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SWITCHED VIDEO TRANSPORT

SWITCHED VIDEO TRANSPORT: UNIQUE TRANSPORT NETWORK FEATURES ENABLE COST-EFFECTIVE VIDEO DISTRIBUTION

The Infinera Switched Video Transport solution is built on the Infinera XTM Series Native Packet Optical architecture. The Switched Video Transport solution addresses a specific issue that some cable TV operators/multiple system operators (MSO) are facing in their networks.

As these operators migrate from standard-definition TV to high-definition and 3D TV, the traffic within the network increases considerably, often by a factor of 10, while revenues do not. These companies are looking for methods to optimize their distribution of video traffic so that they can better manage their networks and add new services and revenue. Infinera offers unique capabilities in the transport network that can help cable TV operators meet these goals.

Technology Background

Internet protocol (IP) multicast enables the efficient transfer of data from a set of sources to a dynamically-created set of receivers. Typical multicast-enabled applications include Internet TV/radio, online games, and webinars.

In these applications, IP packets are normally sent as unicast packets, from one source to one destination. When multiple receivers require the same data, replicating the data from the source to all receivers increases the network load, resulting in network congestion and loss of quality. Multicast provides more efficient delivery of TV/video traffic compared to unicast as it lowers the capacity requirements on the transport network.

IGMP

The Internet Group Management Protocol (IGMP) is a communications protocol used by hosts and adjacent routers on IP networks to establish multicast group memberships.

IGMP is an integral part of the IP multicast specification. IGMP can be used for online streaming video and gaming, and allows more efficient use of resources when supporting these types of applications.

IGMP is used between the client computer and a local multicast router. Switches featuring IGMP snooping derive useful information by observing these IGMP transactions. IGMP operates above the network layer, though it does not actually act as a transport protocol.
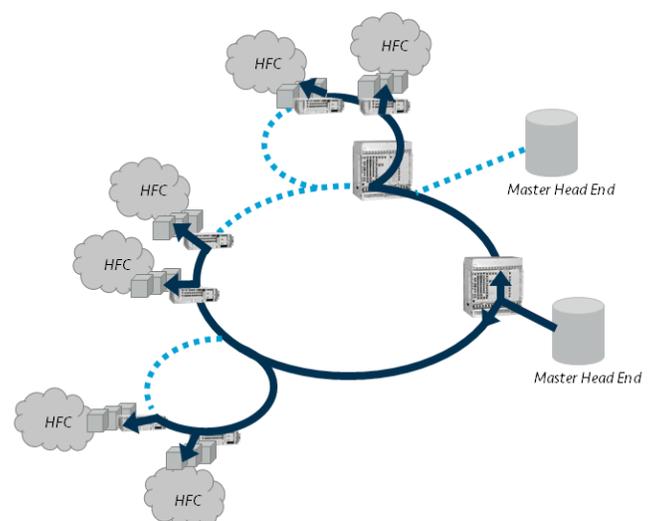

Fig 1. A Typical Multicast Distribution Network for Video Distribution.

Source-specific Multicast

Source-specific multicast (SSM) is a method of delivering to a receiver only those multicast packets originating from a specific souce address that they have requested. By limiting the source, SSM reduces demands on the network and improves security. SSM requires that the receiver specify the source address, which is possible only in IGMP version 3 (IGMPv3). IGMPv3 improves performance over IGMPv2 mainly by adding the ability to listen to multicast originating from a set of source IP addresses only.

Source-specific multicast is best understood in contrast to any-source multicast (ASM). In the ASM service model a receiver expresses interest in traffic being sent to a multicast address. In the SSM service model, the receiver also expresses interest in receiving traffic from only one specific source sending to that multicast address.

SSM relieves the network of discovering many multicast sources and reduces the amount of multicast routing information that the network must maintain.

SSM is a necessity in broadcast-style applications because of its advantages over the ASM model. The ability to provide Internet broadcast services through SSM without the need for unique IP multicast addresses allows content providers to easily offer the service. IP multicast address allocation is problematic for content providers, and there are no good solutions to the problem in the ASM model.

The prevention of attacks is an important factor for Internet broadcast services because, with their exposure to a large number of receivers, they are the most common targets for such attacks. ASM does not prevent unwanted sources from easily disturbing the actual Internet broadcast source because it sends traffic to the same multicast group. On the other hand, SSM ensures better security by only delivering packets to the specific source address.

SSM requires support in last-hop routers and in the receiver. SSM support is not required in other network components, including routers and even the sending host. Interest in multicast traffic from a specific source is conveyed from hosts to routers using IGMPv3 as specified for SSM (RFC4607).

The ease of installation and operation of SSM makes it ideal for network operators, especially in those cases where content needs to be forwarded between multiple independent domains. SSM does not require the network to maintain information about which active sources are sending to multicast groups.

IGMP Snooping

IGMP snooping is the process of listening to IGMP network traffic. IGMP snooping is a feature that allows a network switch to listen in on the IGMP conversation between hosts and routers. By listening to these conversations, the switch maintains a map of which links need which IP multicast streams.

Devices supporting IGMP snooping learn the ports on which the routers are reachable and the ports on which the hosts are reachable. When a report is received on a port, it is forwarded to the port attached to the router. The report is not forwarded to the other ports containing hosts since this could cause the other hosts to suppress their report generation for the multicast group.
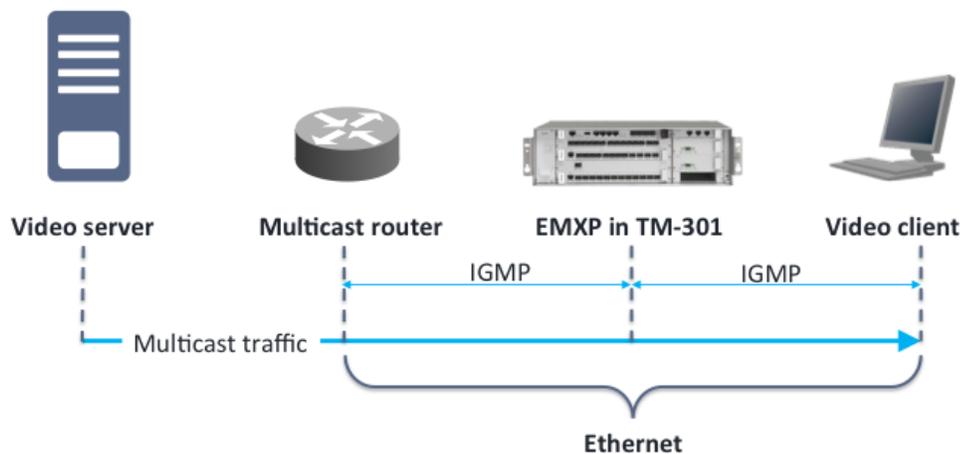
Fig 2. A Typical Video Distribution Network Includes These Components. Multicast Traffic Is Sent from the Video Server Using User Datagram Protocol (UDP)/Real-time Transport Protocol (RTP) Messages. IGMP Messages Are Passed Between the Local Router and Video Clients.
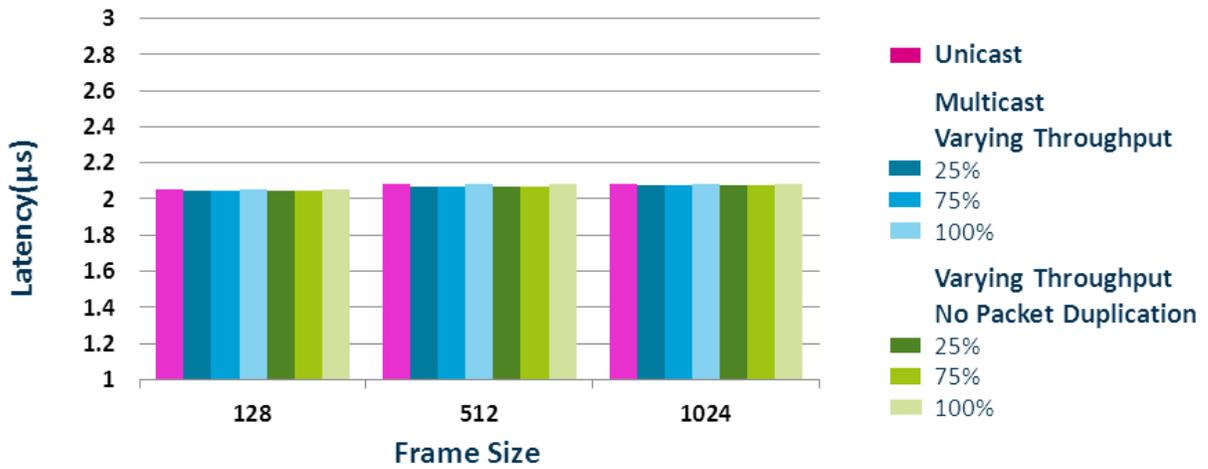
Fig 3. Switched Video Transport Provides Stable, Ultra-low Latency at Varying Throughput Levels and Levels of Packet Replication.

Switched Video Transport

The Switched Video Transport solution is built on Infinera Native Packet Optical architecture and transport Ethernet capabilities. Native Packet Optical enables the integration of Layer 1 wavelength-division multiplexing (WDM) transport and Layer 2 Ethernet into the packet-optical transport switch (EMXP). This approach combines the aspects of carrier Ethernet associated with demarcation, aggregation and transport with WDM transport. It is focused on the transport of Ethernet within backhaul networks and is a key element of the Infinera Native Packet Optical architecture

The Switched Video Transport solution is able to provide very cost-effective Ethernet demarcation, aggregation, switching and transport and can also excel at certain functions that are very important in transport networks. For video distribution networks, Switched Video Transport can provide stable, ultra-low latency for services such as video distribution, financial services and mobile backhaul.

Switched Video Transport moves the EMXP another step, from a Layer 1 and Layer 2 device into one with Layer 3 visibility. As shown in Figure 3, the EMXP uses SSM and IGMP snooping to listen to Layer 3 flows, determine what actions to take and to then perform a Layer 2 switch. This enables the traffic to be optimized as required, but also maintains the transport performance that was desired for video traffic.

The EMXP uses Ethernet switching modules with an architecture that is highly suitable for video distribution applications. This architecture provides tangible benefits to customers, such as 100 percent throughput and very low latency at any throughput level.

The implementation on the EMXP supports full IGMPv3 snooping. Alternative approaches to Switched Video Transport would involve deployment of expensive routing solutions to roll out IGMPv3 and SSM to all nodes or to forego IGMP and accept significantly higher traffic levels with the associated higher cost.
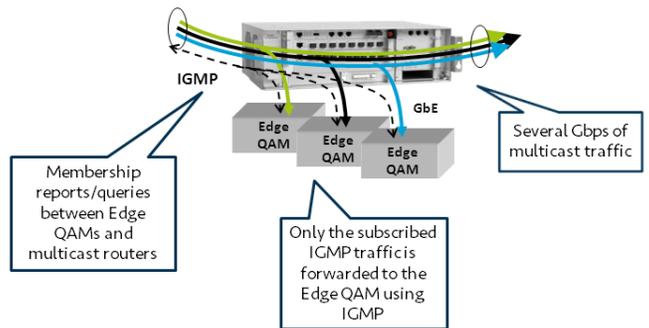

Fig 4. Switched Video Transport Using the EMXP.

Infinera Switched Video Transport Solution Benefits

- **Cost-effectively scale video distribution networks:** With the high level of scalability that comes with the XTM Series and Native Packet Optical architecture, cable TV operators/MSOs can cost-effectively grow and optimize multicast traffic as they move from standard-definition TV to 3D and high-definition TV.

- **Common transport platform:** Optimized multicast traffic, unicast traffic (either via Layer 1 WDM or standard Layer 2 Ethernet), and wholesale services such as mobile backhaul and broadband backhaul are supported, all at the per-wavelength level over the same infrastructure and under the same management platform.

- **Performance:** Switched Video Transport is ideal for video distribution with industry-leading latency and jitter performance. The XTM Series EMXPs have near zero jitter and less than two microseconds latency, which is far better than a router-based solution. The XTM Series 2.5G and 10G multi-rate transponders provide only four to 10 nanoseconds latency per transponder pair.

- **Highly simplified network operation:** The operator simply enables the feature in the necessary nodes and it will listen to IGMP traffic and optimize the network accordingly, without any complex procedures. IP functionality is brought into a transport platform that is typically managed by a transport team within the operator without the typical complexity required for IP networks.

- **Local insertion of traffic:** In countries where multiple languages are used and some regions require additional local language channels, these can be added locally without the need for distribution across the whole network.

Conclusion

The Infinera Switched Video Transport solution helps cable TV operators/MSOs overcome video distribution challenges. Operators can deliver new services demanded by their customers by more effectively using their transport network investment. The video distribution function is integrated into the transport network, eliminating more complex management and higher expenses.

ABOUT INFINERA

Infinera (NASDAQ: INFN) provides Intelligent Transport Networks, enabling carriers, cloud operators, governments and enterprises to scale network bandwidth, accelerate service innovation and simplify optical network operations. Infinera's end-to-end packet-optical portfolio is designed for long-haul, subsea, data center interconnect and metro applications. Infinera's unique large-scale photonic integrated circuits enable innovative optical networking solutions for the most demanding networks. To learn more about Infinera visit www.infinera.com, follow us on Twitter @Infinera and read our latest blog posts at blog.infinera.com.

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