

# Video Network Evolution with IP and HD Integration

## Introduction

Broadcasters and video content providers are expanding their infrastructures to deliver high definition (HD) content to meet the ever growing demand for high quality HDTV. Striving to meet this demand, broadcasters have been upgrading their networks to support the HD capabilities and service their customers' needs for HD connections from studios, live events (e.g., sports, political conventions, etc.) and postproduction facilities. While HD can be transported after having HD-SDI signals compressed, the quality is enhanced when these video signals are transported in their native (uncompressed) format. Thus, transmission of uncompressed HD (and 3G) video content creates a new market for service providers but at the same time creates several challenges arising for the large bandwidth needed for these signals (1.485 Gb/s for HD and 2.970 Gb/s for 3G) which is orders of magnitude of SD video circuits being used today (270 Mb/s).

However, supporting HD/3G video is only one part of the story. In addition to their video connectivity demands, video customers in wide range of markets and applications including television and cable, service providers, studios and video post-production, government and producers of live events do require private data connectivity services, typically in the form of Ethernet. As of today, these customers meet this requirement by buying costly Ethernet connections. Realizing this urgent demand, new technologies need to be developed for allowing customers to leverage their video services in an innovative way: embedding IP/Ethernet services from their video services without additional cost. By exploiting the fact that while customers buy video circuits at a certain rate (SD, HD, or 3G), they may use their video circuits to run lower speed ones; for example, they may run SD

services over HD circuits, which leaves much of the video circuit bandwidth unused.

Therefore, IPITEK has developed its advanced family of Ethernet and video multiplexing solutions, the MSP-300 family, which while supporting multiple transport of SD, HD and 3G video provides new capabilities of optimizing the video network capacity by multiplexing Ethernet and video signals for transport over SD/HD/3G-SDI circuits on demand. This paper outlines the challenges and characteristics of HD video networks and how IPITEK advanced HD solutions provide unprecedentedly cost effective solutions for these new environments.

## Video Network Challenges

As broadcasters and media providers shift towards HD and 3G, demand for IP data connectivity will rise to support various operational needs. Thus, the infrastructure to support the next generation of contribution will be composed of both privately operated broadcast video networks and service providers such as telcos and media operators who are offering services to the media companies which both will need to provide video and IP/Ethernet circuits. The shift towards asset-based production and IP/Ethernet-based video equipment combined with the telcos migration towards an all IP infrastructure will require new ways of building next generation contribution networks. Production will be done both in real-time and file-based. For all these reasons, the contribution offering to the broadcasters must be truly multi service. Broadcasters are also changing their workflows by demanding more automated ways of provisioning their contribution feeds to work on-demand and to more efficiently use the media assets and the facilities they have invested in while meeting all of their operation goals.

Along these lines, the following is a list of some of the most important requirements for HD video network operators:

**Multi-service integration:** Broadcasters are demanding multi service networks to attend all their needs in one network avoiding costly multiple network or network services. Consolidating everything into one infrastructure saves money and simplifies operations. The challenge is to maintain high quality video transport in a consolidated infrastructure.

**Migration towards IP/Ethernet:** Broadcasters are shifting many of their operations to IP and Ethernet infrastructure. To reach the broadcasters' locations, the IP transport capacity is often significantly less expensive than SDH or other type of connections, which is one of the reasons why IP video transport is a must for the future. At the same time, the cost of leasing local loop SDI is far less expensive than leasing Ethernet service. Thus, utilizing the SDI infrastructure already used, broadcasters and video content providers will achieve vast cost saving if they become able to run Ethernet on their SDI circuits.

**Simplified and consolidated network operations:** Service providers offering transport services are facing increased network complexity due to the higher demand of video transport services. They need to simplify operations and offer easy to use configuration. Thus, consolidating multiple service features and transport options in one platform is very beneficial.

**Network capacity utilization:** As the number of signals and the bandwidth of each signal are increased dramatically, the network solution needs to efficiently use the link capacity. Link capacity is expensive and efficient usage of the available bandwidth is key to low overall operational cost.

In addition to these challenges, the transport infrastructure poses another challenge. Increasingly, content providers and production companies are looking for transport of uncompressed digital video signals, regardless of format, over long distances without degrading the original quality. Production companies are now starting to transfer HD and 3G SDI content over fiber for purposes of pre-and post-production, editing, and distribution, live or otherwise. The increasing amount of media production combined with the shift towards High Definition (HD) drives the bandwidth in contribution. Fiber-based solutions are increasingly being used for campus, regional, national, continental and global contribution for live as well as non-live transport. Contribution feeds will span from low bandwidth audio, low bandwidth compressed signals up to uncompressed signals in HD and 3D format requiring multiple Gbps. In addition, optical fiber provides myriad benefits that go beyond merely enabling longer distance content transport, including virtually unlimited bandwidth for carrying video signals. There is enormous potential bandwidth with optical fiber, offering the potential for fiber information carrying capacity many orders of magnitude higher than copper cable. Therefore, solutions designed for carrying video and Ethernet services over high-speed SDI networks such as HD and 3G must provide this flexibility and potential for future expansion to cover fiber networks.

## **Advanced Ethernet-HD Solutions: IPITEK MSP-300 Family**

To solve these challenges, IPITEK introduction of Ethernet over SD-SDI, HD-SDI and 3G-SDI is a game changer for the way broadcasters and media network operators provide services over HD video networks. Instead of leasing expensive Gigabit Ethernet or SONET leased lines to provide services to the last mile, cost effective HD-SDI local loops can be used for multi-service, high QoS

transport in access networks and for event networking.

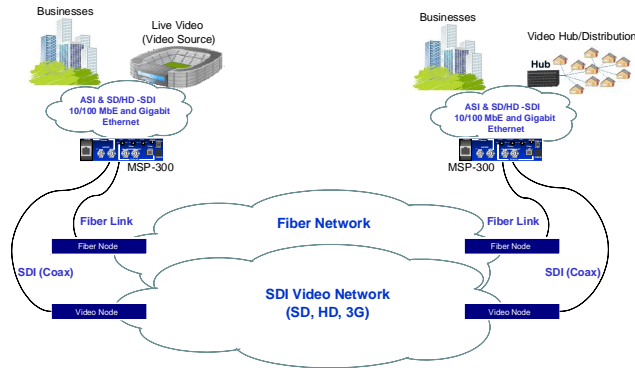


Figure 1: Using IPITEK MSP-300 used for supporting Ethernet and video over SDI networks

The MSP-300 is a network access and aggregation device that can collect both client data traffic and video circuits. Users of the MSP-300 can optimize their regional/national SD/HD/3G-SDI circuits by utilizing their capacities in carrying lower speed video services such as ASI, SD, HD, 3G video and 10 to 1000 Mbit/s Ethernet services. Depending on the rate of the network side video rate (trunk video), users of the MSP-300 can provide Ethernet as well as video services to their customers. Moreover, the introduction of the MSP-300 with its new and intelligent features improves interoperability with both the transport network and the surrounding technology, as it removes the need to introduce an additional vendor and monitoring system typically required for format conversion or data processing.

### Multi-Service Support

The MSP-300 supports the transmission of two-way video trunks. Each video trunk carries a separate video signal. This feature allows broadcasters and carriers to support two-way transmission of video services using only one small platform, and thus, cut capital expenditure by half. As Figure 2 illustrates, the MSP-300 Coax trunk links allow its users for simultaneous

transmission of video signals from both locations, A and B.



Figure 2: MSP-300 used for supporting two-way Video trunks/clients and Ethernet

### Integration of Physical Transport Media (Fiber or Coax)

In addition to supporting two-way Coax video trunks, the MSP-300 adds another dimension to its flexibility by supporting and optical fiber trunk link.

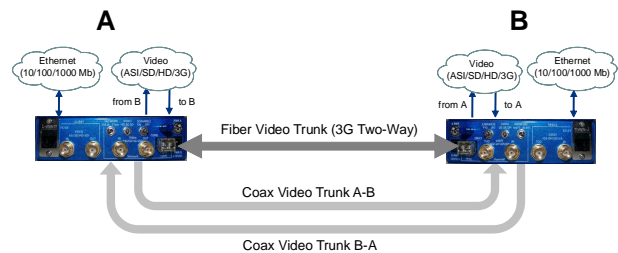


Figure 3: MSP-300 supports both Coax and fiber video trunks for full flexibility

This link is bidirectional, i.e., MSP-300 users can support two-way video services and Ethernet circuit over single fiber link. Customers can switch back and forth from Coax trunk to optical trunk by simply flipping a selection switch. This feature allows our customers to utilize the MSP-300 in different applications.

### Support for Multi-Rate Two-Way SDI Circuits

The flexibility of the MSP-300 does not stop at support Ethernet and video services over coax or

fiber video networks. In addition to these features, the MSP-300 does not require the input/output video trunk ports or input/output video client ports to operate at the same video rate. In fact, customers can have differential video rates on different video ports.

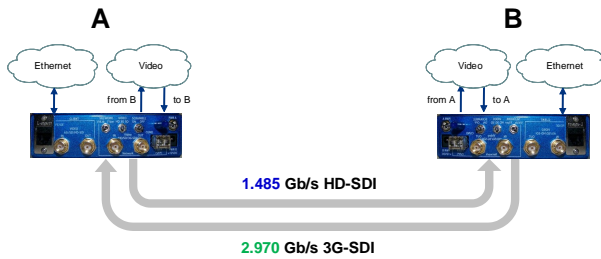


Figure 4: Multi-rate Video transmission using MSP-300: HD/3G-SDI trunks concurrent transmission

As the next two figures show, it is possible that the one of the video trunks operate at 1.5Gb/s HD video (HD-SDI) while the other one (opposite direction) operate at 3.0Gb/s (3G-SDI) or 270 Mb/s (SD-SDI). Please note that the speed of the Ethernet service depend bandwidth permitted by the rate of the video trunk and the rate of the client video signal.

**Interoperability with Broadcast Video Networks**

A major advantage and feature of the MSP-300 is its interoperability video transport networks. The MSP-300 is interoperable when either Coax video trunk is used or fiber trunk is used.

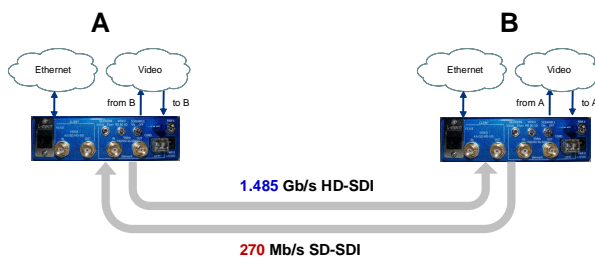


Figure 5: Multi-rate Video transmission using MSP-300: SD/HD-SDI trunks concurrent transmission

When Coax video trunk is used, the video signals generated are fully compliant with relevant video standards (SMPTE 259 for SD-SDI, SMPTE 292 for HD-SDI and SMPTE 424 for 3G-SDI).

Note that even if a fiber trunk is used, the MSP-300 support SMPTE standard optical interfaces (SFPs) that are developed mainly for carrying HD video signal. Therefore, the MSP-300 allows its users to internetwork with third party standards-based video routing or switching systems with any degradation of performance (Figure 6).

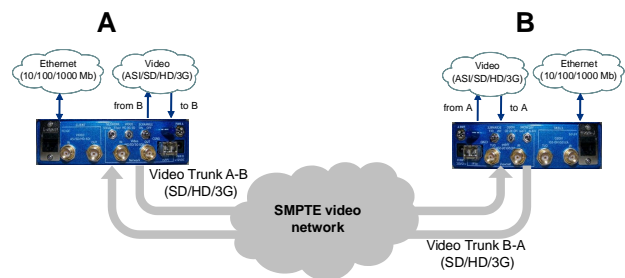


Figure 6: MSP-300 interoperability with SMPTE compliant video networks

**Conclusion**

This paper illustrated the challenges and the characteristics of HD and 3G SDI video networks and how IPITEK advanced HD solutions provide unprecedentedly cost effective solutions for these new environments. Specifically, IPITEK advanced solutions allows video network operators to choose their objectives: multi-service integration, migration towards IP/Ethernet, simplified and network operations, scalability and growth and efficient network capacity utilization all can be achieved with its MSP-300 family.