PCMM's excellent adventure

Early trials working to prove merits of PacketCable Multimedia

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In May of 1974, journalist Jon Landau was so transfixed by a rock concert he'd just attended that he penned what would become an apocryphal statement: "I saw rock and roll future," Landau wrote in an article for a Boston weekly, "and its name is Bruce Springsteen." The cable telecommunications industry generally doesn't regard the knighting of rock stars as one of its core competencies. But we certainly empathize with Landau's enthusiasm for witnessing a breakthrough. In this case, we think we're seeing the future of broadband digital media, and its name is PacketCable Multimedia.

PacketCable Multimedia, or PCMM, is the DOCSIS offspring designed to advance cable's high-speed data networks into a new domain of managed services and interactive, multimedia experiences. Released by CableLabs in 2003, PCMM is a successor to the original PacketCable specification, which describes how to use the underlying high-speed DOCSIS cable data network to deliver a distributed architecture that's well-suited for IP telephony service.

The PacketCable 1.x architecture is limited purely to telephony. Yet even as MSOs are working to make cable-delivered telephony a mainstream consumer offering, operators also are exploring a range of multimedia offerings that may captivate and empower customers. There are some extremely compelling ideas revolving around a mix of services that includes multiplayer video games, content distribution platforms and interesting ways to combine telephone calls and instant-messages with video elements.

Beyond DOCSIS

To deploy any of these services in a manner that produces consistently satisfying customer experiences, networks need to move beyond the core DOCSIS network platform and the telephony-centric PacketCable 1.x specification.

That's not to say that DOCSIS is not a stunning success by any measure. Today's DOCSIS networks represent the nation's most popular means of acquiring access to Internet services at broadband data rates. In the U.S., the cable industry had more than 19.8 million DOCSIS-connected customers at the end of 2004, versus about 13.3 million telco-DSL subscribers, according to Leichtman Research Group.

But in the emerging world of multimedia applications, DOCSIS alone isn't adequate for ensuring the type of network and application performance that's needed to deliver a truly astounding experience across a proliferation of digital household devices. For one thing, the static delivery of bandwidth that is a feature of DOCSIS and other high-speed data networks has the effect of over delivering resources for many applications, and, in the future, could pose a concern of under-delivering resources for others.

Without a specification like PCMM, there is no mechanism for enabling the DOCSIS network to think about what's happening, or to manage the allocation of network resources dynamically, by application, by customer type, or by some other determinant. Imagine a trio of neighbors who happen to be online over a cable high-speed network. One is listening to a friend recite the high points of his weekend golf outing over an IP telephone connection; another–teeth clenched and fingers flying–is playing a graphically rich video game with a rival two states away; and the third (a teenager, of course) is chatting with a friend using an instant-message PC application. Their bandwidth consumption patterns, latency tolerance and network performance demands vary markedly, but under today's prevailing schemes, each of them is treated essentially as a network equal.

A more efficient use of network resources could be produced if the network could recognize the differing demands of each application and ensure that the cable modem termination system (CMTS) reserves the bandwidth with the proper latency, jitter constraints and other performance measures required by the service. The instant-messaging application, for instance, requires far less bandwidth and is much more forgiving of packet delays than the video game session. The game session, on the other hand, begs to be treated with a higher priority level. And there is no tolerance whatsoever for faulty performance in residential telephony: the telephone customer demands and deserves a flawless network connection. If the network understands these priorities, it can steer resources in a manner that best suits user expectations and application performance.

With PCMM, it's possible to allocate resources in a more intelligent manner, to assure failsafe, highly satisfying user experiences across any range of applications, while fortifying selected applications with network quality-of-service conditions that render excellent results every time. This evolution beyond the generic "best effort" approach to data networking has the potential to both distinguish cable as the preferred provider of connectivity for new multimedia services; and to open up new revenue and business opportunities for the industry.

Trial experience

In late 2004 began one of the first industry market trials of a PCMM architecture designed to support a range of new multimedia services. In the trial, the cable operator integrated the DOCSIS 1.1 network infrastructure with a new ingredient: a multimedia policy server. The PCMM policy server authorizes sessions for QoS, signals to the right network gear to set up QoS enabled "flows" for the application media session, and enables prioritization and allocation of network resources associated with various multimedia sessions based on operator-configured policy rules; policy rules which execute based on a combination of the application's QoS needs, what the subscriber is allowed to do, and the network state. That way, the cable provider can assign certain performance parameters to specific applications, thus supporting new multimedia services with the confidence that they'll perform ably in front of customers.

The architecture positions the policy server in the network control plane, where it has knowledge of the QoS state of the network, and where it maintains a sort of holistic position over premium application traffic occurring across the access network at large. Figure 1 shows the QoS signaling interfaces between the various entities in the network.

This control plane approach to providing QoS for premium applications is highly scalable and economically desirable. It enables the operator to leverage the already-deployed DOCSIS 1.1 capabilities in the CMTS and cable modems (CMs) to roll out a new breed of services based on applications with performance assurance. Of course, this means the policy server must be highly scalable, provide very low latency guarantees in signaling, and highly available. This level of redundancy must be a part of the architecture from day one. It is not a feature that can be retrofitted into an existing design easily, and the retrofit typically comes at a cost of performance, scalability and stability.

The control plane approach is essential for the architecture to scale and meet the demands of new subscribers and services. Applications can request for QoS from the policy server, and the server in turn can enforce the rules instituted in the network to describe how resources should be utilized, and to ensure that network resource consumption reconciles with the MSO's business priorities. This network-based model of delivering QoS for applications enables the provider to roll out new applications rapidly, in part because the network no longer must rely on special-purpose end points to deliver QoS. Instead, generic end points and clients that have been authenticated by the application can request for QoS through the application server that is responsible for serving the session. These generic clients can range from PC applications and video game clients, to wireless handheld devices. This network-based model provides greater security in the network because resources can be allocated to applications that have been authorized for QoS by the policy server, not simply to those devices that desire QoS.

PCMM also allows the cable provider to decouple network state from application session control. This is a departure from the PacketCable 1.x telephony specification in which applications are tightly coupled with the transport infrastructure. PCMM abstracts the transport requirements from applications and instead allows them to occur elsewhere in the network. This liberating approach lets the application concentrate on what it does best, which is to setup application sessions and deliver services and content to the client.

The initial deployment is designed with full awareness that a whole range of consumer multimedia devices is emerging– from video game consoles to photo-display tools. In addition, developers continue to amaze with new applications created for the desktop or portable computer. In the PCMM environment, the application client (such as a tool for enriching instant messages with digital photos or video clips) doesn't need to be embedded in a specialized, cable-specific device. It can simply be a PC software client. That means substantially more flexibility and range in applications that can be launched. The power and flexibility introduced through PCMM can be used to extend the operator's reach well beyond the cable plant–into the home and beyond.

PCMM deployments also demand serious integration work with underlying business operations and infrastructure. In the trial deployment described above and in additional PCMM work going on in the industry, most of the integration has focused on applications, and for some projects, integration with OSS systems to ensure the policy server can be properly operated within the network. OSS integration is also critical to being able to create policy rules around subscribers, their entitlements, and what they are allowed to do in the network. Integration with the DOCSIS 1.1 infrastructure through the CMTSs also is a critical component. The PCMM code upgrades on the CMTSs now in place within various operators' networks are under way, with some vendors already having achieved certification.

A favorable constellation of economics is at work in these initial PCMM deployments. The integration of PCMM rules and principles and the addition of a network policy server represent relatively modest incremental investments that ride atop the existing DOCSIS infrastructure and enable the operator to apply bandwidth and QoS selectively to revenue-generating and high-performance applications aimed at customer retention.

Over this DOCSIS layer, the PCMM deployment is supporting enriched multimedia services that have the potential both to generate incremental customer spending and to support long-term strategic goals including improved customer retention and bundled-service longevity.

PCMM is only in its early stages of deployment, and the biggest breakthroughs in multimedia content and services probably haven't even been invented yet. But the good news is that the PCMM architecture appears, based on early experiences with cable operators, to have the breadth and performance muscle to accommodate both existing and future IP services over a broadband data network. To borrow a phrase from a certain New Jersey rocker, cable's multimedia "glory days" are only beginning.