Cisco Content Delivery System

Delivering Personalized Video Services in IPTV Networks

Consumers today are embracing new methods of accessing and interacting with entertainment, propelled by expectations derived from their experience with the Internet, where they can explore a variety of content unimaginable just a few years ago. As traditional wireline carriers enter the competitive TV services market, they need to meet these evolving demands by providing a differentiated, highly personalized customer experience. The Cisco® Content Delivery System (CDS) is the ideal platform for delivering a broad range of next-generation video services, including video on demand (VoD), network personal video recording (nPVR), time-shift TV, and targeted ad insertion. Employing the adaptive intelligence and unique architecture of this next-generation video platform, carriers can deliver high-value entertainment services with outstanding scalability, performance, flexibility, and service availability.

Challenge

The media landscape is shifting dramatically, and service providers are rushing to adapt. As wireline carriers expand into new markets and new types of services, the ability to deliver a high-quality television offering has become an essential requirement. However, to compete with entrenched cable and satellite operators, incumbent carriers must do more than simply provide another television option. They must offer compelling features that differentiate their service and provide unique benefits for both consumers and advertisers. Fortunately, emerging trends in media content delivery are paving the way for wireline carriers to do just that.

As customer expectations for accessing and interacting with entertainment content evolve, service providers are transitioning from the role of basic access providers to full-fledged “experience providers.” That means being able to deliver the full range of video, voice, and data services to any device, both inside and outside the home, whenever customers choose. This transformation is hastening a new generation of networking technologies that allow service providers to unify traditionally disparate content delivery paths and offer consumers more personalized and interactive video content than ever before. Today, service providers that deliver more localized and on-demand content are seeing growth in average revenue per user (ARPU), increased customer loyalty, and reduced subscriber turnover. In the near future, the most successful service providers will be those that empower consumers to experience their “Connected Life,” providing access to “anything-on-demand” content on the consumer’s television, PC, and favorite mobile device.

For traditional wireline carriers now entering the video entertainment market, these trends present an exciting opportunity. While cable operators move to adapt their deployed video networks for more scalable VoD and other personalized entertainment services, wireline carriers have an opportunity to build state-of-the-art IP-based television (IPTV) networks that are designed from the beginning to provide optimal scalability, flexibility, and content personalization. However, building a flexible IPTV network that can fully meet evolving subscriber demands is no small task.

Next-generation video services such as time-shift TV, nPVR, and personalized ad insertion blur the boundaries between on-demand and conventional broadcast TV, necessitating a video network capable of unifying both types of services into a single infrastructure. To deliver the personalization

and “anytime” access to the variety of content that subscribers increasingly expect, service providers must address the scalability concerns that have until now made it impractical to store and manage vast amounts of programming and ensure that it is all available instantly to any subscriber anywhere. They need a solution capable of automatically adapting to unpredictable and rapidly changing traffic patterns in order to deliver long tail content, including niche and user-generated video, just as easily and cost-effectively as it delivers their most popular programming to millions of viewers.

Solution

The Cisco Content Delivery System transcends legacy VoD solutions by providing wireline carriers with an intelligent network-based platform for delivering the next generation of entertainment, interactive media, and personalized advertising services to their subscribers. This platform, the latest addition to the Cisco IP Next-Generation Network (IP NGN) Service Exchange Framework, combines video ingest, storage, distribution, personalization, and streaming capabilities into a solution that wireline carriers can use to deliver localized, interactive, and personalized content across a growing portfolio of heterogonous devices such as televisions, personal computers, mobile handsets, and emerging rich-media-capable devices.

The Cisco CDS, illustrated in Figure 1, consists of networked Cisco Content Delivery Engines (CDEs) that provide content ingest, storage, distribution, personalization, and streaming capabilities. CDEs can be grouped into arrays for storage and streaming, with these arrays together operating as a single logical system. Carriers can easily expand capacity by simply attaching additional CDEs to the array – achieving essentially unlimited video storage and streaming capacity. This network of CDEs forms a virtual video platform designed to run the following Cisco Content Delivery Applications:

- Vault – Provides fast video ingest and resilient, shared storage of a highly scalable content library available to any streaming node on the network
- TV Streamer – Caches, personalizes, and streams video to subscribers’ set-top boxes (STBs) on demand
- TV PlayOut – Provides video storage and multicast streaming for conventional scheduled or looping video delivery
- Integrated Streamer-Vault (ISV) – Delivers scalable storage and streaming functions in a single CDE for entry-level deployments or those requiring less capacity
- Cisco Content Delivery System Manager – A browser-based console for administering configuration, monitoring, and reporting for all CDEs networkwide

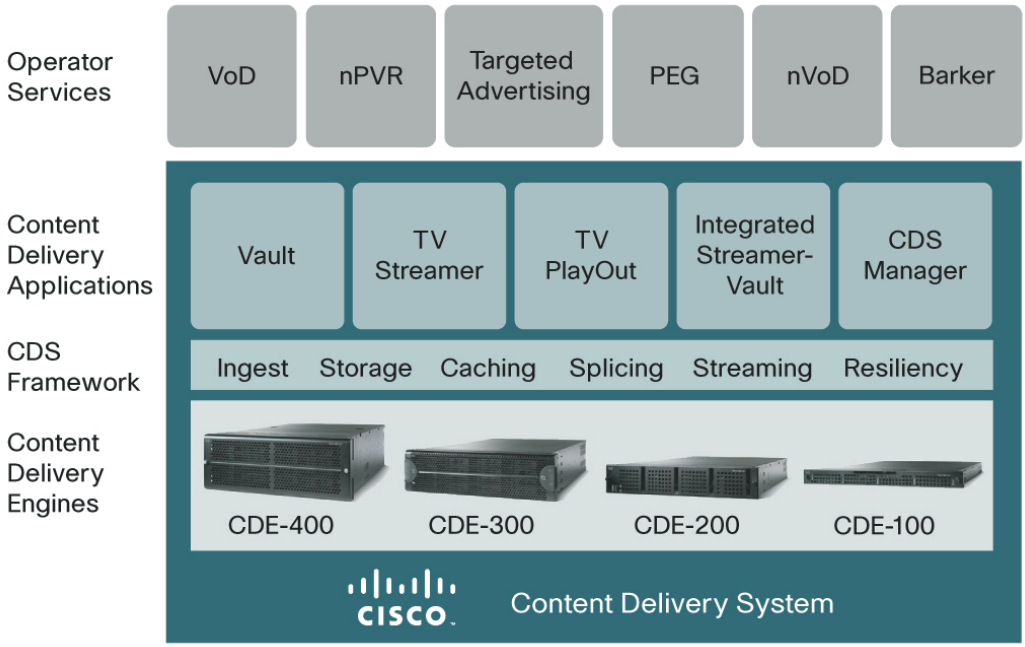
Using these Cisco Content Delivery Applications, carriers can deploy a variety of next-generation, value-added video entertainment services, including the following:

- VoD – Integrated with popular back-office systems and using industry-standard protocols, the Cisco CDS lets carriers deploy VoD services quickly and economically in either a centralized or decentralized network topology.
- nPVR – By deploying the Cisco CDS, carriers can deliver program time-shifting to their installed base of digital STBs with the capability to record, rewind, and pause live TV, directly over the network.
- Targeted ad insertion – The capability of the Cisco CDS to dynamically assemble video streams in real time makes it a uniquely effective solution for delivering customized ad

insertion for both live television and VoD content. Carriers can offer advertisers the capability to deliver high-value localized – and even personalized – advertising to subscribers.

- Broadcast services – The Cisco CDS can be used to broadcast barker channels that stream looping promotional content or informational services, such as a TV channel guide. Carriers also can schedule and deliver a linear program lineup for public, educational, and government access (PEG) channels.
- Near VoD (nVoD) – With the Cisco CDS, carriers can deploy nVoD services through multicast streaming of non-time-shifted content (such as pay-per-view movies) at staggered intervals across multiple channels. nVoD lets subscribers browse programs of interest and watch them at their convenience, without the bandwidth or infrastructure requirements of a full VoD system.

Figure 1. Cisco Content Delivery System Architecture



Previous VoD solutions, which functioned as large, centralized video servers, could offer only a subset of these capabilities, and they were extremely difficult to scale as the VoD subscriber base and content libraries grew. The Cisco CDS functions as a true video network – not just a video server – and takes advantage of the same IP networking concepts that allow the Internet to efficiently scale from a few servers to millions. Wireline carriers can use the platform to begin creating high-value, differentiated video services today by delivering on-demand content, time-shifting, and personalization to consumer TVs. With future enhancements to the Cisco CDS, carriers will be able to extend these services to PCs, mobile handsets, and rich-media-capable devices.

Business Benefits

Building on the rich history and industry-leading expertise that Cisco brings to IP networking, the Cisco Content Delivery System represents a unique, network-centric approach to digital video and IPTV delivery that is fundamentally different from the monolithic server-based VoD products on the

market today. Those products are limited to single-application, proprietary, hardware-centric devices, which are difficult and expensive to scale, cumbersome to operate and maintain, and incapable of incorporating new services to meet changing subscriber demands – essentially succumbing to built-in obsolescence. By fully embracing the capabilities and cost efficiencies of IP networking, the technology underlying the Cisco CDS defines an entirely new paradigm for the delivery of subscriber video services, representing a much more cost-effective, flexible, and future-ready solution. The Cisco CDS provides these benefits:

- Extreme scalability
- Exceptional network efficiency
- Nonstop service availability
- Unmatched flexibility
- Rapid service velocity
- Outstanding performance
- Intrinsically lower total cost of ownership (TCO)

Extreme Scalability

Unlike conventional VoD solutions that limit carriers to the capabilities of the largest single video server, the intelligent architecture of the Cisco CDS achieves built-in scalability using techniques pioneered in scaling the Internet. Just as the Internet scales each time someone deploys a new Web server, the Cisco CDS can scale by simply adding another CDE – dynamically increasing the pooled ingest, storage, caching, and streaming resources available throughout the network. Regardless of the size of the network or the number and mix of applications deployed, the Cisco CDS operates as a single, logical system – providing virtually unlimited capacity for ingest, storage, and streaming.

The flexible architecture of the Cisco CDS allows deployment of ingest, storage, and streaming functions on either a single CDE (for small markets) or separate CDEs where each function can scale independently of the other. As a result, wireline carriers can shape their VoD investments to match their unique network topology and the applications they want to deploy. For example, a carrier deploying an nPVR service (which might require the video platform to ingest hundreds of channels, 24 hours a day) can invest in scaling content storage without spending unnecessarily on additional streaming infrastructure that is not required. Alternatively, carriers can continually scale their subscriber base by adding streaming capacity at the network edge without having to invest in additional replication and storage of the content library.

Exceptional Network Efficiency

The Cisco CDS architecture employs a unique hierarchical storage design that allows carriers to maintain huge content libraries, while actually simplifying content storage management. The platform preserves video programming in a common, shared storage array that is instantly accessible for streaming anywhere in the network. At the same time, the intelligent caching capabilities of the Cisco CDS automate the delivery of video content to the network edge by responding dynamically to actual viewer demand. This adaptive content distribution model helps ensure that the content that is most popular at any point in time at each network node is always available in local storage – reducing the bandwidth burden on the network backbone by up to 95 percent or more. This flexible architecture and the effectively unlimited scalability of content

libraries make the Cisco CDS the industry's only solution for efficiently and cost-effectively delivering long tail content, network-based time-shifted programming, and user-generated content.

Unlike traditional VoD systems, the Cisco CDS eliminates the need to preposition content at every streaming node in the network. Delivery of any content, from ingest into the network to playout on the subscriber's screen, occurs within 300 ms, regardless of where the content is physically stored within the network. This imperceptibly short latency – an order of magnitude less than that for other solutions – also supports the first true convergence of live TV with on-demand content, allowing carriers to deliver personalized streams to each subscriber in the network without disrupting the broadcast timeline.

Nonstop Service Availability

The resource pooling and load balancing of the Cisco CDS, combined with its unique control-plane intelligence, provide built-in resiliency and failover capabilities. CDEs can share state and work together as a single logical pool of resources that can be dynamically reallocated across the available hardware capacity of the network in response to service requests. If a hardware failure such as the loss of a network interface, disk drive, or even an entire Vault occurs, the Cisco CDS immediately and automatically assigns alternate hardware resources so that the failure is recovered transparently. Extending this transparent, self-healing capability even further beyond that offered by others, the Cisco CDS will allow network operators to configure their networks so that even the failure of a TV Streamer application under full load is recovered immediately and automatically, without interruption to viewers' video streams.

In conventional VoD solutions, if a video server fails, all customers who were watching a program streamed from that server experience a service outage. With the Cisco CDS, if a CDE fails (or is even taken off line intentionally for upgrades or scheduled maintenance), the autofailover capabilities of the platform will provide continuous video service – without service interruption to subscribers, and without the need for the idle standby units that conventional VoD servers require.

Unmatched Flexibility

The Cisco CDS is the only video platform designed to support centralized, distributed, and hybrid video networks equally effectively – rather than compelling carriers to adopt a specific video architecture that may not adequately address their needs. To provide the greatest bandwidth efficiency and scalability in large national or regional deployments, the platform is designed to operate as a fully distributed video solution. However, for carriers embarking on a more limited deployment, the Cisco CDS also can operate as a centralized, fully self-contained "solution in a rack." Carriers even can begin by deploying the Cisco CDS in a centralized manner and evolve the platform over time to a decentralized design as the content library and subscriber base grow.

Rapid Service Velocity

The Cisco CDS is based on intelligent, modular software running on a network of high-performance appliances that employ industry-standard designs. As a result, the Cisco CDS can continually evolve to incorporate new services and capabilities without requiring the costly, time-consuming change-out of installed equipment frequently required by proprietary, hardware-centric architectures. Whether adding new features or deploying additional CDEs to scale with demand, carriers can add new functions and capacity without complex redesigns or service outages. The result is faster service velocity and a more flexible video platform with a much longer service life.

Outstanding Performance

The Cisco CDS delivers exceptional density and performance. A CDE running the Vault application supports a maximum ingest rate of more than 750 Mbps – enough for up to 400 channels of video – and can store 12 Terabytes of content – representing up to 12,000 hours of content. A CDE running the TV Streamer application can deliver 12 Gbps of streaming bandwidth (up to 5000 video streams) and can be clustered into arrays capable of streaming to more than 1 million subscribers simultaneously. (Ingest, storage, and bandwidth capacity vary by format – MPEG-2 or MPEG-4/AVC – and resolution – standard definition [SD] or high definition [HD].)

Intrinsically Lower TCO

The exceptional scalability and service availability of the Cisco CDS, together with its intelligent caching and storage capabilities and the ease with which it allows wireline carriers to deploy new applications and services, combine to deliver superior value. The Cisco CDS provides the following:

- Operational simplicity – Carriers can manage hundreds or even thousands of CDEs as a single system, centralize content ingest and library storage, automate content distribution with adaptive technology that dynamically accommodates changes in viewing behavior, and create a highly resilient environment that automatically adapts to device failures and maintenance upgrades.
- Reduced capital expenses – The intelligent caching technology of the Cisco CDS eliminates the need to replicate content at each streaming node, significantly reducing content storage requirements. By minimizing the number of required headends; eliminating the need for one-to-one video server redundancy; and supporting VoD, nPVR, and advertising services with a single infrastructure, the platform further reduces hardware costs for the video network. As a software-based solution, the Cisco CDS also allows carriers to continually add new services and features without upgrading hardware.
- Reduced operating expenses – The inherent resiliency and automatic failover capabilities of the Cisco CDS significantly reduce system maintenance and upgrade costs. Further, the hierarchical storage and intelligent caching capabilities of this solution can reduce network backbone use by more than 95 percent, delivering enormous recurring bandwidth savings.

In addition, unlike conventional standalone VoD solutions, the Cisco CDS acts as a fully integrated component of the Cisco IP NGN – the industry's only comprehensive "glass-to-glass" solution that can scale to targeted customer bases, maximize bandwidth resources, provide end-to-end quality of service, and effectively deliver IP-based video services to any market, over any high-speed access technology.

Why Cisco

As consumers continue to experience new forms of content delivery, their expectations for video entertainment services are evolving. Carriers that can deliver the large content libraries and highly personalized services that subscribers demand stand to cement their position in the dynamic market for entertainment services and develop longer-lasting, more profitable relationships with their customers. The Cisco Content Delivery System is the ideal platform for intelligently and cost-effectively delivering the full range of next-generation video content, personalized entertainment, and targeted advertising services. Employing proven Cisco IP networking intelligence and a unique distributed architecture, the Cisco CDS provides exceptional scalability and service availability, outstanding performance, and a lower TCO than other solutions. Recognizing these advantages, major service providers around the globe have deployed the Cisco CDS to deliver high-value entertainment services today, while at the same time positioning themselves for expansion in scale

and service offerings that will deliver to their subscribers a true “Connected Life” experience through access to personalized content anytime and anywhere they want.

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