IPTV SERVICE DELIVERY USING EOPDH TECHNOLOGIES

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ABSTRACT

Internet Protocol Television; (IPTV) is changing the foundation of television with a new way of delivering and viewing television programming using an IP network and broadband access links. This paper analyzes IPTV, to help service providers understand the challenges associated with deployment and to make informed decisions about offering IPTV services with a better end-user experience.

MARKET DRIVERS

Service providers need differentiated services in a landscape in which many players are competing for the same customer base. IPTV offers that possibility. IPTV is changing how television is distributed and viewed, offering numerous advantages to broadcasters and end users. While enjoying lower cost of delivery of programming, broadcasters are now able to offer differentiated services such as on-demand TV to an enthusiastic, growing audience base.

While IP promises capabilities such as interactive and on-demand TV, which terrestrial TV lacks, it demands link error immunity, low latency and low jitter. Since IPTV traffic must co-exist with other, less demanding services, this is a major challenge to vendors to offer equipment with efficient bandwidth usage, scalability and reliability and to do so in a cost-effective manner.

TECHNICAL CHALLENGES AND SOLUTIONS

Most operators evaluate networking technologies for specific requirements that differ between deployments. However, for IPTV there are common attributes across installations. Also there are several factors that are not directly related to IPTV service offering that must also be considered.

Although telcos are offering differentiated services such as IPTV, fiber penetration in North America is still low. Furthermore, service providers are facing the challenge of preserving existing revenue streams that are running on legacy technologies, such as traditional copper-based TDM technologies. For the migration toward an all-packet network, Ethernet gains momentum as the preferred technology of next-generation networks for access and transport. Ethernet is cross elastic with legacy technologies making it the technology of choice running over traditional copper TDM. For the gradual migration toward all-packet networks in a cost-effective manner several technologies exist, with two competing ones, namely MLPPP and EoPDH leading the way. Among these competing technologies, MLPPP and EoPDH both split bandwidth over T1/E1 or DS3/E3 to allow high bandwidth.

EoPDH has advantages for the delivery of services, such as video and voice, where hitless bandwidth adjustment, low latency and efficient use of bandwidth are critical. EoPDH, is based on the same concept of Ethernet over SONET/SDH and built upon standards-based technologies:

- EoPDH uses GFP as the method of encapsulation;
- EoPDH uses VCAT (Virtual Concatenation) to concatenate the required PDH connection for the required bandwidth of the transmission;
- EoPDH uses LCAS (Link Capacity Adjustment Scheme) for dynamic addition or extraction of link capacity.

These technologies enable EoPDH to not only respond to error conditions rapidly, but also adjust the traffic pipe size, in a hitless manner, while MLPPP link capacity adjustment causes service disruption. GFP supports CRC for error detection and correction, while PPP can detect, but cannot correct errors as in the case of GFP. This helps reduce re-transmission needs due to bit errors, thereby enabling efficient bandwidth utilization. For TCP, this becomes a significant advantage, since TCP treats bit errors as “congestion.” In the event of link failures, VCAT/LCAS provides the required hitless restoration capability without the need for any higher-level protocol, thereby eliminating service disruption, compared to MLPPP, where a link problem will cause service interruption until a higher layer protocol intervenes for service restoration.

One of the most important aspects of EoPDH is its ability to transmit latency-sensitive traffic successfully. With MLPPP, IP packets are fragmented into smaller packets and distributed over multiple links. This necessitates buffering and realignment, thereby causing latency, which is one of the key disadvantages of MLPPP for delay-sensitive applications such as IPTV. EoPDH's VCAT and GFP combination provides byte-level granularity to data, which significantly reduces latency by reducing buffering needs and makes it ideal for IPTV.

PUTTING IT TO THE TEST

To compare EoPDH and MLPPP-based bonding technologies for media delivery services, a series of tests have been conducted for the delivery of reliable, resilient services for applications such as streaming video, which are particularly sensitive to link failure, latency and jitter.

For the testing environment, two separate setups were used that were built upon EoPDH and MLPPP technologies, as illustrated in Figures 1 and 2 respectively. The tests were designed to measure the user experience during streaming media transmission under various network impairments.

Conducting the tests, engineers interrupted T1 lines and caused artificial network congestion by overloading the transmission pipe. The test verified that the media server application runs uninterrupted with a noticeable degradation of video quality during some extreme test cases. However, with MLPPP service interruption occurs where re-convergence of the connection must take place as predicted. During the tests, EoPDH and MLPPP based services were tested simultaneously using side-by-side displays for an unbiased comparison of the media quality while causing network impairment conditions on both setups, simultaneously. The test subjects were then asked to select various user experience attributes from a multiple choice set of questions.

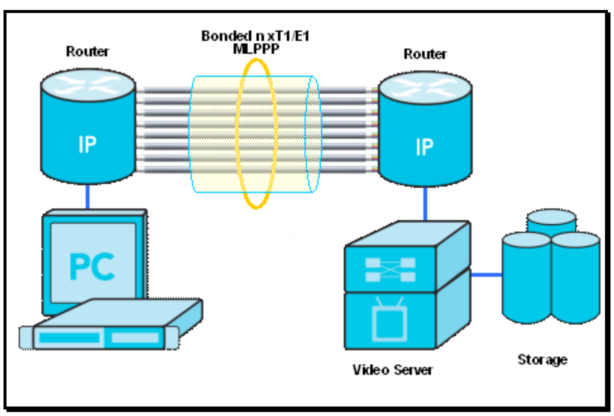

Figure 1 – Video streaming over MLPPP

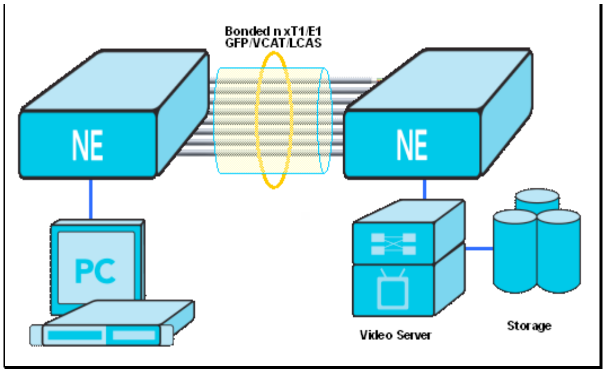

Figure 2 – Video streaming over EtherReach™ EoPDH solution

All test subjects have concluded that the EoPDH-based setup yields a trouble-free viewing experience, since unlike MLPPP, EoPDH does not need the re-convergence times to recover service upon link failures or line degradation. The re-convergence was the cause of stuttering video and audio delivery or temporary loss of service during complete or partial loss of WAN T1 link paths, while the uninterrupted, graceful service recovery of the EoPDH based streams had been ranked better in terms of the subjective user experience.

Independently, the same test setups have been characterized for parametric performance using IXIA equipment. Although the parametric tests may indicate an advantage of the MLPPP setup over an EoPDH setup, from a purely user experience perspective, EoPDH was ranked more favorably for IPTV and voice delivery services by the test subjects, thus hinting that the advantage of EoPDH for IPTV over a significantly more expensive router-based solution.

CONCLUSION

As telecommunications companies continue to roll out IPTV as part of their offerings, deploying the right technologies is becoming an increasingly vital part of each operator's strategy. Among the competing technologies for IP-based voice and video service delivery, EoPDH is a cost effective solution and offers better end-user experience over MLPPP. Through a set of audio and video streaming tests, EoPDH has been ranked higher than the MLPPP by users, who report EoPDH better than MLPPP for end user experience.

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