stated bandwidth over the available pairs. Should one or more pairs fail, the circuit bundle will keep on working, although it may slow down until repairs are made. In a T1, if one pair fails the circuit would be down hard.

6. Are ILECs planning to replace copper networks with fiber?

With more than 100 million copper access lines in service, they couldn’t even if they wanted to. One carrier has talked about replacing faulty copper loops with fiber, but in most cases the ILECs are moving to a “deep fiber” strategy in suburban areas which brings fiber closer to the customer, while relying on copper lines to span the remaining distance to the customer. Only in commercial office buildings and business parks is it cost-effective to run fiber to a single site. In many buildings with fiber, the copper lines are still available, which allows for competitive access.

TelePacific Access Decision Matrix

Access Type	EoTDM	EoC	EoFW	Eo3PV
Selection Factors	<ul style="list-style-type: none"> • Available from >550 LSOs in Calif. and Nevada • Supports all core services • No distance limitation • Bonded T1 bandwidth from 1.5-12Mbps • DS3 bandwidth up to 135Mbps • Reliable except during extreme weather events • Portable & movable 	<ul style="list-style-type: none"> • Available from 250 LSOs growing to 300 in Calif. and Nev. • Available from 150 LSOs in Texas • Low cost solution • Supports all IP based services • Bandwidth scales smoothly over a wide range from 1Mbps to 100Mbps • Up to 200Mbps possible • Rate adaptive reliability – matches bandwidth to number of working pairs • Extra pair redundancy • Provisioning interval generally within 45 days • Generally portable/ movable 	<ul style="list-style-type: none"> • Available in San Francisco Bay Area; Southern California from Santa Barbara to Orange County; Las Vegas • Low cost solution • Immune to backhoe fade • Shortest provisioning intervals because no ILEC circuits needed • 100% TelePacific controlled access • Land-Air Bundle offers physical diversity • Internet, MPLS, and SmartVoice in Las Vegas • Bandwidth up to 100Mbps • Reach 5 to 6 miles from base stations 	<ul style="list-style-type: none"> • Available to 24,000 buildings in California, Nevada, and Texas • Fiber providers include AT&T, Verizon, tw telecom, Charter, Cox, Time Warner Cable • No distance limitation • Scalable bandwidth from 10-100Mbps; up to 1Gbps via NSR • Supports all IP-based core services
Limiting Factors	<ul style="list-style-type: none"> • High cost solution • Scalability limited to 12Mbps • 1.5Mbps stair-step increases • “Mileage” rates apply in some high-cost areas • Subject to rain-fade in flood prone areas and vulnerable to backhoe cuts • Costs rise in direct proportion to bandwidth 	<ul style="list-style-type: none"> • Not available from all LSOs • Not available when pairgain or remote terminals online • Bandwidth varies with distance • Ethernet in First Mile (EFM) bonding adds small amount of overhead • Vulnerable to backhoe cuts 	<ul style="list-style-type: none"> • Must have line-of-site (LOS) from base station to customer site • Low speed bandwidth subject to interference and recalibration • Limited base station backhaul capacity for high-cap services • DIA-only in California • Complex high bandwidth pre-qual process 	<ul style="list-style-type: none"> • High cost solution • Longer provisioning interval 90-180 days • Dependent on 3rd Party for installation and troubleshooting • Generally reliable but vulnerable to backhoe fiber cut • Generally not portable or movable

Sports Basement Success Story



New Hosted PBX phone system offers savings, security and future peace of mind for rapidly growing retail chain

It started as a local San Francisco go-to source for triathletes looking for advice, camaraderie and bargain prices on discounted name brand equipment. The business blazed an unconventional retail arc, focusing on creating a quirky, passionate and eclectic community of outdoors sports people who loved to hang out in the store's one-of-a-kind handmade and constantly evolving atmosphere. Fifteen years and five new stores later, the Sports Basement is a retail success story that remains true to the focus on people and community that's powered its growth throughout a challenging retail environment.

The Challenge

"We just opened our fifth store in Campbell and plan two more over the next 12 to 18 months," says Chris Welch, who's run the store's networks since 2002. "We'd built up a strong data networking solution, using TelePacific's ①Net MPLS network to connect our warehouse and stores, but were facing a

Highlights

- **Challenge** Aging communications infrastructure and big plans for expansion
- **Solution** TelePacific HPBX provides expandability, security and proven customer service
- **Benefits** Saved money on toll charges, utilized existing bandwidth, and minimizes the hassle of dealing with hardware issues now and down the road

“We looked at other Hosted PBX options but most of those carriers did not offer Bring Your Own Bandwidth solutions. They required new Internet circuits from providers other than TelePacific, something I didn’t want to do.”

Chris Welch
Network Manager
Sports Basement

challenge on the voice side because we were running pretty antiquated phone equipment and solutions that were really beginning to show their age.”

The Solution

The just-opened Campbell store gave Welch the chance to trial a new Hosted PBX system from TelePacific that promises to bring immediate costs savings as it ties together inter-store and warehouse calls and takes them out of toll calling. They installed nine basic and nine executive HPBX seat packages, running over a dedicated 1.5Mbps circuit running on the MPLS network. The ability to rely on TelePacific’s customer service and a cloud system that doesn’t require buying, installing and maintaining hardware also loomed large in the decision.

“We tried VolP about six or seven years ago and it just didn’t work well for us then,” Welch explains. “Now our old PBX’s are beginning to take up too much time, attention and money. I just had one, for instance, where a board overheated and failed and the solution was to go on eBay to find a replacement part. Not how I want to plan for the future.”

Sports Basement had already turned to TelePacific for its data networking needs because of customer service concerns with its former carrier, AT&T. Satisfaction with TelePacific’s performance played an important role in their Hosted PBX decision, but it wasn’t the only factor.

“We looked at other Hosted PBX options but most of those carriers did not offer Bring Your Own Bandwidth (BYOB) solutions. They required new Internet circuits from providers other than TelePacific, something I didn’t want to do,” says Welch. “I wanted the security of the private MPLS network and the ability to use the bandwidth we already had in place — just adding more as we need to. This is our roadmap for the future. This HPBX implementation’s been fantastic and, as contracts expire, we plan to roll it out into our existing and new locations.”

Snapshot

Access

- 1.5Mbps circuit

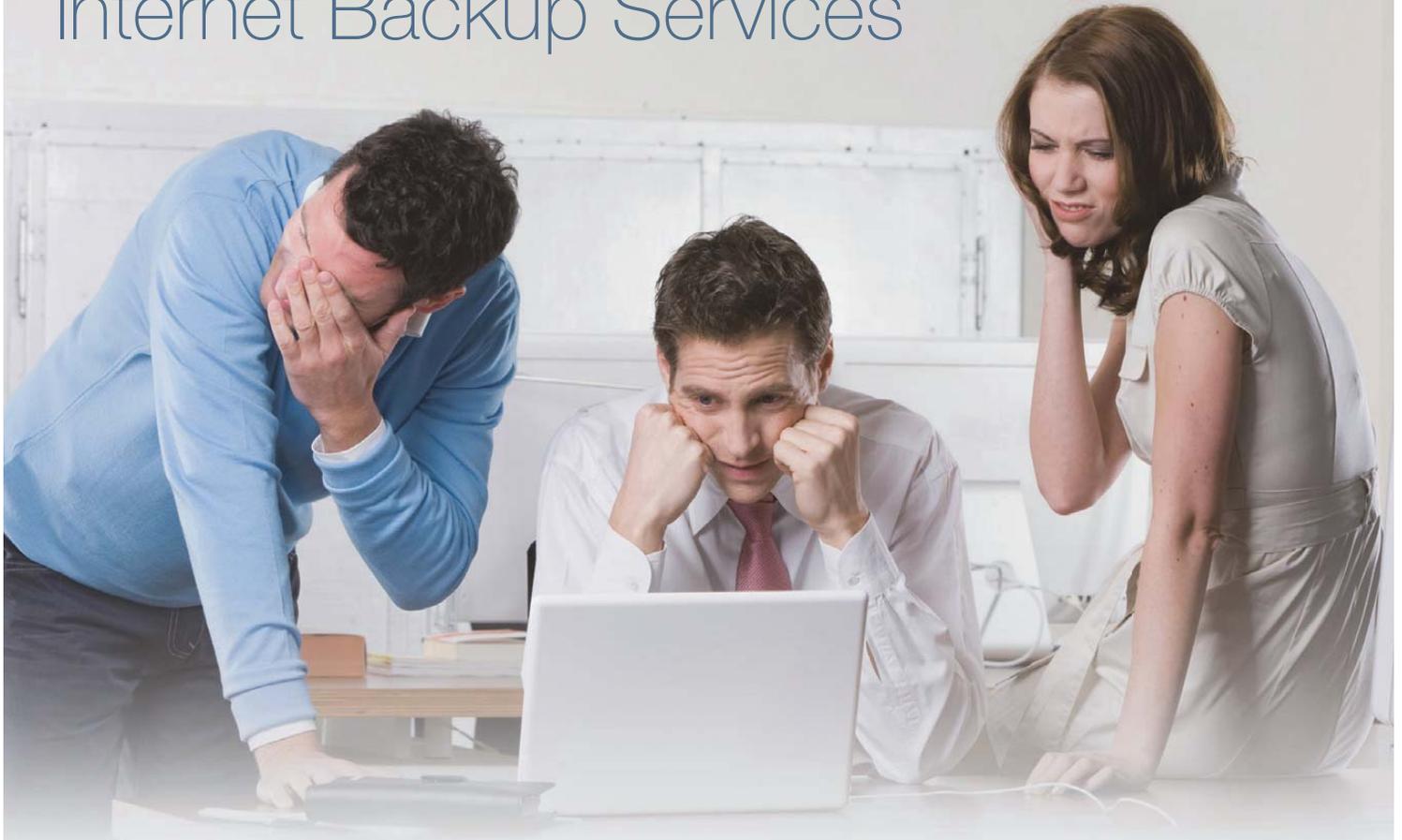
Services

- Hosted PBX system over MPLS network

Advantages

- Immediate cost savings from elimination of inter-store toll charges
- No need to buy, install and maintain hardware
- Security of private network
- Local customer service support
- BYOB capability

Internet Backup Services



We can provide your business with the redundancy necessary to ensure full time access to mission critical applications, resources, and customers.

Is your network protected if your Internet is down? Network resiliency is the key to success for any business. When you have real-time critical business operations, it is imperative that they remain up and running at all times — even in times of disaster.

With TelePacific Backup Services, we provide your business with the redundancy necessary to ensure full time access to mission critical applications, resources, and customers. They offer you peace of mind and business continuity by automatically routing your business data traffic to another connection if your primary line fails. You can choose from three backup options:

- **Wireless Backup:** High performance internet access automatically routes to the 3G EVDO network for uninterrupted business operations. With download speed up to 3Mbps, this resilient, cost-effective option is ideal for businesses with highly distributed locations and primarily uses Internet for critical application traffic and point-of-sale transactions.
- **DSL Backup:** Ensure continuous communication and network uptime with high speed DSL Backup. With download speed up to 6 Mbps, this redundant link to the Internet insures a business from downtime and loss of revenues and employee productivity.
- **Dial Backup:** Automatically reroute your data traffic to a dedicated analog landline. This backup option acts as an insurance against loss of Internet connectivity.

The Real Cost of Downtime: 1% downtime example	
Company's gross annual revenue	\$8,000,000
% of revenue attributed to Internet activity	30%
Annual revenue attributed to Internet activity	\$2,400,000
% Internet Downtime	1%
Total annual revenue loss	\$24,000

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Solutions for Healthcare



TelePacific gives you the rich connectivity, cloud and continuity solutions across your business ecosystem with secure, reliable and consistent performance for your critical applications.

The healthcare industry today is faced with increasing demand for secure, high-bandwidth and reliable connectivity that links hospitals, clinics, nursing homes and physicians' offices.

As demand and regulatory oversight continue to challenge healthcare communications, TelePacific's communication architects are there to help healthcare providers meet those requirements without unneeded complexity, letting them keep their focus on their patients, not their networks.

Expanding without sacrificing quality of care

The key to staying ahead of these demands is a high performance network. So when a multi-location medical imaging company needed to replace their antiquated phone system, looking to open a sixth location and wanting to modernize their communications systems, they turned to TelePacific for a turnkey integrated solution that included a great deal on bandwidth, cloud services and a new phone system.

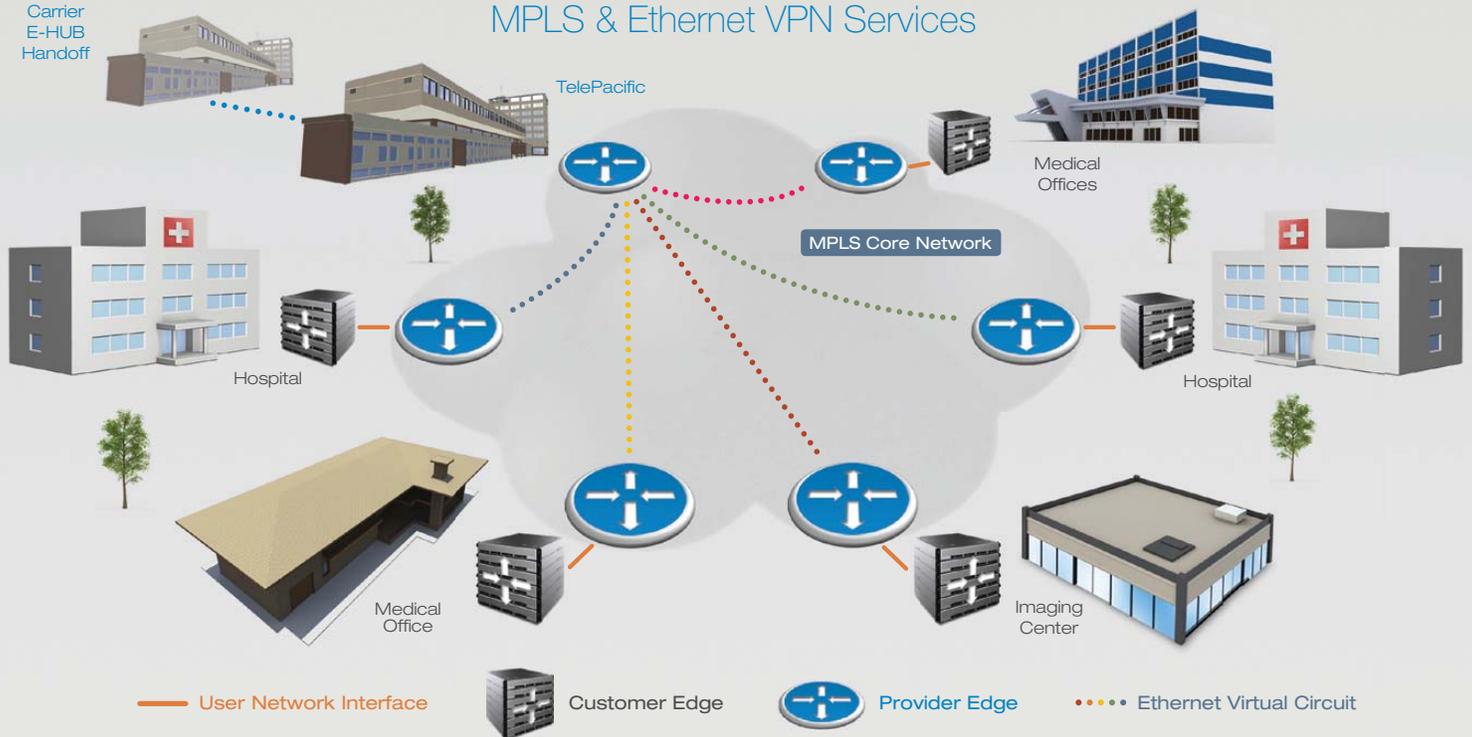
Healthcare providers are using Ethernet services to connect one location to another or one floor to another within their organizations. TelePacific Ethernet services give you the rich connectivity across your provider ecosystem with the secure, reliable and consistent performance you need for your critical applications.

Driving businesses forward with the right solutions

TelePacific's connectivity, cloud and continuity solutions meet healthcare industry requirements for cost-effective high bandwidth services, security and responsiveness. Our Ethernet services are fast, scalable and reliable — giving providers the security, reach and expanded network capacity they need today to effectively serve patients, meet regulatory requirements and control costs.

Carrier
E-HUB
Handoff

MPLS & Ethernet VPN Services



TelePacific: Ethernet Ecosystem at its Best

TelePacific provides the connectivity, cloud and continuity solutions for multiple locations through secure, scalable and reliable Ethernet. With one of the densest access footprints in our operating region, TelePacific can provide Ethernet or MPLS VPNs over Copper, Fiber and Fixed Wireless, access links from hundreds of colocated central offices and wireless base stations in its multistate markets.

Healthcare Services Requirements

TelePacific Solutions

Business Continuity and Disaster Recovery

- Cost of network downtime
- HIPAA mandates for disaster recovery plans
- High-network availability and survivability
- Advanced medical devices that generate enormous amount of data to be stored, transported and analyzed 24/7

- Redundant connection with automatic switching capability if a failure is detected
- ①Net Private IP MPLS Continuity solution automatically re-routes MPLS VPN data traffic in a matter of seconds
- Network performance and quality of service is guaranteed by industry-leading Service Level Agreements (SLAs)

Electronic Medical Records and Regulatory Compliance

- Private, secure networking
- EMR applications that eliminate paper files and handwritten orders
- HIPAA requirements for protection and security of patient information
- Network extensibility to enable remote access

- MPLS and Ethernet VPNs reduces or eliminated the need for multiple firewalls
- Redundancy and reliable network performance
- Private, secure networking architecture

Medical Imaging and Communications

- Scalable bandwidth
- Capacity to transmit large, digital x-ray, MRI, CT and ultrasound images
- Network extensibility, enabling remote access
- High-performance connectivity
- Quality of service with high-network availability

- Affordable and scalable bandwidth up to 1Gbps
- Extensive coverage within our market footprints
- Connect imaging and CT centers with private communications without the need for special hardware
- Network performance, speed and quality of service is guaranteed by industry-leading Service Level Agreements (SLAs)

TelePacific[®]
COMMUNICATIONS

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more details

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<%SAVO.user.email%>

Telos Systems Success Story



SmartVoice service keeps The Tech Guy, Leo Laporte, happy with the performance of his Telos-driven broadcasts

The call came in from the VP of engineering for the leading provider of syndicated radio content to stations across the country. The Tech Guy was unhappy with his technology. Leo Laporte, like many national talk radio hosts, depended on the rapport built in the back and forth during listener call-ins to maintain and build his following and audience. Poor voice quality, delay and unreliable connections were hampering those relationships and The Tech Guy's communications network needed to be upgraded — quickly, efficiently and powerfully.

For Joe Talbot, Product Manager at Telos Systems, this was a business-as-usual request. Telos is a global leader in the research, development and manufacturing of the IP-Audio, telephony, and high-performance audio processing equipment that powers the broadcast industry. With installations in more than 175 countries and systems found in just about every radio and TV network studio, Talbot knew exactly how critical getting the best solution in place was for The Tech Guy's show.

Highlights

- **Challenge** Poor voice quality and delay making a national Talk Radio client very unhappy
- **Solution** SmartVoice SIP Voice Only with 15 call paths
- **Benefits** Works beautifully with Telos' most advanced VoIP equipment and provides exceptional HD call quality, with Service Level Agreements to guarantee performance

“We provide all the systems that make broadcast call-in shows work, but if the network transport’s not up to par, I’m the one who fails. The recommendations I make to my customers for a network provider are something I never take lightly.”

Joe Talbot
Product Manager
Telos Systems

The Challenge

“We’re in a 24 x 7 x 365 environment because every minute of down time can mean thousands of dollars of lost broadcast revenue for our customers,” he says. “We provide all the systems that make broadcast call-in shows work, but if the network transport’s not up to par, I’m the one who fails. The recommendations I make to my customers for a network provider are something I never take lightly.”

The Solution

For Talbot, a key consideration was working with a company with a strong telecom background, customer service focus and a proven portfolio of leading — but not bleeding — edge technology and services. He recommended his customer choose TelePacific’s SmartVoice, Voice Only as a core part of his solution to the dependability and audio quality issues plaguing The Tech Guy’s show. A 1.5 Mbps, 15 call path connection would keep the on-air conversation flowing smoothly. Talbot knew from experience that SmartVoice’s SIP network would work beautifully with Telos’ most advanced VoIP equipment and provide exceptional HD call quality. Just as importantly, TelePacific’s guaranteed Service Level Agreements and responsive customer support would provide worry-free performance.

“It’s critical that when there is a problem — and since I’ve been doing this for thirty years I know that nothing’s ever perfect — I can get to someone quickly who can help. I don’t want to be connected to a call center in India. I like that TelePacific has a local presence and people that I can develop a relationship with. They’re creative, professional and there’s no blame-game mentality, just partnership that I can count on to keep my customers happy.”

Snapshot

Access

- 1.5Mbps circuit

Services

- SmartVoice SIP Voice Only with 15 call paths

Advantages

- Compatible with Telos’ most advanced VoIP equipment
- Exceptional HD call quality
- Service Level Agreements for performance
- Local tech support

Fitness Chain Success Story



Multi-state fitness chain improves voice and data performance, while reducing secure access administration hassle and expense.

A fitness center chain with 13 with locations in California and one in Texas was receiving services from multiple providers because its locations spanned multiple ILEC and Cable MSO territories. The company was using a mix of T1 Internet access from a California CLEC and voice from two national ILECs. The company also self-managed a WAN data network using IPsec encrypted VPN tunnels across the public Internet. This solution required setting up and configuring the VPN tunnels from CPE devices installed at every location.

The Challenge

The company was looking to reduce the number of services providers from three to one for reduced management complexity and lower costs.

Highlights

- **Challenges** Reduce business services providers from three to one and simplify network security administration.
- **Solution** High bandwidth MPLS access to all 14 California and Texas locations with consolidated voice and data over a single access circuit with redundancy for both streams.
- **Benefits** Integrated services from a single provider with a single bill. Higher bandwidth than previously with pooled voice minutes across all locations. Added redundancy for both voice and data to ensure that critical call traffic and data streams are uninterrupted. Lower VPN costs and complexity.



The company was able to lessen the management overhead devoted to communications, so it could allocate more time and attention to running the core fitness business.

The Solution

After an extensive evaluation of alternative suppliers, the company selected TelePacific for its ability to provide high bandwidth access to all of its locations in California and Texas while consolidating voice and data services over a single access circuit with redundancy for both voice and data. In addition, TelePacific's managed MPLS VPN solution was more secure and scalable than the CPE-based IP-VPN

The Details

The TelePacific solution provided services via a range of access types including Ethernet over T1, Copper and Fiber, and a mix of bandwidths from 3Mbps to 50Mbps. The California fitness centers were able to consolidate most voice and data services, with SmartVoice SIP Trunking and ①Net MPLS VPN sharing the same access link. The solution also included analog POTS lines for redundant phone service and ①Net Continuity over 3G wireless to provide managed data VPN redundancy. The company datacenter collocation facility in Texas was linked to the California VPN over a high-bandwidth 50Mbps ①Net Extended Reach connection.

Thanks to TelePacific's ability to provide integrated voice and data services over a wide range of high bandwidth access types, the company was able to lessen the management overhead devoted to communications, so it could allocate more time and attention to running the core fitness business.

Snapshot

Access

- Multi-service access 3Mbps to 50Mbps
- 3G Wireless for data VPN redundancy

Services

- 3Mbps SmartVoice 8-12 PRI lines
- Multiple analog POTS lines
- Integrated ①Net MPLS VPN
- ①Net MPLS Extended Reach
- ①Net Continuity 3G redundancy

Advantages

- Consolidated most services across two states with single provider and single bill
- High bandwidth access from 3Mbps to 50Mbps
- Integrated Voice & MPLS Data VPN over single access circuit at all centers
- Redundant Voice and Data VPN backup
- Voice minute package shared among all locations



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Overseas Bank Success Story

Foreign bank uses TelePacific to improve telecom services at stateside offices in California, Georgia, and Washington, DC.

An overseas bank has established a branch banking presence in the United States to better serve its customers in this country. The bank, which has offices throughout California and a presence in two east coast states, was receiving services from three different providers — voice from a national ILEC, data from a national ISP, and security from a managed services provider.

The Challenge

The company sought to consolidate all communications services with a single provider to reduce the service costs and eliminate the complexity of managing multiple providers.

Highlights

- **Challenges** Provide California and east coast bank locations with voice, data, and security services without the inefficiencies of multiple providers.
- **Solution** 1.5Mbps to 10Mbps circuits, 6Mbps fixed wireless Internet access HQ redundancy, SmartVoice SIP trunking, ①Net MPLS VPN, and OneSecure Unified Threat Management
- **Benefits** With TelePacific, the bank enjoys integrated services from a single provider with higher bandwidth, lower costs, pooled voice minutes, improved redundancy, and a single bill for all 14 U.S. locations.



TelePacific was able to meet the bank's needs for integrated multi-service access and along with Internet security thanks to its extensive access footprint in California and its wide range of access options that ranges from traditional TDM T1 to Ethernet over Fixed Wireless and Fiber.

The Solution

After careful consideration, the Bank selected TelePacific to provide integrated voice, data and managed security services to twelve offices in California, as well as locations in Georgia and Washington, DC. The company now receives a single bill and has a single point of contact for all three services. In addition, the bank achieved its goal of reducing the overall cost of the combined solution.

The Details

The TelePacific solution is based on integrated voice, data and network security services provided over a single circuits ranging from 1.5Mbps to 10Mbps. A headquarters site also has a separate 6Mbps Fixed Wireless Internet access link for physical redundancy. Out-of-state locations are linked into the Bank's California offices via TelePacific's ①Net MPLS Extended Reach VPN solution.

Each branch office location has a TelePacific SmartVoice SIP trunking service for local and long distance voice calls, integrated with ①Net MPLS VPN for inter-office data transport. Managed security is provided by TelePacific's OneSecure Unified Threat Management platform, a fully managed and monitored hardware appliance that protects the bank's Internet traffic with firewall, Intrusion detection/protection and Web content filtering. All Internet bound traffic is carried to and from the centralized UTM platforms located at the bank's hub sites and headquarters over the secure MPLS private network.

TelePacific was able to meet the bank's needs for integrated multi-service access and along with Internet security thanks to its extensive

access footprint in California and its wide range of access options that ranges from traditional TDM T1 to Ethernet over Fixed Wireless and Fiber. At the same time, TelePacific could provide services nationwide through its Extended Reach capabilities. As a full service provider, TelePacific is uniquely positioned to provide the integrated communications services that enable this international Bank to provide secure and reliable service to its customers.

Snapshot

Access

- Multi-access 1.5Mbps to 10Mbps
- 6Mbps Fixed Wireless

Services

- SmartVoice SIP + ①Net MPLS VPN
- ①Net MPLS Extended Reach
- DIA with OneSecure UTM

Advantages

- Integrated Voice, Data, Security
- Higher bandwidth
- Lower cost
- Improved network security & redundancy
- Pooled voice minutes
- All locations on a single bill
- Single point of contact for all services



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Executive Brief



Efficient Networks Increase Revenue and Productivity:

Making the Case for Better Bandwidth

Global Internet traffic is expected to increase more than fourfold between 2009 and 2014.

Matt Mather

IP Traffic Set to Quadruple By 2014

posted on
"Packet Blog"
IT Knowledge Exchange

June 3, 2010

Today's decision-makers know that user demands on a network dramatically impact bandwidth and overall network functionality. Increased Internet usage, along with modern technologies such as Software-as-a-Service and business video conferencing, can create an unbearable strain on networks that do not have enough resources.

The decision to upgrade any part of your network, however, requires careful consideration of cost and other factors. And, working with limited budgets, companies understandably are reluctant to invest in anything that does not guarantee a return. With this in mind, making the case to devote more resources to your existing network may seem like an impossible task. But, investing in more bandwidth actually is one of the best things your company can do to boost both productivity and revenue. If you are considering the functionality or future needs of your network, you should keep some key points in mind.

Limited bandwidth limits your business. With limited bandwidth, your company is forced to stay with outdated technologies. For example, without a certain amount of bandwidth, your company will not be able to access some cloud-based applications.

Increased bandwidth leads to greater employee productivity and morale. If your network is slow, employees are forced to sit around and wait for content to be delivered before they can accomplish the next steps for their jobs. Previously productive employees start taking breaks and complain about the network speed around the water cooler. Some may even pack it up early.

Too little bandwidth also interferes with IT resources. When the network is down, IT is tasked with troubleshooting and fixing the problem ASAP. Unfortunately, this takes IT away from other pressing projects.

Network stability leads to business stability and revenue. Many businesses now depend upon network applications and communications for their core business needs. And, when applications are hosted in the cloud, absolutely no work can be accomplished when the network goes down. Accordingly, a network crash is no longer a minor inconvenience. Instead, your business grinds to a halt and sustains a serious blow to revenue until the network is up and running again. But with a stable network, your business and your revenue continue to thrive.

Cost obviously is an important factor to think about in this calculation. Fortunately, the minimal monetary investment involved in increasing your bandwidth goes a long way in terms of your network's functionality. Moreover, a company that treats its network as a strategic asset, and understands how to use it to provide more efficient business services, ultimately will reap lower business costs and higher profitability.

“
Cloud-based application
delivery depends *entirely*
on high-bandwidth,
low-latency networks.”

melvinjim

*Who's Managing the
Performance of Your
Cloud Applications*

posted on The Path – AppNeta
February 8, 2011

“
Investing to upgrade aging
network infrastructures
can yield a number of
efficiencies and long-term
cost savings across the
board.”

Randy Perry and Abner
Germanow

*ROI of Switched Ethernet
Networking Solutions for the
Midmarket*

p. 2 IDC – Analyze the Future
August 2009

(Sponsored by HP ProCurve)

As you further consider bandwidth and your network's functionality and future needs, here are 8 quick tips you can use to improve the performance, speed, and scalability of your network:

1. **Benchmark Your Bandwidth Needs:** Possessing the correct amount of bandwidth is the key to network performance. How much bandwidth are you really using? How much will you need six months or two years from now?
2. **Migrate to New Technologies:** Transfer from legacy access technologies to newer access technologies to increase bandwidth, scalability, and reliability. Newer access technologies are less expensive and easier to troubleshoot as well.
3. **Minimize Connections to the Public Internet:** Reducing the number of connections to the public Internet improves performance by keeping internal company data on the private network. Reducing these connections minimizes security concerns and follows best practices within the security industry, too.
4. **Add Network Monitoring Capabilities:** This allows you to determine real time and historical bandwidth utilization and latency statistics.
5. **Identify and Address Latency Issues:** This will show you where network bottlenecks are located and will identify places where routing problems or other issues exist.
6. **Identify Where Traffic is Coming From:** Enable network quality by prioritizing critical applications over non-critical applications.
7. **Initiate User Controls:** Web content filtration allows for increased network speed because employees cannot access unauthorized sites and use precious bandwidth unnecessarily.
8. **Institute a Back-Up Option:** If there is an outage on your primary network, you can still conduct business on the Internet if you have a back-up. For example, if your primary network access is Ethernet Over Copper, your back-up could be wireless access.



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White Paper



MPLS and Ethernet VPN Services:

Two Sides Of The Same Coin

Spring 2013

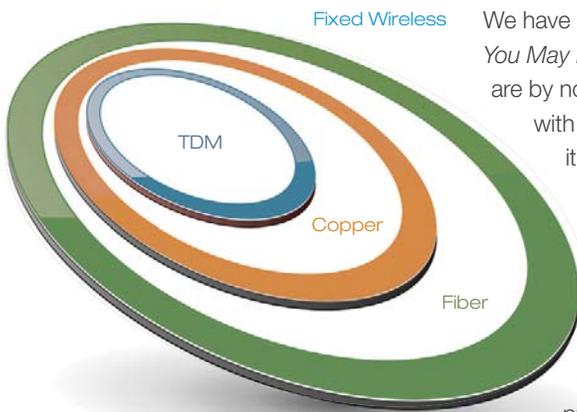
TelePacific Communications

For many enterprises, particularly those with multiple locations, private carrier-grade networks are the preferred networking solution to get the data performance and security (peace of mind) they need, along with the speed, flexibility and ease-of-management they desire to achieve and sustain optimal business performance. And those private network services are increasingly based on Multiprotocol Label Switching (MPLS) and Carrier Ethernet Virtual Private Network (VPN) services. In fact, the purpose of this white paper is to provide:

- A basic understanding of MPLS and Carrier-grade Ethernet VPNs and their value
- Understanding the difference between Layer 2 and Layer 3 VPN services
- Why not all MPLS or Ethernet VPN services are created equal
- A brief introduction to MPLS and Ethernet VPN solutions from TelePacific

My goal is to fill in knowledge gaps so your organization can accelerate to success.

MPLS and Carrier Ethernet VPNs and why they are popular



At the local level, Ethernet can be provided via Copper, Fiber and Fixed Wireless access links.

We have already explained why MPLS-based IP VPN is popular in the previous paper, *What You May Not Know But Should About MPLS Virtual Private Networks*. To recap, most of us are by now familiar with that big public IP network, the Internet. We also are all too familiar with why it is called a “best effort” network, because it works when it works and when it doesn’t, it’s just too bad. There is no such thing as Internet Quality of Service (QoS) and there are no service agreements that guarantee anything other than the access link, or on-ramp, to the Internet superhighway. And of course, there are all those security breaches that we hear about every day such as network intrusions and denial of service attacks that are made possible by the fact that we are all connected to this one huge global network.

It is true that IP-VPNs that run over the public Internet can protect your data from prying eyes, but at the cost of encryption and the need to manage point-to-point ‘tunnels’ and CPE (hardware) for every location that wants to connect to another location. All of that translates into overhead, both network and operating, which makes Internet-based IP VPNs useful mainly for connecting remote employees or locations to the corporate network.

Because of the inconsistent performance and security risks that are inherent to the Internet, most larger enterprises and many of the smaller ones depend on private networking services to a large extent. These private network services, which in the previous decade were comprised of Leased Lines, Frame Relay and ATM services, have now shifted almost entirely to IP VPNs based on MPLS.

The reason for this popularity is that MPLS VPNs provide the security and control that enable guaranteed service quality while keeping the flexibility of fully meshed or hub and spoke networking that made VPNs so popular in the first place. In short, MPLS combines the best aspects of Layer 2 Frame Relay with Layer 3 IP services, such that it is sometimes referred to as ‘Layer 2.5.’ Meanwhile, Carrier-grade Ethernet has been emerging as an alternative to MPLS and has actually been one of the fastest growing data network services over the past few years.

Ethernet VPN — from LAN to WAN

Most of us are familiar with the Ethernet local area networks (LANs) that interconnect our office computers, servers and printers. Although based on the same technology, Carrier-grade Ethernet has undergone considerable technological evolution and now bears little resemblance to its LAN roots other than the basic frame and addressing formats. Today's

Ethernet VPN services can support multiple classes of service just like MPLS and is deployed on fully redundant carrier-grade switching platforms. Although it has been mainly deployed as a Metropolitan area service, which led to the wide spread acceptance of "Metro Ethernet," Ethernet VPN services can extend nationally and even globally over fiber optic transport networks. At the local level, Ethernet can be provided via Copper, Fiber and Fixed Wireless access links.

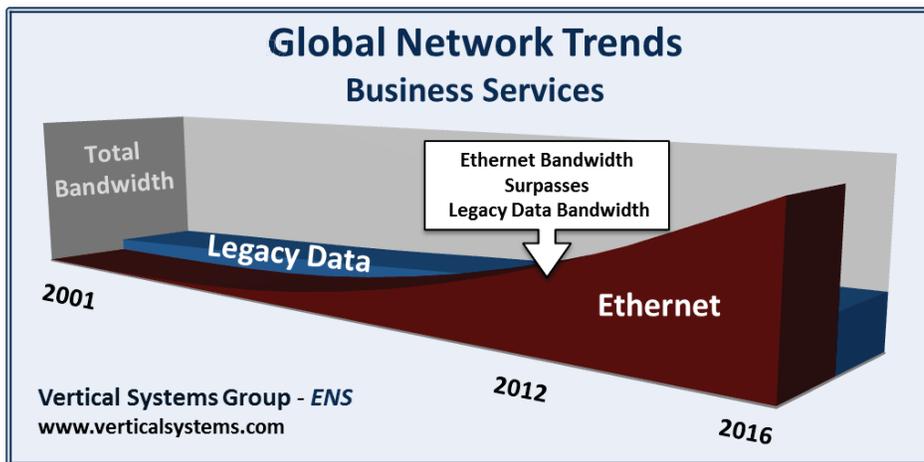
The main difference between MPLS and Ethernet is that Ethernet is a Layer 2

technology that uses the Ethernet MAC addresses, which are embedded in every computer, to forward traffic. MPLS relies on the customer's IP address list to forward and route traffic from source to destination, with the addition of special "labels" that are used to make sure that each customer's VPNs are isolated from each other since they all share the same infrastructure. Similarly, customer separation on Carrier-grade Ethernet is enabled through numbered VLAN labels that are added by the service provider.

Standards and more standards

In the previous paper we noted that the Internet Engineering Task Force (IETF) developed specifications for MPLS that imposed circuit-like behavior onto what had been a connectionless service. These 'connections' enable service providers to offer multiple classes of service and also allowed the network provider to rapidly reroute traffic around link failures as if they never happened.

Likewise, Carrier Ethernet services have also been addressed by a number of standards groups including the IETF, the IEEE and the Metro Ethernet Forum (MEF) for Layer 2 — the data link layer which deals with framing, physical addressing, flow control, error control, access control and media access control (MAC). In this way, Carrier Ethernet services have taken on characteristics similar to MPLS, and in fact certain Ethernet VPN services such as Ethernet Virtual Private LAN Service and Ethernet Virtual Private Wire service (EVPLS & VPWS) run over the same MPLS network infrastructure. MPLS and Ethernet VPNs could thus be considered two sides of the same coin.



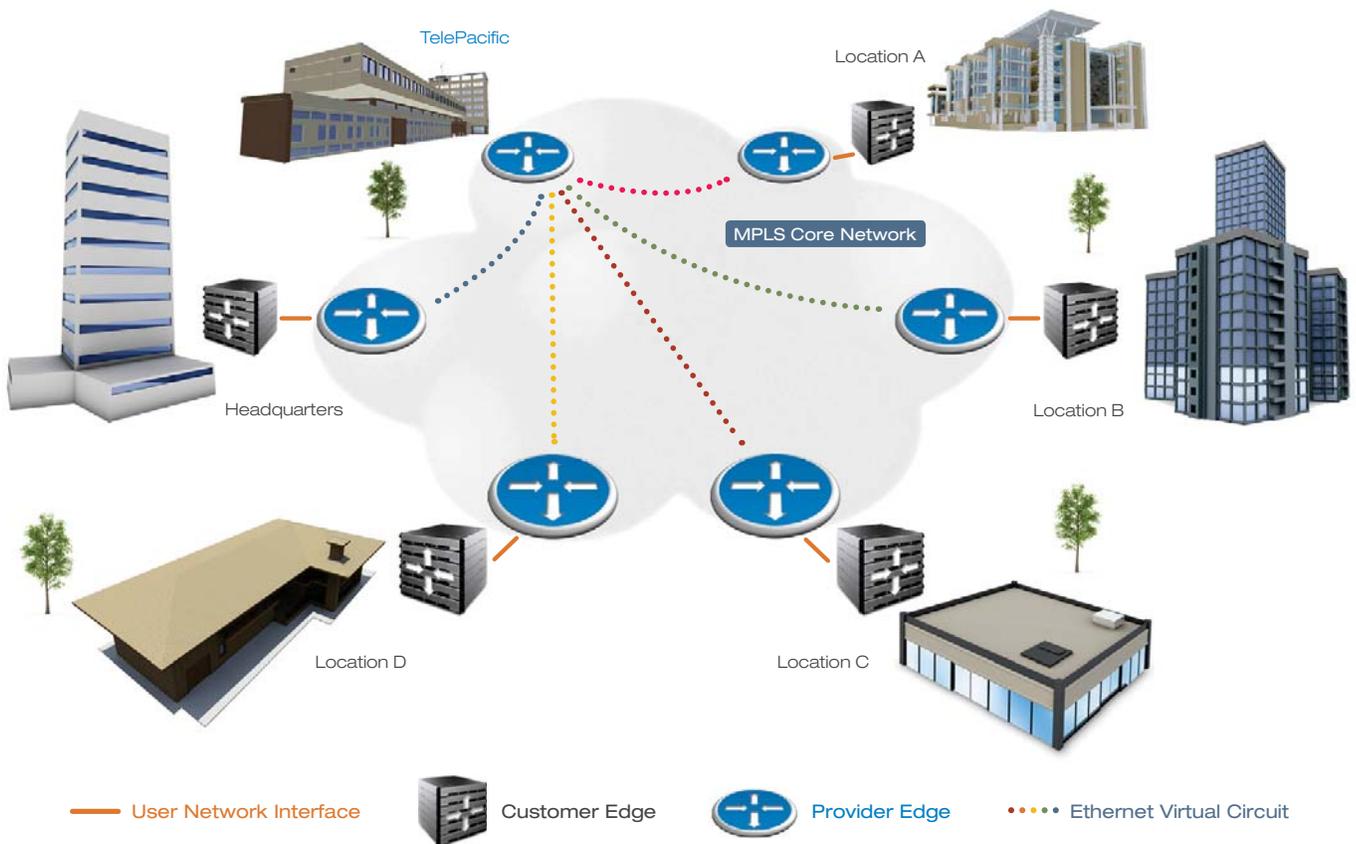
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Consider the options

Each option runs over an underlying MPLS infrastructure, but what you may not know is why each of these options is popular.

Ethernet Virtual Private LAN Services (EVPLS) and Why it is Popular

We have already explained why MPLS-based IP VPNs are popular. It is worth noting the attraction of the alternatives. There are many types of Ethernet VPNs; VPLS is one that shares many similarities, and a few differences, with MPLS. First, to a customer, all E-VPNs look like a basic Layer 2 LAN (bridged) network but extended over a geographically wide area. Its attraction is to those companies with internal IT shops who are used to managing the routing functions of Layer 3. In contrast, MPLS services outsource IP routing to the service provider. Ethernet VPNs have no knowledge of the customer's Layer 3 IP addresses or routing tables, which some IT managers will prefer for its simplicity. It should be noted that EVPLS in particular operates over the same carrier network infrastructure as MPLS, but that aspect is not visible to the customer.



Reality is that some enterprises will be best served by a hybrid MPLS/EVPLS approach; MPLS to interconnect a large number of small branch offices; EVPLS to interconnect a smaller number of corporate hubs and datacenters with high bandwidth or low latency requirements.

There are several reasons why an Ethernet VPN may be preferred to MPLS IP VPN:

- Customer network managers have deployed an extensive IP routed network with large IP address lists and wish to retain control.
- Customer network managers have security requirements that prevent them from revealing their IP addressing and routing policies to a 3rd party.
- Businesses with a small number of high-bandwidth locations may prefer the simplicity of interconnecting those locations at Layer 2 (Ethernet).
- Conversely, enterprises with a large number of small bandwidth locations, such as retailing or branch offices, will find that MPLS scales more easily to large numbers of end-points.

Reality is that some enterprises will be best served by a hybrid MPLS/EVPLS approach; MPLS to interconnect a large number of small branch offices; EVPLS to interconnect a smaller number of corporate hubs and datacenters with high bandwidth or low latency requirements.

Note: An EVPLS WAN acts as a single LAN subnet, so all customer routers connected to the VPLS WAN will appear to be directly connected, or adjacent, to every other customer router. Depending on the routing protocols involved, some network managers may wish to limit the number of routers attached to a single LAN subnet, which may impose a limit on scalability in large networks.

Ethernet Private Line (EPL) and Why it is Popular

Ethernet Private Line (EPL) offers a third VPN alternative to both MPLS and E-VPLS, and of course to traditional TDM-based private line services. As the below chart shows it has virtually all of the features of EVPLS except that it is point-to-point only. From a network perspective it is most efficient when the customer simply wants to connect two locations together.

A good application for EPL is data mirroring between two datacenters to perform server or storage array backups and synchronization. These links are typically high-bandwidth and low-latency requirements and so there is no reason to add the complexity of IP routing to this simple network topology.

Knowing what your various options are for connecting your various locations with secure and high-performance data networking solutions is important. Getting to where you want to go depends on where you are and what you need. The chart on the following page illustrates the capabilities available for connecting disparate locations over an MPLS network with IPVPN or through Ethernet services.

MPLS & Ethernet VPN Services

Attribute	MPLS	EVPLS	EPL
Protocol (customer)	Layer 3 - IP Routing	Layer 2 - Ethernet	Layer 2 - Ethernet
Customer Interface	Ethernet	Ethernet	Ethernet
Addressing	IP	Ethernet MAC	Ethernet MAC
Address Structure	Hierarchical	Flat	Flat
Connectivity	Multipoint Point to Multipoint	Multipoint Point to Multipoint	Point to Point
Scale	High 100s of endpoints	Medium 50 endpoints*	Low 2 endpoints
Bandwidth	1Mbps – 1Gbps	1Mbps – 1Gbps	1Mbps – 1Gbps
Complexity	Higher	Lower	Lowest
Multiprotocol	Yes	Yes	Yes
IP Routing Mgmt	Service Provider	Customer	Customer
Classes of Service	Yes – Max 8 Typically 3 - 6	Yes – Max 8 Typically 3 - 6	Max – 8 Typically 3 - 4
QoS	MPLS EXP/Label	IEEE 802.1p/q	IEEE 802.1p/q
CPE	Router	Router or L2 Switch	Router or L2 Switch
Typical Application	Many low-bandwidth branch office or retail sites connected to corporate hub or datacenter	Small number of high-bandwidth end-points connecting corporate hubs or datacenters	High bandwidth link connecting headquarters or datacenter

* EVPLS Scalability based on recommended number of router adjacencies in single OSPF area. Actual network size can vary by customer preference and routing protocols employed.

All network solutions are not created equal

What you may not know but need to know is that while MPLS and Ethernet are standardized, and the quality of experience (QoE) and performance of network elements from leading vendors such as Cisco, Juniper and others is well documented and certified, that does not mean that all MPLS or Carrier Ethernet VPN services and service provider experiences are alike.

TelePacific: Ethernet Ecosystem at its best

Knowing what best practices are and what questions to ask when considering transforming your networking capabilities is obviously important. That is why knowing about a company, TelePacific, and its VPN services is a case where knowledge is power, and understanding what is possible could be invaluable as your company accelerates to IP.

First, what you may not know, if you are a multi-location enterprise in California and Nevada, is that TelePacific boasts the largest MPLS and Ethernet capable broadband network footprint in region. The company has an extensive owned and operated network in the aforementioned states and in Texas. Interconnection agreements with best in class partners enable seamless private networking across the U.S. and around the world. Customers get one point of contact, i.e., more responsiveness and less hassle.

Private network VPNs can deliver partially or fully meshed private and secure communications at less cost and more efficiency, and do so quickly. In fact, TelePacific recently deployed a 40-location solution in just 30 days.

With one of the densest access footprints in its operating region, TelePacific can provide Ethernet or MPLS VPNs over Copper, Fiber and Fixed Wireless, access links from hundreds of colocated central offices and wireless base stations in its multistate area. And TelePacific has recently increased its maximum Ethernet access speed to 200Mbps by bonding multiple copper pairs to act as a single wire. The company can also offer Fiber Optic Ethernet access up to 1Gbps through network interconnections with the leading fiber providers in its region, through which it can also provide direct connections to 24000 buildings in its tri-state area.

Below is what you need to know about the kinds of MPLS and Ethernet VPN capabilities TelePacific provides that you should consider when evaluating services for your multi-location operations:

- MPLS and Ethernet VPNs enable customers to reduce or eliminate the need for multiple firewalls through centralization at a single site, reducing costs and administrative overhead.
- MPLS and Ethernet VPNs enable customers to reduce or eliminate the need for CPE-based encryption and tunnels at every location, improving performance while cutting costs and administrative overhead.
- Ethernet VPNs allows customers to preserve existing IP addressing and routing systems which means less work on implementation.
- MPLS outsources IP routing management to the service provider, saving the customer the expense and time of managing and maintaining a network of IP routers.
- With MPLS, EVPLS and EPL, customers get an equivalent level of security and performance as private line, ATM and frame relay services for fewer dollars.
- MPLS and Ethernet VPNs provide multiple classes of service for different types of applications ranging from real-time to best effort.
- Network performance and quality of service is guaranteed by industry-leading Service Level Agreements (SLAs).

As noted, whether your business has multiple sites locally, nationally or internationally, private network VPNs can deliver partially or fully meshed private and secure communications at less cost and more efficiency, and do so quickly. In fact, TelePacific recently deployed a 40-location solution in just 30 days.

The facts of the matter are that what you don't know can cause you to make less than optimal decisions.

TelePacific's MPLS and Ethernet VPN services are known for their the reach, reliability, features, functionality, performance, security, customization and value that are becoming table stakes for multi-location enterprises of all sizes looking to accelerate their move to IP. And, TelePacific's service and support organization has also earned praise from the company's diverse customer base of over 40,000 businesses.

When it comes to decisions regarding MPLS and Ethernet VPNs you have questions, and need answers so you can have the peace of mind necessary for moving mission critical business processes and applications online where they can improve business operations, the delivery of superior customer experiences and sustainable value. The best advice is to ask, compare and contrast and go with the company that best fits your unique needs. TelePacific not only has best in breed solutions, but also gives you a yardstick for your decisions on accelerating application performance via MPLS and Ethernet.



Contact your <%SAVO.user.displayname%>
sales rep for <%SAVO.user.workphone%>
more details <%SAVO.user.email%>