IPTV

Application Note
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THE IPTV APPLIANCE

INTRODUCTION

With Service Providers pursuing new revenue streams from non-traditional sources, the end result is that providers become more and more alike, and yesterday's specialty services becoming today's commodities. Established voice providers are pursuing high-speed Internet access and multimedia (particularly video) distribution. "Gathering more momentum in the ongoing broadband wars, U.S. phone companies netted slightly more high-speed data subscribers in the second quarter than did their cable rivals," (*Cable Digital News*, Light Reading, 9/14/2006)

The common denominator is the Internet Protocol [IP] as the basis for services delivery. IP-based telephony is offered by cable and satellite data providers as a means to avoid tariffs associated with circuit-switched telephony. Circuit-switched networks transitioned to IP to provide audio and video programming to existing subscribers in hopes of retaining them. Multicast overtook unicast as the efficient transport for multimedia data in the providers' networks.

The optimal edge device, then, will be the one that accurately and efficiently allows for the participation in the new multimedia services, like IPTV, and tracks that usage for revenue generation. Further, it will participate in IPTV while imposing the lowest impact on the core of the network, maximizing network resources for the distribution of additional revenue generating multicast data streams.

With most of the provider infrastructure in place, delivery of multicast data, especially that relating to broadcast and on-demand video (IPTV) is assured *right up to the edge of the network.* What is needed now is development and introduction of a device (or family of devices) that will optimize the last mile of the connection into the premises.

One of the most recent concepts in the distribution of multimedia is the home gateway [GW]. Central to the contemporary multimedia household, the home GW serves as the repository for all multimedia data in the household, to which supplicants connect for content, and to which source devices send the data which they have captured.

The home GW serves all authorized devices within range, and also remote devices connecting via wide-area connections across the Web. In effect, the household then becomes a private or semi-private content provider, filling content requests to all authorized users regardless of connection. It is this application that makes the optimization of that last mile of utmost importance.

The next critical piece of the IPTV story is the optimized, application-specific appliance that guarantees the highest-quality viewing experience for subscribers to the Next Generation Network. Consumers are driving the explosion of multimedia data through the purchase of IP-enabled devices. They will be the primary market for the home GW, securing always-on access to their personal media. It stands to reason the consumer will be the driving force behind the grooming of the last access mile into the home.

Network location will be critical to the placement of the IPTV appliance. It must be located where the benefits from the enhanced technologies can provide the maximum benefit to the last mile connection to the provider network edge. Quality of Service must be extended from provider edge to consumer edge. Overhead associated with multicast distribution must be minimized to provide the greatest amount of bandwidth for actual data delivery. Authorization, authentication and accounting [AAA] must be performed to support provider delivery and prevent theft of services.

The IPTV appliance should lie either within the residence or just without a group of premises (e.g.: multi-tenant unit or small residential association). This will place the device just behind the demarcation between public and private network, taking advantage of a firewall and other security measures in place.
For the multi-tenant implementation the IPTV appliance will be the last location of control for the provider, authenticating requests for participation in multicast streams through local (or remote) policies. It will aggregate all requests for downstream leaf nodes, and convey only those requests for services that are licensed by the consumer back up the tree for registration and participation. It will likewise convey drop requests for more efficient bandwidth reclamation as leaves leave the tree.
As the focal point for group arbitration, the appliance will significantly reduce the amount of overhead associated with joins and leaves by using the most recent enhancements to the group management and multicast distribution protocols. This will also improve delivery of streams as fewer network and processing resources are expended on administrative overhead, and more on delivery of packetized data.
For the home implementation, the appliance serves an offload function for the home GW, providing group administration for all devices within the home, and optimizing delivery of multimedia streams to the requesting device(s) for direct consumption, or storage for future use. Confining the overhead associated with membership administration to the home network, the direct effects are:

- increase in the available bandwidth on the local loop for multimedia data,
- reduction in the group management protocol overhead arriving at the provider edge from subscriber households
- a significant savings in processing overhead associated with the expanded number of devices in the household, as a single authentication is done for the IPTV appliance, which then performs all further downstream authentication.

SUMMARY

With Internet access becoming ubiquitous, and multimedia data (particularly IP-based TV) assuming primary importance as a premium revenue-generating service for Providers, networks are in danger of becoming overwhelmed with control traffic to the detriment of actual content.
Incorporating both IPv4 and IPv6 stacks, the IPTV appliance also incorporates IGMP and MLD in support of group memberships for either v4- or v6-based networks. Performing snooping, and acting as a proxy on behalf of the downstream leaf nodes, the device eliminates multiple control sessions between designated router, or rendezvous point and leaves, freeing large amounts of bandwidth in the public network.
IP Infusion is able to provide embedded software for these Next Generation Network appliances incorporating its market-leading dual IPv4/IPv6 stack, IGMPv3 and MLDv2. Supporting these advanced functions, IP Infusion provides standards-based, robust QoS implementations that are tightly integrated with silicon from leading chip manufacturers so that maximum use is made of available bandwidth in the public (and private) networks.
Each protocol module in ZebOS ARS is built on the ZebOS Network Services Module (NSM). The NSM is the base module that simultaneously and independently communicates with every ZebOS ARS routing and switching process. The NSM manages both the route table and each of the enabled protocols; performs route conversion and redistribution; and manages the interface state, routing policies, and filtering. The ZebOS Integrated Management Interface (IMI) provides a command line interface and SNMP capability that can

be used by vendors as is—or integrated into that vendor's existing management infrastructure. APIs defined in both NSM and IMI are accessible and extendable.

AIS is an architecture of software platforms called the Hardware Integration Platform (HIP), each of which is created for, and pre-integrated with, an industry-leading merchant silicon and an operating system. These HIPs provide a comprehensive forwarding plane implementation supporting L2, L3 (IPv4 & v6), multicast and MPLS/Traffic Engineering. A ZebOS AIS HIP, when combined with the ZebOS ARS protocol software for the control plane, provides a full system solution for enterprise switching, metro Ethernet, access, edge, mobile wireless and advanced IP services applications.

Two key components in the ZebOS architecture enable AIS support—Protocol Abstraction Layer (PAL) and Hardware Abstraction Layer (HAL). PAL is a set of well-defined API that abstracts operating systems calls, enabling ARS to use a unified set of API to access system resources and services such as memory and timer, on any operating systems.

Hardware Abstraction Layer (HAL) is the well-defined, extensible API between the ARS (control plane) and the AIS (forwarding plane). HAL isolates all hardware platform-specific interactions into a small set of well-defined function calls for the ARS (control plane). The HAL provides a unified interface for the control plane to interact with the forwarding plane for all L2, L3, multicast and MPLS forwarding needs. The function calls above the HAL run unmodified for any switching and routing hardware platform. The result is that customers have full flexibility to select only required protocol modules in the most cost- and code space-effective way.

Please visit the IP Infusion Web site for more information on ZebOS architecture and product offerings www.ipinfusion.com.