DLNA for operators: heading for a face lift

DLNA is nearing completion of a new collection of features that establish a higher baseline of functionality that compliant devices must support. Stephen Palm outlines these developments and discusses the role of DLNA in maintaining control of commercial content throughout the home.

The promise of multi-room digital video recording (DVR) as well as the ability to deliver commercial content to more devices within the home excites both consumers and service providers. The ability to view any content in any room on any device is a compelling model for the home entertainment network. The realization of such ubiquitous enjoyment, however, requires a consistent foundation of standards and features that ensure interoperability and reliable delivery of content between devices.

The Digital Living Network Alliance (DLNA) has developed a robust set of technical guidelines supporting high-quality streaming of multimedia content over wireless and wired connections between home entertainment and mobile devices. When built into set-top boxes (STBs), digital TVs, Blu-ray players, mobile handsets, personal media players, and other devices, the DLNA guidelines enable a full-service home entertainment network that can deliver even multiple channels of HD video reliably. Service providers are now leveraging these features and infrastructure to enable delivery of commercial content to a myriad of consumer entertainment devices, thus increasing potential revenue opportunities by providing more entertainment options for consumers.

Current copy protection schemes require that every device to which content can stream has a device such as a cable card, CI+ module or smart card to handle all conditional access. Thus, all devices, including televisions, must support the appropriate hardware and software to access protected content and services. In addition, each service provider tends to have its own conditional access infrastructure, equipment and standards. Effectively, manufacturers are forced to put STB functionality into every television.

DLNA and a higher feature baseline

The DLNA guidelines enable robust interoperability and capabilities by outlining a set of standard technologies devices can implement. However, a number of the features contained within the DLNA guidelines are optional, thus limiting the types of capabilities service providers can be sure that clients will be able to support. For example, while a digital TV may support MPEG-2, it may not support advanced viewing modes like fast rewind or advanced codecs such as AVC (H.264).

To ensure widespread support of advanced capabilities and services, the DLNA is nearing completion of a new collection of features that establish a higher baseline of functionality that compliant devices must support. With a specific set of standards and features that are mandatory to implement, service providers can now begin to rely on the availability of devices that meet their stringent requirements for receiving commercial content.

The introduction of a higher feature baseline allows for a major shift in how the home entertainment network is architected. Traditionally, a set-top box is required for every device to which a service provider wants to provide content (see Figure 1a), with a modem plus router/gateway required to support Internet connectivity. This set-top box is necessary to manage content protection as well as implement advanced viewing modes. A network comprised of devices supporting a higher feature baseline, in contrast, allows a single set-top box or gateway per home to service multiple clients across the home entertainment network because content protection and advanced viewing modes can be distributed in a consistent and...
reliable way (see Figure 1b).

The primary benefits service providers gain from a more consistent and capable infrastructure is the eventual reduction of the set-top box at every endpoint and being able to deliver content to new endpoints such as mobile and portable devices. Service providers will also be able to consolidate content protection to a single entry-point in the home entertainment network, which simplifies the implementation of multi-room DVR capabilities that allow content to be viewed in any room of the home. Further consolidation of content storage also becomes possible, enabling the hard drive on the gateway at the entry-point of the home to serve every client across the network. Together, all of the features improve the user viewing experience, increase the reliability and performance of content distribution, simplify installation, and substantially lower system equipment cost.

Consolidating Conditional Access through DTCP-IP
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While the operation of conditional access is relatively transparent to consumers when viewing content, the need to implement conditional access technology in every receiver means that each television available for purchase would be locked to a single service industry type such as cable or satellite or even to a particular content provider. This creates serious issues for retailers since a particular television may be good for only a limited portion of their customers. Alternatively, retailers will have to carry multiple, service provider-specific versions of what would otherwise be the same device. Finally, the need for so many modules or smart cards not only increases the cost of end equipment but also makes it more difficult for users to bring new equipment into the home. Rather than simply being able to bring home a new HDTV and begin watching movies, consumers must first secure an extra module or smart card.

The DLNA guidelines simplify the implementation and management of content protection across the entertainment network using DTCP-IP (Digital Transmission Content Protection). Service providers may still use their existing conditional access technology to protect content as it enters the home. However, rather than require every device in the home to support a service provider-specific conditional access standard, the DLNA guidelines allow consolidation of conditional access functionality into the gateway or primary STB. Under this topology, the only place a module or smart card is required is at the gateway. And, once content reaches the gateway, it is transferred securely throughout the home entertainment network using the single standard DTCP-IP.

Consolidating content protection through DTCP-IP is attractive to service providers, retailers and consumers for many reasons. By facilitating content protection throughout the home with a single, non-proprietary standard, devices only need to support a single standard to display controlled content. As DTCP-IP can be used by many different service providers, substantial cost savings are realized through the elimination of the need for multiple modules or smart cards throughout the home. Retailers benefit because one television can receive protected content from any service provider. Consumers win as well since they can get lower cost equipment that is as simple to install as plugging it in. The true winners, however, are the service providers: DTCP-IP provides a mechanism that offers full content security while lowering system complexity, reducing system cost, and facilitating ease-of-use.

DTCP-IP operates using copy controls that define what content can be streamed to which devices in the home entertainment network. In order to get a license to implement DTCP-IP, manufacturers must agree to implement these control codes appropriately. Companies that fail to abide to these agreements face significant financial exposure. In this way, manufacturers have a vested interest in protecting service provider content.

It is important to recognize that as the gateway is controlled by the service provider, and full control of access to content through DTCP-IP is retained by service providers. This is because the way the gateway handles negotiations with devices for content and decides which devices can receive DTCP-IP streaming content.

Note that DTCP-IP specifically supports content in transit. In this way, service providers also have full control over whether content can be recorded for future viewing. For example, service providers have the option of adopting a topology where the only hard drive that can store protected content resides within a service provider's controlled device such as the gateway itself. Of course, user content that is not protected can be freely transmitted and stored throughout the home entertainment network.

Key features of the next-generation client device
Having a well-defined higher feature baseline as defined within the DLNA guidelines provides a solid foundation for creating a comprehensive and full-featured home entertainment network that service providers can leverage to increase the features and content they offer while building new revenue streams. Some of the capabilities underlying this next generation include the following.

Connectivity. For full flexibility, home entertainment networks require both a wired and wireless infrastructure. The DLNA guidelines provide for a
homogeneous and universal infrastructure through Wi-Fi 802.11n with Wireless Protection Setup (WPS) for wireless connectivity and MoCA for wired connections. MoCA (Multimedia over Coax Alliance) uses the home's existing coaxial cable infrastructure to provide reliable distribution of video content and services. As coax is already used by service providers to distribute video throughout the home, it is the natural choice for video distribution across the home entertainment network.

Remote User Interfacing. Part of the goal of the DLNA is to allow consumers to introduce equipment from multiple manufacturers within the home entertainment network. However, a significant factor in ease-of-use when considering distribution of commercial content around the home is the ability to provide a consistent user experience no matter where content is transmitted. To ensure the availability of common features and familiar access to subscribers, service providers would prefer to be able to project their user interface and brand onto clients, especially clients which the service provider does not provide to its customers.

The RVU Alliance, which consists of many key members of the DLNA, provides a Remote User Interface (RUI) that allows a pixel-accurate user interface to be projected onto an RVU client. RVU is based on technology from the DLNA and can be implemented with a small software addition. In addition, with the RVU RUI, even non-traditional devices such as digital picture frames can receive and display commercial content.

'Trick' modes. Consumers have come to expect the availability of features such as fast forward, rewound, and pausing of live and stored content. Such features are commonplace on DVD players, Blu-ray players, and handheld media players, and consumers expect no less from satellite-, cable-, and IP-based content providers. To implement these features in higher feature baseline clients requires support of trick mode standards such as byte-based, time-based, and playspeed. Service providers will need to implement one or more of these trick mode standards on their servers as appropriate for their content delivery system to meet even the minimum expectations of consumers. Playspeed offers the best-looking trick mode, even on low processing resource clients, since the server creates a new, smooth stream based on the client's current requests.

Formats. All home-based devices following the DLNA guidelines have supported MPEG-2 to date. Service providers wanting to reach consumers through their mobile devices will want to support AVC (H.264) as well since mobile devices are unlikely to natively support MPEG-2. Transcoding technology will also play an important role in bridging content intended for traditional and mobile devices between each other. For example, native MPEG-2 content will need to be converted to AVC for mobile devices. As service providers are transitioning to AVC, for bandwidth efficiency reasons, devices will be able to receive AVC directly and transcoding capabilities between MPEG-2 and AVC will be unnecessary.

Reliability through QoS. Priority-based Quality of Service (QoS) provides the most practical choice for delivering sufficient video performance throughout the home entertainment network. The presence of simultaneous data-driven and time-sensitive traffic streams and services necessitates a mechanism for differentiating between the different latency requirements of each of these.

Priority-based QoS operates by sending priority bits with transmitted packets from the video source. Implementing QoS in this manner avoids the management overhead, complexity, and added latency of parameter-based QoS schemes. Parameter-based QoS also assumes constant bandwidth availability with minimal jitter, conditions which may not be applicable to many home networks. In addition, priority-based QoS is compatible with other media technologies and can be overlaid over existing shared-media home networks. In this way, service providers can set the priority of video streams to receive preferential treatment as they pass through MoCA and Wi-Fi networks as well as Ethernet switches.

Despite all of the benefits offered by a home entertainment network founded on the DLNA guidelines, there will be a certain transition time required to shift from traditional STB-based installations. However, the groundwork is being laid to facilitate a smooth migration to a home entertainment network that reduces the need for a STB at every endpoint. Service provider client devices can contain their traditional tuners as well as home network ‘tuners’, serving as hybrid boxes to ensure a smooth transition between the existing and new network architectures.

In the meantime, the DLNA guidelines and adhering to a higher feature baseline will enable service providers to consolidate hard drives and conditional access mechanisms to realize substantial cost savings. In addition, consistency of features through a baseline will provide sanity in the marketplace by giving consumers a straightforward way to select end equipment without having to worry about service provider and multi-standard interoperability issues. This consistency also gives service providers' confidence that they will be able to deliver content in a standards-based environment. The end result is greater flexibility and functionality for consumers while simplifying designs for manufacturers and keeping service providers in complete control of their content and services. CSI