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VIDEO CONNECT

A network for the world of television and for the broadcasting domain.

White paper

Abstract

Increased competition has led to a demand for highly reliable and highly efficient video networks for content owners and broadcasters. However, video traffic introduces stringent requirements around packet loss and jitter, making an off-the-shelf traditional tweaked data solution insufficient for Video Network.

Media providers need a purpose-built video network solution that can provide connectivity to key destinations, as well as premium quality and high levels of reliability, all available on flexible commercial terms. DTM provides an alternative for media-oriented services, which offers greater flexibility and capacity over traditional technologies. When choosing an interface, media companies prefer ASI, though Ethernet is seeing increased popularity. With the right provider, media companies can enjoy the benefits of a network architected for video.

BUSINESS CHALLENGES

With the advent of a network of networks, on the Internet/MPLS, it is a known fact that TCP/IP is the best mode of moving data between PC-AT clones or computers on the data front. Similarly, signaling has been prevalent in traditional voice network. Voice Over IP network is also used for voice. The next big thing, as industry veterans' say, is video application.

Video is predominantly viewed in television, in most parts of the world, because it includes higher quality, one-way traffic, etc. Typically, video traffic may flow between production companies, who are content owners like Disney, and broadcasters like Home Box Office. Broadcasters may process this content and send it to audiences using satellite or cable networks to be viewed on televisions placed in homes either through cable operators like Comcast or DTH operators like DIREC TV in the USA. Essentially, these audiences have umpteen choices of television channels available with a varied choice of content. So, none of these companies in the value chain can compromise on availability, when they are looking to buy a network to use for their video.

VIDEO NETWORK IN COMPARISON TO TRADITIONAL INTERNET/MPLS CLOUD

At the outset, the video network is elusive. Video can be defined as pictures or frames in continuous motion. The network element used at home for viewing video is a set-top box with the end being a television set. However, standards vary in Europe and North America.

Professional video over IP systems use some existing standards or proprietary video codec to reduce program material to a bitstream (such as an MPEG-2 transport stream), and then to an Internet Protocol (IP) network to carry that bitstream encapsulated in a stream of IP packets. This is typically accomplished using some variant of the RTP protocol. Carrying professional video over IP networks has special challenges compared to most nontime critical IP traffic. In particular, there are very strict qualities of service requirements which must be fulfilled for use in professional broadcast environments.

Packet loss

Since even well-engineered IP networks tend to have a small residual packet loss rate caused by low-probability statistical congestion events and amplification of bit errors in the underlying hardware, most professional solutions use some kind of forward error correction in the CPE (encoder) to ensure that the encoded video stream can be reconstructed even if a few packets are lost. This is typically applied at the packet level, since the encapsulated video bitstream is only designed to tolerate low levels of bit or burst errors, rather than the loss of whole packets. Resending packets is not an option because of the sequential nature of the underlying video signal. For live video, a resent packet would arrive well after the arrival of the next frame of video.

Jitter

Network delay variation can be kept to a minimum by using a high-speed network backbone, and ensuring that video traffic does not encounter excessive queue delays. The remaining delay variation can be removed by buffering, at the expense of an added time delay. If forward error correction is used, a small proportion of packets arriving after the deadline can be tolerated, since they can be dealt with by being discarded on receipt, and then treated in the same way as lost packets. The other problem presented by latency variation is that it makes synchronization more complex by making the recovery of the underlying timing of the video signal far more difficult.

Typical Standards and Bandwidth Range

Types of Digital Video Services	Bandwidth Capacity
I. Uncompressed digital video	
SDTV (480i CCIR 601 over SD-SDI SMPTE 259M)	165.9-270 Mbps
EDTV (480p or 576p via SMPTE 344M)	540 Mbps
HDTV (1080i or 720p over HD-SDI SMPTE 292M)	1.485 Gbps
HDTV (1080p over Dual link HD-SDI SMPTE 372M)	2.970 Gbps
II. MPEG-2 compressed video	
SDTV broadcast (3.75 Mbps for cable VOD)	3-6 Mbps
HDTV broadcast (19.3 Mbps for ATSC DTV)	12-20 Mbps
SDTV production (contribution–4:2:2 I-frame only)	18-50 Mbps
HDTV production (contribution–4:4:4 I-frame 10-bit)	140-500 Mbps
III. MPEG-4 AVC/H.264 compressed video	
SDTV broadcast (about 50% less than MPEG-2)	1.5-3 Mbps
HDTV broadcast (1080i about 4x SDTV)	6-9 Mbps

A LOOK AT DTM

DTM is a technology that has developed circuit switching to support media-oriented services. The great advantage of circuit switching is its way of providing predictable delay and guaranteed reliable transport. On the other hand, does traditional circuit switching technologies such as SDH/SONET and PDH, show drawbacks in multiservice environments, due to being originally developed for narrowband telephony. The DTM technology removes such shortcomings, and enables convergence of video, with supreme, future-proof support for media-rich applications of all sorts.

The Most Important Improvements of DTM as Compared to SDH/SONET are:

- **Arbitrary channel size** – Channels can have arbitrary size and they can be symmetric or asymmetric according to desire, thereby dramatically increasing bandwidth utilization.
- **Flexible topologies** – The data link topologies can be configured to build ring, bus, and/or point-to-point/mesh structures as desired.
- **Nonhierarchical switching** – Channels can be switched arbitrarily between network links, without considering network hierarchies. Links can be set up as desired to build large network structures, without affecting the characteristics of the transport. There are no limitations of the size of the channels being switched.
- **Signaled end-to-end provisioning** – Channels automatically find their paths through the network during provisioning, only requiring identification of endpoints. In-band signaling protocol handles the setup through the network.
- **Multicast** - DTM channels can be point-to-multipoint, essential to the accommodation of media services of high quality to a large number of receivers. An example of such a service is IP-based cable TV.

The DTM technology is standardized by the European Telecommunication Standardization Institute (ETSI). The standardization does not only involve the properties of DTM, but great effort is put into the specifications of interoperability towards other technologies, such as DWDM, SDH/SONET, PDH and Ethernet. The focus on the interoperability aspect is driven by the urge that not only new networks should be able to utilize the technology, but also existing telecom and datacom infrastructure investments should be upgradeable to support media networking.

Furthermore, other parts of the industry are working to create a common control plane for all layers (from packets to fiber). GMPLS (Generalized Multiprotocol Label Switching) and DTM fit very well into that model. The introduction of DTM in the GMPLS model will ensure a truly homogenous management of multiservice networks built on the best components from several technologies.

CHOOSING THE RIGHT NETWORK

Predominantly ASI is preferred as a video interface though Ethernet and is gaining traction. Typical, CPE used for compressed video transfer is encoder at source/ingress and decoder at receive/egress end. ASI is the interface of choice for MPEG video in the broadcast community, in particular, when it comes to contribution applications. Although MPEG-2/MPEG-4 could be carried in different ways, DVB-ASI is the industry standard.

Some Reasons for Broadcasters to Use ASI Compared to IP:

- Much greater interoperability at the teleport end or DTH operator end if you keep the stream as ASI
- Less costly in terms of test and measurement equipment

These Approaches Include:

- Ready video network capable of delivering native video interfaces like ASI, SDI, Ethernet, etc.
- Capable of high definition and standard definition video traffic
- Auto re-routable and switching between multiple domestic and undersea cable paths
- Lead time to deliver can be as low as one day for a connected site for 24X7 circuits
- On-demand ad hoc video network will be available and the delivery timeline can be within hours

Although it is possible to combine few network elements of the above approaches, relying on a subset of the total network requirements may leave a firm lacking the requirements necessary for managed service.

The Key Considerations in Selecting the Right Approach for Video Network:

- Seamless global connectivity to all media capitals and/or hotspots like event venues
- Premium-quality delivery of video content guaranteed even at full utilization
- 4X protection ensures up to 99.999% uptime
- Scalable, flexible pricing that allows for rapid expansion when needed
- Customized network suits all topologies for maximum flexibility
- Pay-as-use for ad hoc network requirements.

ABOUT TATA COMMUNICATIONS

Tata Communications offers a full suite of media solutions for broadcasters, production houses, cable operators and other relevant organizations. Tata Communications' Global Media solutions group enable companies to find the right balance between performance, and operational objectives with a solution tailored to their unique technology requirements using both long-term and short-term commercial models.

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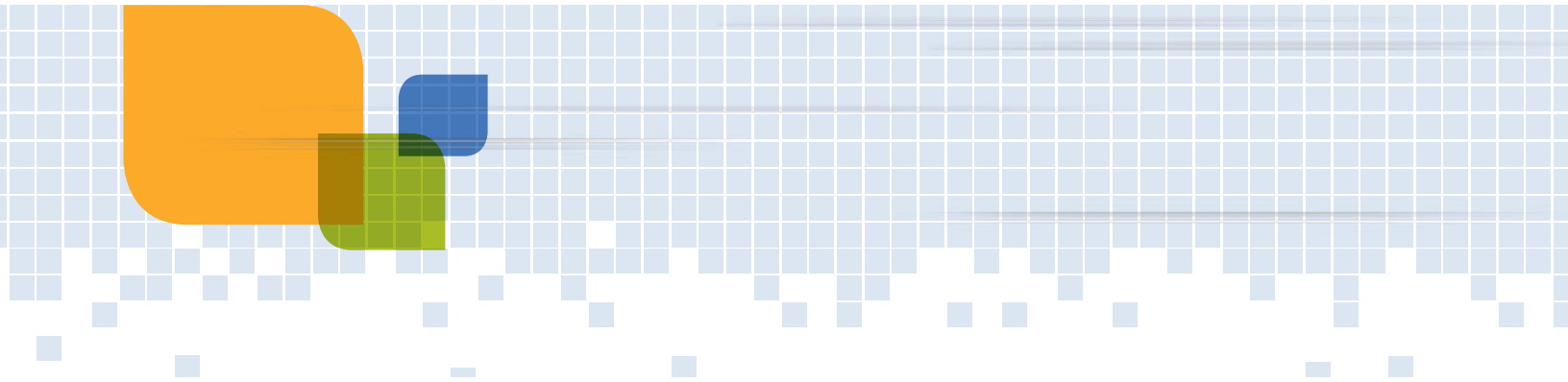

Tata Communications Limited along with its global subsidiaries (Tata Communications) is a leading global provider of the new world of communications. The company leverages its Tata Global Network, vertical intelligence and leadership in emerging markets, to deliver value-driven, globally managed solutions to the Fortune 1000 and mid-sized enterprises, service providers and consumers.

The Tata Communications portfolio includes transmission, IP, converged voice, mobility, managed network connectivity, hosted data center, communications solutions and business transformation services to global and Indian enterprises and service providers as well as, broadband and content services to Indian consumers. The Tata Global Network encompasses one of the most advanced and largest submarine cable networks, a Tier-1 IP network, connectivity to more than 200 countries across 300 PoPs and more than one million square feet of data center space. Tata Communications serves its customers from its offices in 80 cities in 40 countries worldwide. Tata Communications has a strategic investment in South African operator Neotel, providing the company with a strong anchor to build an African footprint.

The number one global international wholesale voice operator and number one provider of International Long Distance, Enterprise Data and Internet Services in India, the company was named "Best Wholesale Carrier" at the World Communications Awards in 2006 and was named the "Best Pan-Asian Wholesale Provider" at the 2007 *Capacity* magazine Global Wholesale Telecommunications Awards for the second consecutive year.

Becoming the leading integrated provider to drive and deliver a new world of communications, Tata Communications became the unified global brand for VSNL, Tata Communications, Teleglobe, Tata Indicom Enterprise Business Unit and CIPRIS on February 13, 2008.

Tata Communications Ltd. is a part of the $29 billion Tata Group; it is listed on the Bombay Stock Exchange and the National Stock Exchange of India and its ADRs are listed on the New York Stock Exchange (NYSE: TCL).

www.tatacommunications.com/enterprise/gmes/video_connect.asp

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