Business Paper

ML-IP Achieves Universal Broadband Access Independent of Provider Networks

stallion technologies

ML-IP Achieves Universal Broadband Access Independent of Provider Networks

Multilink IP (ML-IP) boosts the bandwidth, reliability and flexibility of multi-site IP data connections

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Extract

Organizations with more than one office need to connect all their sites into a single, homogeneous Wide Area Network (WAN). These network connections include point-to-point leased line, Virtual Private Network (VPN), wireless and managed private network links based on services such as Frame Relay. Integrating these disparate services into a single corporate network is only one challenge. A single network connection at any site leaves that site (and possibly the entire network) vulnerable to a single point of failure. Furthermore, the bandwidth provided by existing WAN solutions is inflexible and rarely matches an organization's requirements and budget.

Stallion Technologies' Muli-Link IP (ML-IP) technology uniquely addresses all three challenges, as well as offering many other advantages over alternative bandwidth boosting solutions, to deliver affordable broadband to any business.

About Stallion Technologies

Stallion Technologies is the leader in ML-IP access appliances, providing the most cost-effective broadband connectivity to businesses anywhere.

Stallion has over 15 years experience developing innovative technologies for organizations throughout the world. Its award winning ePipe family of access appliances pioneered the use of ML-IP and is currently in use by small companies with as few as two sites to multi-national enterprises.

Introduction

This paper highlights the performance, reliability and flexibility benefits that can be gained through Stallion's Multilink IP (ML-IP) technology. The paper is aimed at networking professionals. It identifies how end user organizations, network equipment manufacturers and service providers can gain a competitive advantage today through ML-IP.

Over the past 20 years, the business landscape has become wholly mobile and distributed. Today's computer networks are stretched to keep up with this mobilization. Regardless of the size of the organization, business users need access to their networks from anywhere, at any time.

Coupled with this mobilization, demand for bandwidth is growing at an exponential rate. Businesses of every size need to expand their bandwidth affordably without being limited in their choice of network provider.

The most common method of delivering a distributed data network is a leased line between offices, but this is costly and can become cumbersome where many sites are involved.

To satisfy the growing bandwidth demands and distribution challenges, businesses are faced with several issues. Do they need to completely rebuild their network? Should they pay for expensive upgrades? What is the most cost-effective alternative?

The search for an alternative to leased line connections has led to an assortment of Wide Area Networking (WAN) technologies. The more conventional WAN technologies include several managed private networks, the most popular being Frame Relay. Frame Relay connections are trusted and proven, making them preferred for business critical services, especially in high-traffic routes. However, Frame Relay is expensive for low-traffic routes, unavailable in many remote locations, and is difficult to scale beyond the maximum CIR.

The rise of the Internet has created a widespread demand for solutions that use this ubiquitous, public infrastructure to link branch offices together securely and allow network resources to be accessed remotely. As a result, Virtual Private Networks (VPNs) are becoming a convincing method of providing data connections to branch offices and remote workers. A VPN that uses the Internet offers businesses far greater flexibility and lower costs than point to point or managed private connections. However, this dependency on the Internet has created some challenges that organizations must tackle. These challenges lie in four areas:

- A single Internet connection leaves the network vulnerable to a single point of failure
- Currently available Internet access types restrict bandwidth choices
- Security of data across a public network
- The Internet does not offer any Quality of Service (QoS) guarantees

Stallion Technologies has developed a third generation Multilink technology called Multilink IP (ML-IP) that uniquely addresses these challenges, as well as offering many other advantages over alternative WAN solutions. ML-IP is ground breaking, patent-pending technology; proven in the field to affordably deliver maximum performance and reliability to distributed data networks.

What is Multilink IP (ML-IP)?

ML-IP effectively multiplies the speed at which any organization can access branch offices and other remote sites, whether through point-to-point connections, an Internet-based VPN, or a carrier-provided IP Managed Private Network (MPN).

The Third Generation of Multilink Technology

ML-IP is a new third generation solution to the challenges facing businesses today. It enables organizations to boost bandwidth and deploy networks anywhere.

Multilink is not a new networking concept. The first generation solution, known as inverse multiplexing, converts a physical circuit into multiple circuits that transfer data simultaneously.

The next generation includes IMA (Inverse Multiplexing over ATM), ML-PPP (Multilink Point to Point Protocol) and ML-FR (Multilink Frame Relay). All of these enable data packets to be sent in parallel across multiple links that can be dynamically added or removed. Although operating as a single logical link at the customer premises, these methods require the service provider to terminate each bundle of links at every access point using Multilink capable access equipment. As a result, service providers have been reluctant to invest in Multilink access services and the penetration of second generation Multilink technologies has been limited to predominantly 128Kbps ISDN.

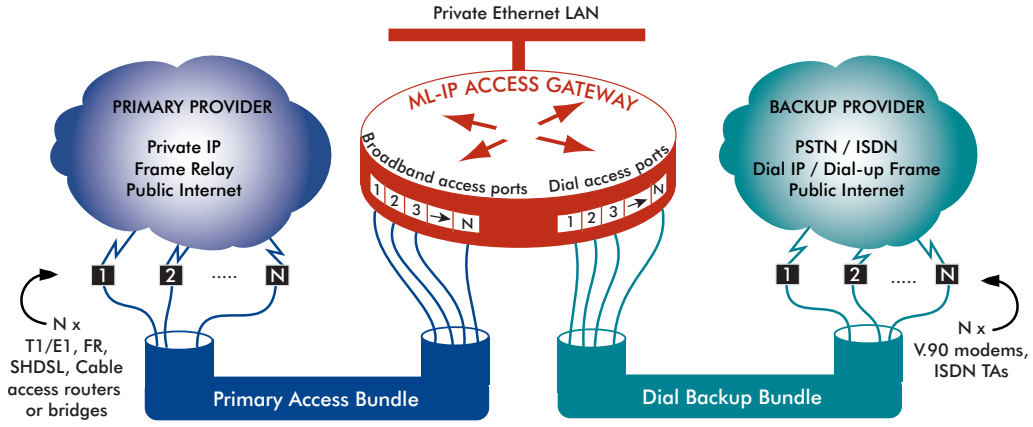
ML-IP moves this concept to the IP layer. It supports any IP-based customer network and does not require service provider involvement or investment. It is a "layer 3" method of aggregating IP links without the need for technology swap outs, allowing bandwidth to be scaled incrementally. ML-IP also implements IP link directed routing. This manages the transfer of independent packets across parallel paths between multiple sites on any provider network that supports IP access links (Internet, T3/T1, F-R, ATM).

Universal Broadband Access

Three factors limit the widespread business use of broadband access technologies: availability, expense and reliability. The types of access available to businesses include T3/T1 private circuits, ATM, Frame Relay, xDSL, Cable, Wireless, ISDN and PSTN. Although businesses would like to select the most cost effective high-speed access method, they usually find themselves limited to a subset of choices. As a result, the only method of increasing bandwidth is well outside their budget.

With ML-IP, businesses can utilize any combination of the above access types to deliver global broadband WAN access. It also delivers a fault tolerant access solution through ML-IP's link fallback and automatic fail-over to ML-IP's dial backup.

Because ML-IP integrates with any access type, customers can build broadband networks with the lowest cost bandwidth. This access type independence also gives businesses all the bandwidth they need at every site, regardless of the services offered by the local provider.



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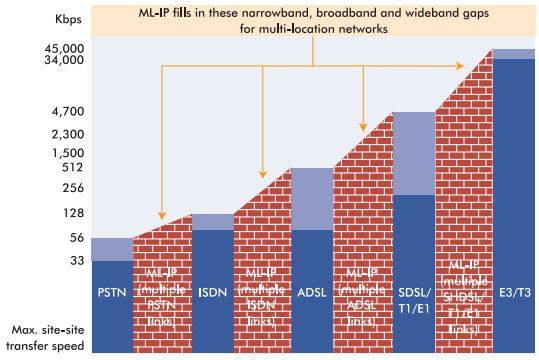
What Are The Benefits of ML-IP in Delivering Broadband Access?

ML-IP delivers several key advantages to organizations. They include the ability to:

1. Consistently boost bandwidth at any site, whether connected through a managed private network, a point to point network or an IP VPN without any special provisioning by the carrier/provider
2. Consistently boost bandwidth across different access media (dial-up, PSTN, ISDN, ADSL, T1, etc)
3. Transition from dial-up to broadband-based connections and beyond without investing in new equipment and without effort - ML-IP works across a gamut of connection types
4. Increase network uptime; ML-IP provides high availability connections. These include automatic fallback to secondary links if a primary link fails and automatic fail-over to dial backup links if there is a network-wide outage. Unlike other high availability solutions, additional links are not redundant, as they are used to carry data when operational
5. Create practical network connections from very remote sites by bundling multiple narrow-band satellite modem connections
6. Bridge the bandwidth gaps between ADSL and T1, and T1 and T3, in highly granular increments (see graph below)

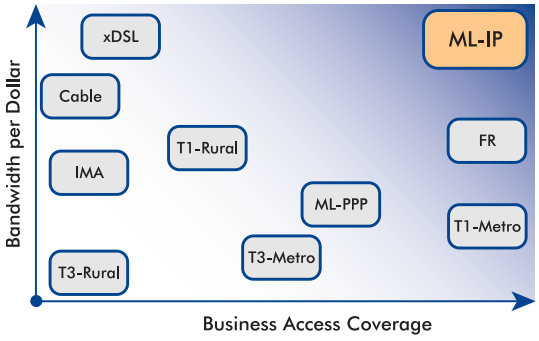


7. Reduce dial-up telecommunication costs; ML-IP automatically establishes new connections when demand reaches pre-set thresholds, and terminates them when demand falls below pre-set thresholds
8. Ensure secure site-to-site VPN transmissions with optional IPSec gateway functionality
9. Deploy easily; instead of replacing one (slow) service with a different (fast, expensive) service, ML-IP builds on multiples of the same, familiar, affordable service. Increasing bandwidth can be as simple as adding another modem or router. The carrier/provider only needs to supply more of the same service to the customer
10. Scale bandwidth globally (using an Internet-based VPN)

The bandwidth gains afforded by ML-IP are best demonstrated by an example. A medical practice needs to send a 20MB digital x-ray image from an imaging office in one town to a general practice in a neighboring town. A router without ML-IP could transmit that image over single ADSL connection through the Internet in approximately 11min 15sec, assuming an upstream speed of 256Kbps and 5% overhead incurred through Internet latency.

If that router supported ML-IP, both offices could install a second ADSL connection and use ML-IP to split the x-ray image across the two ADSL connections. Assuming the same 5% latency overhead, and adding a further 2.5% overhead incurred by ML-IP, the transmission would take 5min 45sec. A third ADSL connection would enable the transmission to occur in approx 3min 50sec, and so on. The productivity gains are obvious and linear and involve only an incremental increase in telecommunications costs.

The chart below demonstrates where ML-IP is positioned, compared with other broadband alternatives. ML-IP offers universal broadband access, which scales incrementally from 128Kbps to multiple T3 connections.



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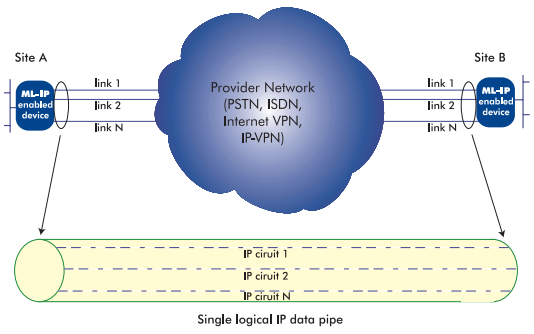
How Does ML-IP Work?

ML-IP uses a standard technique called bundling in a unique way that combines multiple IP circuits into a single logical data pipe. The IP circuits are created by ML-IP between IP connection peers at each site. When there are multiple IP connections at sites, ML-IP can automatically use multiple IP circuits in parallel. These may be permanent for "always on" connections or dynamic for "dialup analog/ISDN" connections. These IP circuits may be spread across IP connections from multiple providers.

To spread data across the multiple IP circuits, ML-IP splits the payload of each outgoing IP packet into smaller fragments, encapsulating these fragments into new IP packets. These new IP packets are transparently routed by ML-IP through the IP connection associated with the IP circuit.

ML-IP gains its independence from intervening networks by maintaining IP addressing. New IP packets can travel independently of each other along parallel IP circuits to the remote IP connection(s). ML-IP monitors the condition of the IP circuits automatically, which enables bandwidth to throttle up or down transparently, with corresponding links brought online or dropped accordingly.

ML-IP Bundling Technique



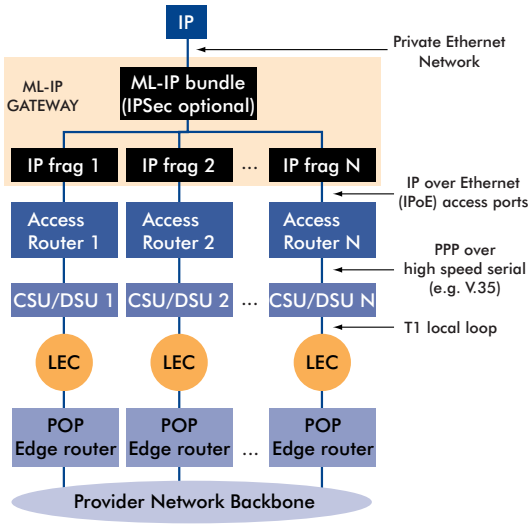
ML-IP splits packets consistently and transfers them across multiple IP circuits, so performance gains are predictable, unlike other less granular bandwidth aggregation schemes.

ML-IP eliminates many problems that exist in other Multilink connection aggregation schemes. These typically require Multilink-capable equipment and configuration within the provider network access points and some techniques are not extensible to IP networks.

At the destination site, ML-IP retrieves multiple payload fragments and reassembles them into the original IP packet, which is then forwarded to the internal IP destination. ML-IP can optionally invoke the full range of IPSec transforms at each site. This enables strong authentication and encryption of the data (e.g. across a public network such as the Internet). In addition, ML-IP supports additional encapsulation of IPSec packets to enable them to traverse restrictive firewalls that normally block IPSec traffic.

The diagram below shows an expanded view of the packet flow through an ML-IP enabled device at Site A, using multiple private circuits to a provider network. This flow is repeated (in reverse order) at the destination Site B and is transparent to the POP edge routers.

ML-IP Packet Flow
N x Private Line Access to Provider Network



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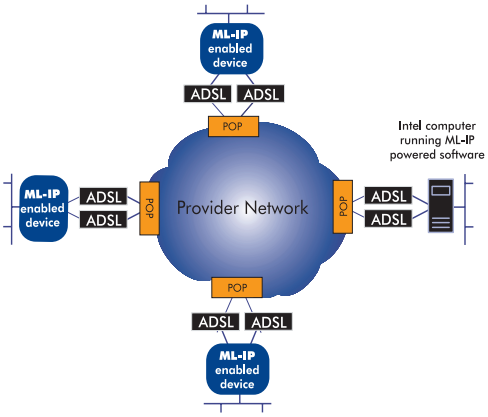
ML-IP and Link Topologies

First and second generation Multilink technologies and other bandwidth aggregation schemes have an fixed, inflexible relationship between the number of links at each site. They require the same number (and type) of links at every site, because they assume a direct relationship between the ends of each link.

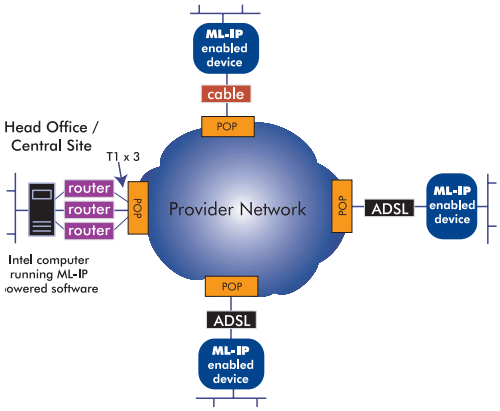
In contrast, ML-IP can operate within a wide range of access link topologies. This allows organizations to dynamically tailor bandwidth at each site to best suit their needs, and deploy a wide range of connection methods throughout the organization.

Link Properties	Description
Many-to-many	Each site has an arbitrary number of links
Many to-one	Remote site has many lower-bandwidth links and the central site has one high-bandwidth link
One-to-many (pending)	Remote site has one link and the central site has many links
Dynamic	Sites automatically adjust the number of dial-up links based based on bandwidth demand

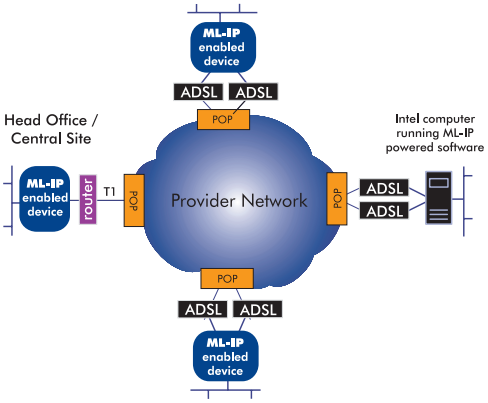
Many to Many Topology



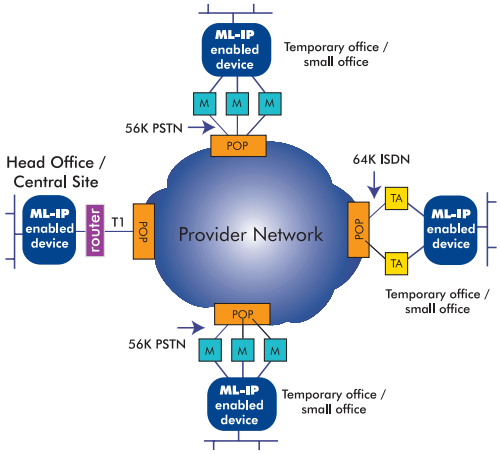
One to Many Topology (pending)



Many to One Topology



Dynamic Topology



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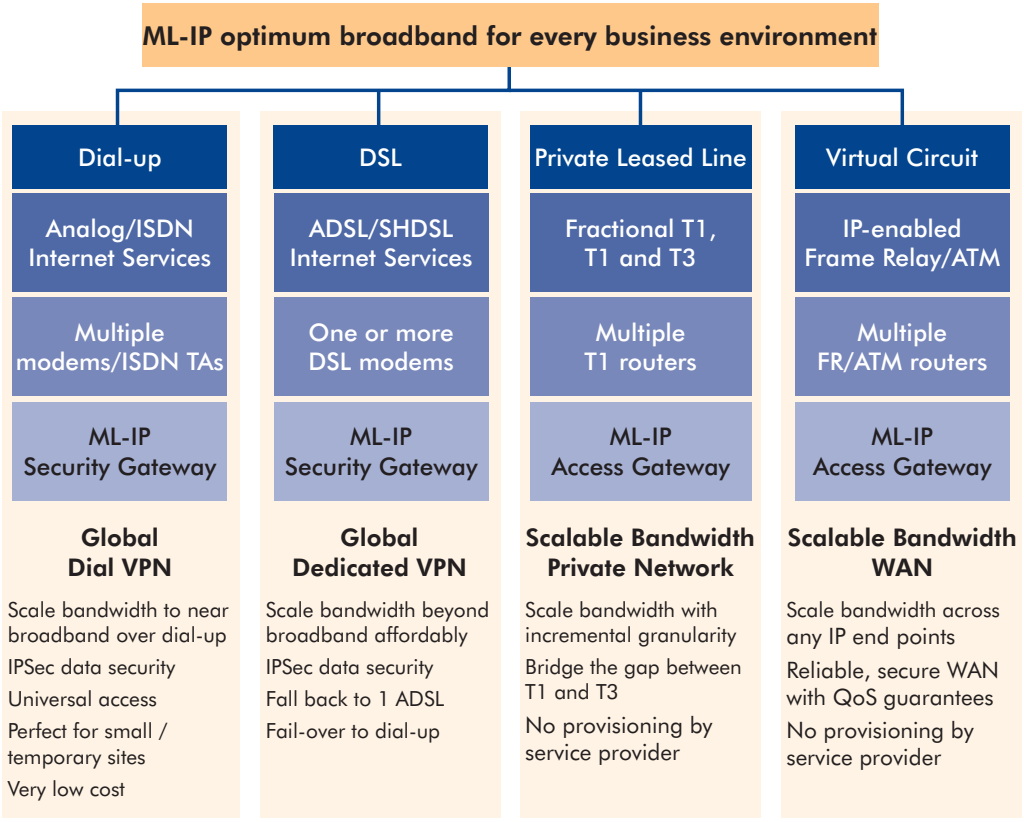
ML-IP Delivers Broadband Access for Every Business Environment

ML-IP is the only IP bandwidth boosting technology that enhances bandwidth and reliability of each site across the broadest range of business environments.



ML-IP is the only IP bandwidth boosting technology that operates consistently across the most popular access media:

Data Interface Type	Data Link Protocol	Access Equipment
Asynchronous serial	Point-to-Point Protocol (PPP)	V.90 analog modems ISDN Terminal Adapters Cellular Packet Data Modems
Ethernet	PPP over Ethernet (PPPoE)	ADSL bridging modems Cable bridging modems
Ethernet	Internet Protocol over Ethernet (Release Pending)	Leased-line Routers (Frame Relay or ATM) ADSL/SHDSL Routers Cable Routers

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How Do I Evaluate ML-IP?

Stallion Technologies, the leading developer of ML-IP, has included this third generation Multilink technology in a number of products, collectively known as the ePipe family of VPN gateway appliances and central site concentrators. The products below are examples of how a partner can test ML-IP with existing Stallion solutions, pending releases and future products.

ePipe VPN Gateway Appliance

The ePipe 2242 is the multi-access appliance solution in the ePipe range. It is a VPN gateway, firewall, dialup access router and ML-IP aggregation device in one unit. It enables an Ethernet LAN to connect to a provider network (Internet, IP MPN, etc.) using up to four concurrent dialup connections. These are provisioned by connecting up to four external analog modems or ISDN TAs to its four asynchronous serial ports.

With ML-IP enabled, the 2242 can transfer data between sites at up to 512 Kbps across these connections. With IPSec enabled, it can secure these transfers when using the Internet. The 2242 also allows customers to then migrate to a broadband or leased line circuit by connecting a cable modem, or ADSL modem/router or T-1 access router to the second Ethernet interface on the unit at speeds up to 2 Mbps.

In the broadband application, the serial ports provide a fail-over to multiple dial back up links rather than simply a single link.

For more information, see
http://www.stallion.com/html/products/epipe-2200-technical-specs.html

ePipe ServerWare VPN concentrator and firewall software

The ePipe ServerWare suite transforms a standard Intel computer into a cost-effective firewall and VPN security gateway, securely connecting up to 500 distributed office networks together. ePipe ServerWare enables any organization to scale bandwidth incrementally to match their changing Internet access and VPN requirements, at a fraction of the cost of a high speed connection. It also bridges the gap between T1/E1 and T3/E3 services by bonding multiple DSL connections into one faster connection, independent of the provider infrastructure.

Currently ePipe ServerWare uses ML-IP to bond up to 7 ADSL connections when used with ADSL bridging modems supporting PPPoE. To achieve this, the system running ePipe ServerWare needs to be equipped with multiple quad Ethernet cards for bonding the PPPoE connections through the 7 ADSL modems.

For more information, see
http://www.stallion.com/html/products/esw-overview.html

Pending and Future Releases

New ePipe appliances are under development that will allow bonding of multiple leased-line or broadband connections using ML-IP by supporting more Ethernet interfaces and more CPU horsepower.

The next major release of ePipe ServerWare will allow ML-IP to operate across multiple Ethernet segments to access routers enabling it to bond multiple T-1, SHDSL, etc. connections, end to end. Ensuing releases will support single-ended ML-IP where remote sites have a single connection (e.g. ADSL) and the central site has multiple ADSL, T-1, etc., connections.

Who Benefits from ML-IP-enabled Broadband Access?

Customer Benefits

Businesses who benefit from ML-IP have several attributes. Firstly, many of them cannot obtain broadband access at all locations today, or such access is financially beyond their reach.

Secondly, the cost of incrementally increasing bandwidth is prohibitively expensive and requires major changes to the existing network.

Thirdly, the increasing use of and dependence upon broadband networks makes the reliability of these networks paramount.

Fourthly, some organizations prefer either public or private managed network services.

Small to Medium Businesses with multiple sites that need to share business critical data and want fast Internet access can utilize ML-IP enhanced connections to cost effectively deliver broadband performance.

Many large organisations want to upgrade or replace expensive public or private WAN solutions with cost effective alternatives. ML-IP enabled appliances integrate easily with existing enterprise networking infrastructure to affordably deliver more flexible bandwidth and improved uptime.

Other benefits of ML-IP include:

- ML-IP creates mobile offices easily
  - *instantly create temporary scalable bandwidth using multiple dial-up connections*
- ML-IP highly leverages investment in IT equipment
  - *because ML-IP works across a wide range of connection types, you can migrate from dial-up/ISDN to broadband from a single device*
- ML-IP fits any size organization, any size office, adapting to the needs of each site
  - *ML-IP operates across a broad spectrum of link topologies, from central sites with a single multi-megabit network connection to small, temporary sites with a small number of dial-up PSTN connections*
- Maximum network uptime; no lost productivity. ML-IP delivers high availability network connections in several ways:
  - *Fallback to a secondary high-speed connection if primary connection fails*
  - *Fallback to a secondary provider network if primary network fails or becomes slow*
  - *Failover to multiple dial-up connections in the event of a complete failure of a high-speed service*
  - *Backup connections during teething stage of broadband implementation*
- Deploy access to the corporate network at every site, regardless of location or infrastructure
  - *ML-IP supports disparate connection types at different sites*
  - *ML-IP is totally transparent to the intervening network infrastructure (PSTN/VPN/MPN)*
  - *ML-IP is totally independent of carrier/service provider equipment or products*
  - *ML-IP creates useful bandwidth from narrow-band satellite connections for very remote applications*

Carrier Benefits

- Sell more access circuits (all kinds)
  - *Because ML-IP creates useful bandwidth by bonding multiple links, customers purchase more circuits*
  - *ML-IP supports a wide range of connection types; carriers can sell "horses for all kinds of courses"*
  - *Extend data networking services to a broader market - attract small to medium businesses with enterprise grade bandwidth at affordable prices*
- Bridge between all network technologies
  - *ML-IP forms a link between leased lines, VPNs and MPNs*
- Fill gaps in bandwidth/product offerings
  - *ML-IP bridges the bandwidth/price gaps that exist in existing products (eg T1-T3 vs multi-broadband)*
- Increase service availability to within reach of every customer
  - *Attract customers who cannot access broadband but need high-speed low cost connections today*
- CPE-enabled high availability
  - *ML-IP dissipates customer backlash from broadband unreliability*
  - *ML-IP offloads some of the cost and concern of fault tolerance*
  - *ML-IP offers comprehensive backup services that can be integrated in a single service*
- Works with all network types - zero administration
  - *ML-IP introduces no carrier-based infrastructure overheads*
- More revenue per customer
  - *ML-IP increases the number of products/ services that customers are likely to purchase from carriers*
  - *Lock customers in with CPE-derived service contracts*

Service Provider Benefits

- Generate more revenue per customer
  - *ML-IP accelerates dependence upon and productivity from the Internet, building solid income streams from corporate clients*
  - *ML-IP increases the amount of bandwidth customers consume*
- Broader audience to sell Internet-based data connections
  - *Sell Internet services to any size multi-site organization*
- Build ongoing revenue from each customer
  - *Lock-in customers with scalable bandwidth across all access types*

OEM benefits

- Lock out competitors by licensing ML-IP
  - *Protection through patent-pending technology*
- Create consistent benefits across a wide range of products
  - *ML-IP can easily be incorporated into routers, switches, access servers and software products*
- Leverage Stallion's ML-IP-enabled appliances and server software products
  - *Take advantage of existing marketing collateral, case studies and business models*
- Rebrand Stallion's ML-IP-enabled products
  - *Reliable, field-proven and innovative software and hardware products*
- Proven technology partner
  - *16 years developing data connectivity products*
  - *ISO 9001 accredited design and manufacturing processes*

North America
2880 Research Park Drive, Suite 160
Soquel, CA 95073
Ph +1 800 347-7979
Ph +1 831 477-0440
Fx +1 831 477-0444

Asia Pacific
33 Woodstock Road
Toowong QLD 4066
AUSTRALIA
Ph +61 7 3270-4242
Ph 1800 687-727
Fx +61 7 3270-4245

World Wide Web
www.stallion.com

E-mail
info@stallion.com

stallion technologies

A patent has been applied for ML-IP.