Wide Area Network (WAN) over IP

A Next Generation Broadcast Solution

WHAT MAKES MEDIA LINKS DIFFERENT?

Innovative:
- Early leader in a rapidly expanding and critical technology space

Decades of Experience:
- Video & network technologies expertise n a continuously transitioning content environment

industry Standards:
- Active involvement in industry standard setting

Scalable Solutions:
- Scalable network architecture for limitless bandwidth possibilities

Multi-Service Solutions:
- Supports traditional Broadcast architectures, as well as IP/Ethernet-based leased network infrastructures

Customer Focused:
- To help you efficiently operate, scale, and grow

Superior Support:
- Outstanding engineering, project management, service, pre-, during and post-sales support

Television, event, and sports broadcasters have long relied on a diverse array of legacy and newer network technologies to deliver critical video, audio, and data signals from venue to destination. This varied mix of legacy and current WAN transport methods includes satellite and microwave feeds, SONET and SDH networks, dark fiber, MPLS networks, metro Ethernet, and ATM, DTM, and DWDM transmission systems.

While each of these technologies offers users benefits in terms of rate, reach, and cost, their continued use has left broadcasters with a disjointed set of networks that are expensive to operate, hard to provision, and difficult to troubleshoot. Due to network fragmentation and isolation (islands of connectivity), critical items such as Quality of Service (QoS) guarantees, end-to-end circuit visibility, multipoint connectivity, and error protection are often lacking in these solutions.

Over the past decade, however, the old rules surrounding broadcast video networks have begun to shift, with next generation WAN IP networks emerging as the clear front runner among competing transport technologies. Popular applications using next generation IP networks are numerous and include live sports, live event contribution, stadium-to-studio and studio-to-studio connectivity, remote production, and mobile studios. Broadcaster adoption rates have been high; the reasons behind the success of IP WANs are compelling and include the following key elements:

- Scalable, high performance bandwidth to accommodate video signals at increasing bit rates (as with HD 4K and UHD 8K)
- A common, shared network infrastructure that can transport video, audio, and data signals in all widely used formats
- Adherence to standards, ensuring longer product lifecycles, improved vendor support, true interoperability, and future product enhancements.
- Intelligent network transport, including low latency, traffic prioritization, QoS assurances, lossless transmission, error control/correction, bandwidth management, and route failover options.
- Varied network connectivity options, such as point-to-point, point-to-multipoint, easy access to secondary distribution networks, multi-homing, and signal aggregation.
- A rich set of standards-based (SNMP) network management and diagnostic tools to speed provisioning and troubleshooting
- A future-proof network architecture that supports emerging network-centric applications, including the greater use of data and reverse channels, remote production, live-to-file conversions, and streamlined workflows

Balancing Efficient Bandwidth Usage with Smooth Network Scalability and Expandability

One of the keys to increased network revenues and a better ROI on network equipment investments is the efficient use of network bandwidth. Legacy time-division multiplexing (TDM) technologies like SONET allocate bandwidth in discrete channels or bands. But broadcast video and data sometimes don't fit neatly into these boundaries, so even if trunk or backbone bandwidth is still available, it may not be large enough to fit an uncompressed or moderately compressed video signal. The result: stranded bandwidth on an existing SONET trunk and a new monthly bill for an additional trunk circuit.

Newer carrier-based WAN technologies such as metro Ethernet and Ethernet Metropolitan Area Networks (MANs) avoid some of SONET/SDH's drawbacks and come with a number of other advantages. On a per gigabit basis, monthly circuit charges are typically much less expensive than pure SONET/SDH connections.

Service Providers are faced with three choices

Service providers and customers living with legacy video transport networks are faced with three distinct choices:

- ☑ carry-on
- ☑ upgrade
- ☑ replace

While calculating the cost of new replacement network hardware and software is a straightforward exercise, other "soft" factors merit careful scrutiny.

10Gbps Ethernet links can be provisioned over a variety of transport technologies, including SONET/SDH, Multiprotocol Label Switching (MPLS), and Dense Wavelength Division Multiplexing (DWDM) networks, so availability is nearly universal. Different priority classes can be assigned to video, audio, and data signals traversing the same network path, so that statistical multiplexing gains are achieved. Data circuits can also be provisioned with an upper limit on bandwidth usage; if input bandwidth is exceeded, those data packets are buffered up to a point and then eventually dropped without any effect on video or audio traffic. Finally, Ethernet bit rates, now speeding along at 10Gbps, 40Gbps, and 100Gbps, continue to increase, with 400Gbps and Terabit speeds on the horizon.

When additional trunk or network backbone capacity is needed in a WAN IP network, new circuits can be ordered in the size that fits best, there is no need to over provision in locations where bandwidth isn't needed. There are software, hardware, or logical limitations on network expansion, an unlimited number of nodes and circuits can be added to the network, all the while maintaining network management visibility that is edge-to-edge. And year-after-year, service providers can continue to ride the downward price curve for IP-based network equipment and circuits.

Long Distance IP Network
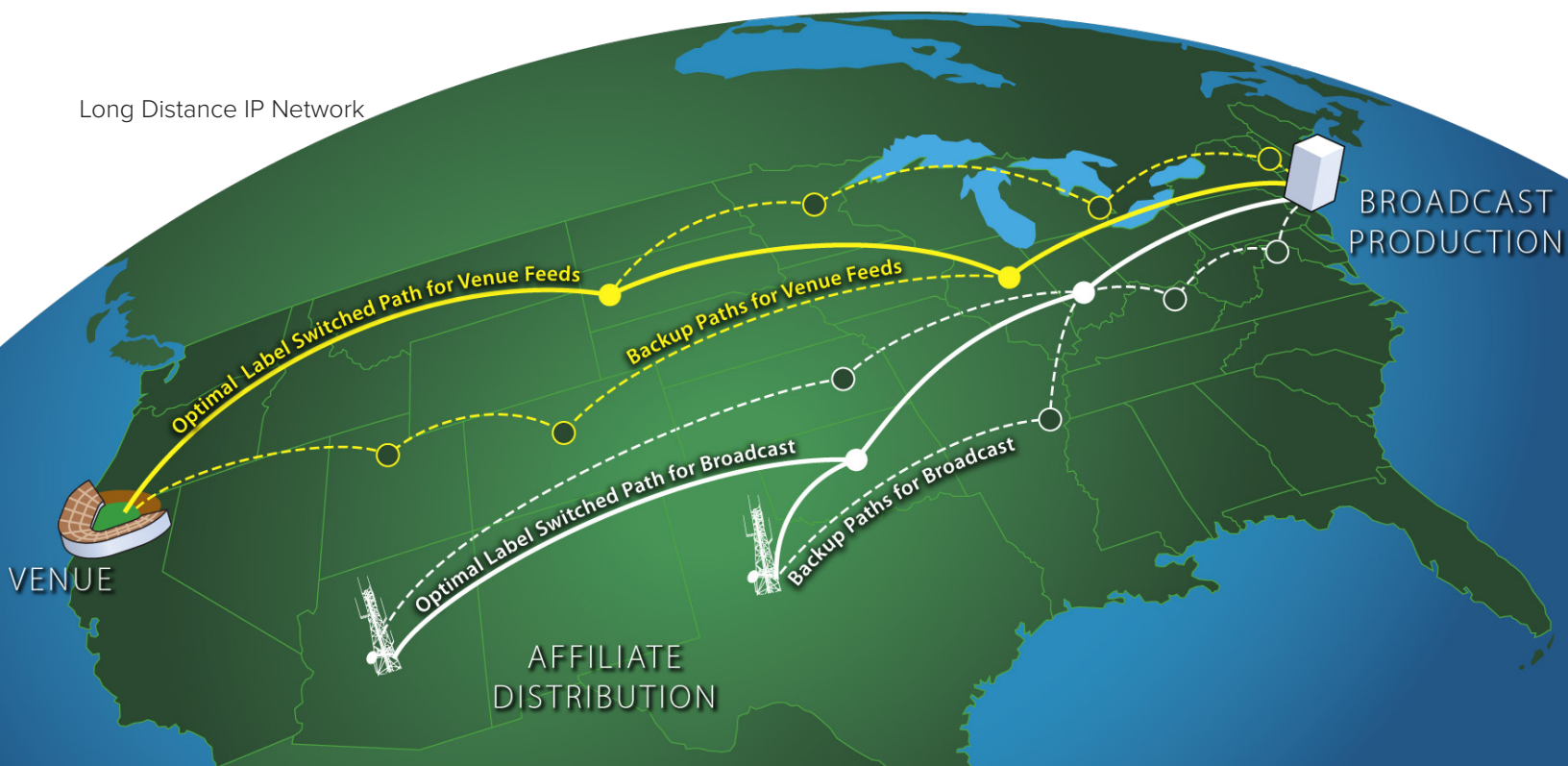
The Three R's: Reliability – Redundancy – Resiliency

Large viewership national or international television broadcasts and high profile sporting events represent some of the most technically demanding applications in all of broadcast television. Dropping a video or audio signal at the wrong time may represent tens or hundreds of thousands of dollars of lost revenue to the service provider and broadcaster. Furthermore, network outages in these high profile events tarnish service providers' reputations in a very public way and may jeopardize future customer contract and revenue possibilities.

Media Links' advanced IP Media Transport solutions use a variety of different transport assurance mechanisms to ensure that outages never happen or, in those rare cases where they do, that switching occurs seamlessly without signal disruption. At its most fundamental level, power supply, switch fabric, and trunk redundancy is built into all Media Links MD8000 equipment.

Sometimes referred to as Spatial Redundancy, Hitless Switching allows users to accept a single input signal and send it as two separate streams across diverse network paths in the network. Both streams arrive at the same destination line card but are typically out of time with each other due to the diverse paths taken. On the destination card, these signals are then realigned and synced with each other to assure precise video timing. Should the primary signal be lost or interrupted, the destination card automatically switches over to the secondary signal without any signal disruption (lossless switching). In contrast to Hitless Switching, the Auto Protection Switching option monitors the primary channel but does not send traffic on the secondary channel unless the primary channel goes down.

Another option for improved network resiliency is Forward Error Correction (FEC), a coding technique applied to video/audio frames that can correct a limited number of errored frames on the fly without retransmission. FEC is particularly effective in cases where burst errors occur. Other broadcast specific transport features include QoS monitoring and control of network impairments such as jitter, latency, and packet loss.

Leading the Industry in Standards-Based IP Video Transport

For many decades, both the broadcast television and telecommunications industries have relied heavily on standards organizations such as the Society of Motion Picture Engineers (SMPTE) and the International Telecommunication Union (ITU) to define standards-based approaches to complex technical challenges in the areas of encoding, video transport, compression, encapsulation, and more. Media Links engineers have been at the forefront of many of these activities, especially in the area of high bit rate media transport over IP (HBRMT) and JPEG2000 interoperability.

In an effort to cut hardware costs and shorten design cycles, some network transport vendors choose to base new products on older time division multiplexing or circuit-switched technologies. Under light or moderate network loads, these products may compete with newer IP packet switched devices which offer statistical multiplexing to achieve gains in efficiency. Under congested conditions, however, these products may exhibit frame jitter and packet loss problems.

If the adoption rates for less efficient legacy technologies aren't high enough, these technologies may suffer greater exposure to becoming phased out or orphaned. IP-based approaches, on the other hand, typically have greater customer and vendor "critical mass" behind them, thereby improving the odds for their long-term adoption and commercial success.

Options in Network Connectivity

The types of services (video, audio, and data) transported over IP networks have grown steadily in recent years. Customer's network connectivity needs have also been on a similar steady rise, moving from basic uni-directional point-to-point circuits to more complex multi-service, multipoint ones.

Due to the switching capability inherent in the IP protocol, IP networks are particularly adept at handling these new transport requirements. One such example is point-to-multipoint or multicast transmission, where a single input signal is replicated by the network and sent to multiple sites. To create multicast streams, the MD8000 efficiently replicates packets on the switch controller, then sends these packets out multiple trunk ports in the same chassis. If needed, the next downstream MD8000 device can perform the same multicast replication, so that only a single stream's worth of bandwidth is consumed on each trunk.

Options in Network Connectivity

✓ As IP and other WAN and even LAN network technologies converge, the islands of connectivity that have plagued service providers in the past are beginning to break down.

✓ IP networking delivers seamless end-to-end connectivity from originating Remote Sites/Access networks, to Contribution and Distribution networks, and finally to destination production sites and studios.

Ethernet data connections are inherently bi-directional so that source and destination sites are capable of concurrently sending and receiving data. Remote production uses and mobile studios using live two-way interviews, remote camera controls, and back office applications are also well suited to the very low latency compressed and uncompressed IP connections made through the MD8000. In addition, for remote production applications, JPEG2000 compression delivers visually lossless HD quality video with very low latency and supports transparent audio and ancillary data channels.

As IP and other WAN network technologies converge, the islands of connectivity that have plagued service providers in the past are beginning to break down. As shown in the diagram below, IP networking delivers seamless end-to-end connectivity from originating Remote Sites/Access networks, to Contribution and Distribution networks, and finally to destination production sites and studios. The use of a single common set of network protocols and equipment significantly lessens the workload placed on network managers and staff related to service provisioning, route diversity, network upgrades, capacity planning, fault isolation, and troubleshooting. The result: improved customer responsiveness, lower CAPEX and OPEX costs, and a faster rollout for new products and services.
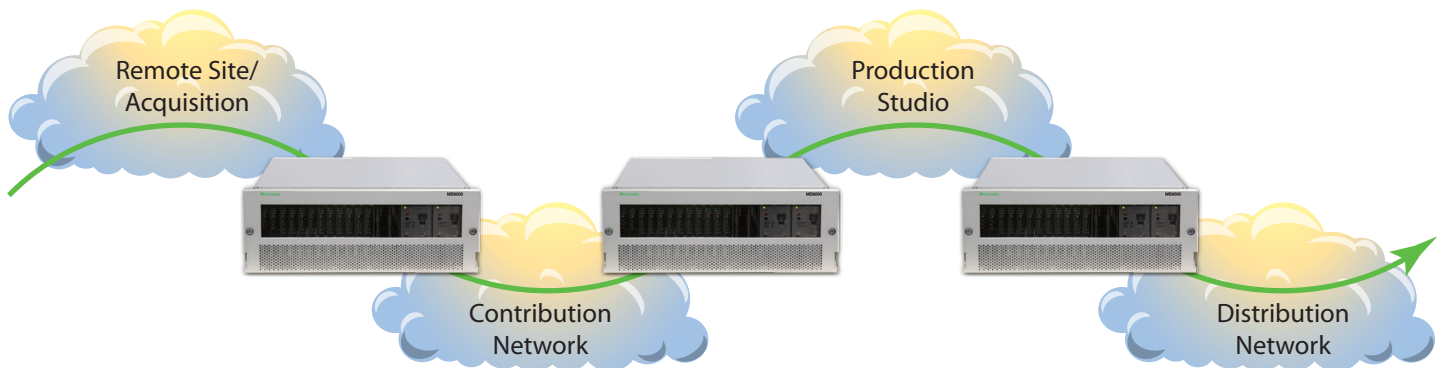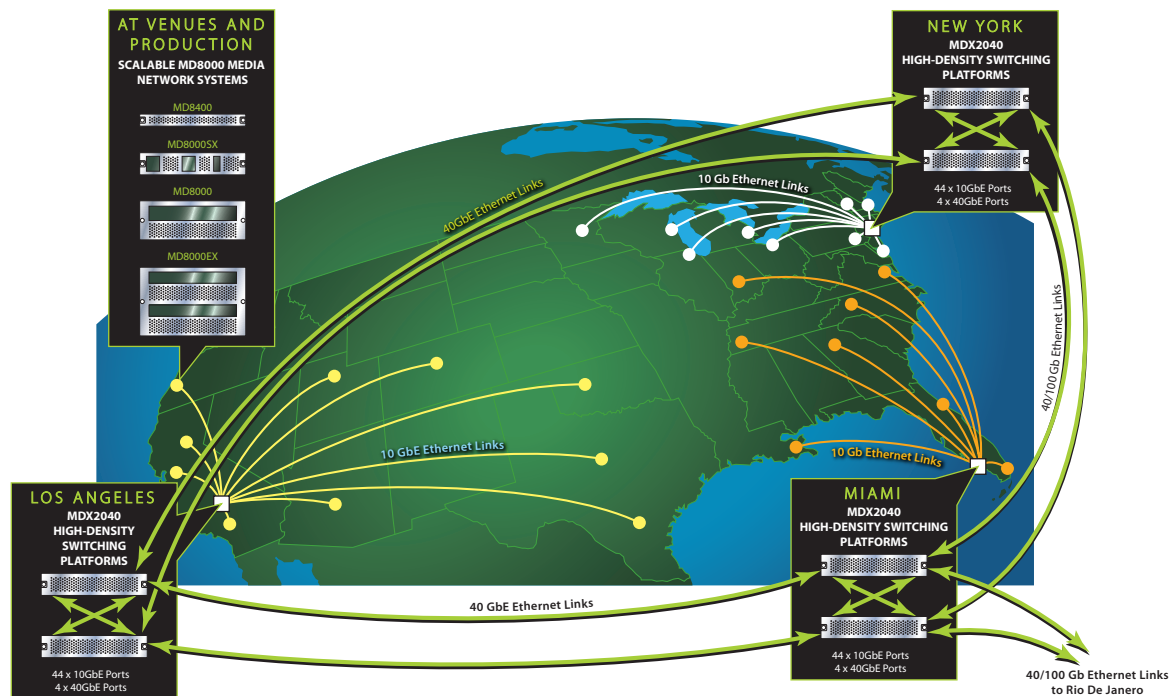

End-to-End Network Connectivity

To ensure reliable 24x7 operations, broadcast-grade video transport equipment must be designed from the ground up with real-time statistics, on-board diagnostics, and hardware serviceability in mind. Media Links provides its customers with a full set of SNMP-based network management tools that give customers the ability to remotely poll, diagnose, troubleshoot, and upgrade remote systems in the field, regardless of location. Network management connectivity includes both out-of-band and in-band options. These same network management platforms have been used to manage some of the most highly visible television events in the world, including the Super Bowl, Olympics, and World Cup football tournaments.

WAN IP Networks: Merging Performance, Versatility, and Longevity

Service providers and customers living with legacy video transport networks are faced with three distinct choices: carry-on, upgrade, or replace. While calculating the cost of new replacement network hardware and software is a straightforward exercise, other "soft" factors merit careful scrutiny.

• Does the new network design improve network reliability and resiliency?
• Can I easily scale the network to add more sites, access and backbone bandwidth, and high bandwidth services?
• Is the new network design a true "Unified Services" platform?
• Can I rapidly provision, maintain, and troubleshoot true end-to-end services?
• Is the new solution standards-based only at the edge or throughout?
• Does the vendor have more than 15 years' experience working with high profile customers on video over IP transport solutions and or are they relatively new to the game?
• Does the new design save on CAPEX and OPEX so I can improve service margins?

In the case of Media Links IP WAN products, including MD8000 access and transport equipment and MDX core switches, the answer to all of the above questions is a resounding "Yes". Since its inception in 1993, Media Links has never strayed from its commitment to video over IP broadcast network solutions. Some twenty-two years later, the decision to base the company's products and strategic direction on this choice now seems fortuitous. WAN IP networking is an evergreen technology; switches are getting faster, feature-sets are getting richer, and circuits are getting cheaper, year after year. Most importantly, its flexibility, converged architecture, and long list of proven successes means that WAN IP networking will continue to adapt to new technical challenges and market requirements for many years to come.