Monetization of the IP Video Opportunity: Cisco and Anystream Enable New Business Models

Introduction

With total marketplace spending for paid and ad-supported online video content expected to increase from US$1.5 billion in 2008 to $2.3 billion in 2009, service providers are seeking new opportunities to deliver video over new platforms. Service providers, especially those who offer triple or quad play, want to expand the reach of traditional TV assets to their customers' PCs, mobile phones, and end-user devices of tomorrow. Just as viewers quickly adopted and now expect anytime, anywhere access to video content, service providers must capitalize on technologies and solutions that deliver premium content to subscribing customers on demand.

Cisco and Anystream have collaborated to provide the Cisco® Managed Media Solution, an end-to-end solution that allows service providers to convert their video-on-demand (VoD) content to streaming content that can be accessed on an end user's PC or mobile phone. The fully automated process transcodes VoD assets to Flash or Windows Media, publishes the content listings to a navigation portal, and selectively applies Digital Rights Management (DRM) to the content. Subscribers view a list of content on a customer-facing navigation portal that displays the programming they are authorized to view. After the subscriber makes a selection, the content is streamed to the subscriber's device – either a PC or mobile phone.

The Managed Media Solution gives service providers the infrastructure and complete solution to deliver appropriately formatted and licensed content to any end-user device.

Overview of the Content Delivery System

A key component of the solution is the Cisco Content Delivery System (CDS) – an integrated system with a network-based architecture that transcends existing streaming solutions. It incorporates both TV streaming applications for content delivery to digital televisions and set-top boxes (STBs) as well as Internet streaming applications for content delivery to IP devices such as PCs and Wi-Fi connected mobile phones and personal digital assistants (PDAs). The Internet streaming applications described in this paper only require the CDS Internet streaming components, but "converged" services, which deliver Internet content to IP-enabled STBs, may also make use of the TV streaming components of the CDS.

Because the Cisco CDS uniquely delivers personalized services to both STBs and IP devices, it empowers service providers to transform themselves into "experience providers" in order to offer Connected Life services to subscribers.

Because of its tight integration of TV streaming and Internet streaming capabilities, the Cisco CDS unleashes new capabilities never before possible. For example, it enables "session shifting" between devices; a television viewer can now pause a program on TV, leave home to catch a train, and resume watching the program from the same point on a laptop or a PDA during the train ride. This is just one of the many possibilities.

CDS Internet streaming technology incorporates three main functions: content ingest, service routing, and content delivery.

Content Ingest

Content ingest is the process of taking in content from the Internet for distribution to devices throughout the Cisco Content Delivery System. The system makes use of standard Internet protocols (such as FTP, HTTP, HTTPs, and CIFS) to acquire content from the Internet and from service-provider-controlled sources. It supports both “pre-ingest,” when popular content is ingested before it is needed, and “dynamic ingest” when it is acquired in real time. The Cisco CDS is therefore able to quickly adjust to changes in content demand; when a new piece of user-generated content becomes hugely popular, it will be automatically cached for very scalable distribution to a large number of users.

Service Routing

Service routing is the process of intercepting subscriber requests for content and ensuring that content is delivered appropriately by using a streaming device that is in close proximity to the end user, passing automated health checks, and running at acceptable load. Multiple standard HTTP and RTSP redirection methods are supported. Service routing makes the CDS scalable, flexible, reliable, and efficient. It also helps ensure “location independence” – meaning that subscribers can be served regardless of where they are on the network.

Content Delivery

For final delivery to the end user, content is either streamed or transferred (downloaded) to the subscriber. Content can be streamed to the subscriber in multiple formats including Windows Media Technology, VC-1, Adobe Flash, and QuickTime for maximum client compatibility. A sophisticated caching protocol dynamically fetches content from other devices in the system when it is required. Popular content typically remains in the cache, thereby maximizing efficiency and reducing operating expenses (OpEx).

Table 1 lists the individual Cisco Content Delivery Applications (CDAs) in the suite of Cisco CDS Internet streaming applications.

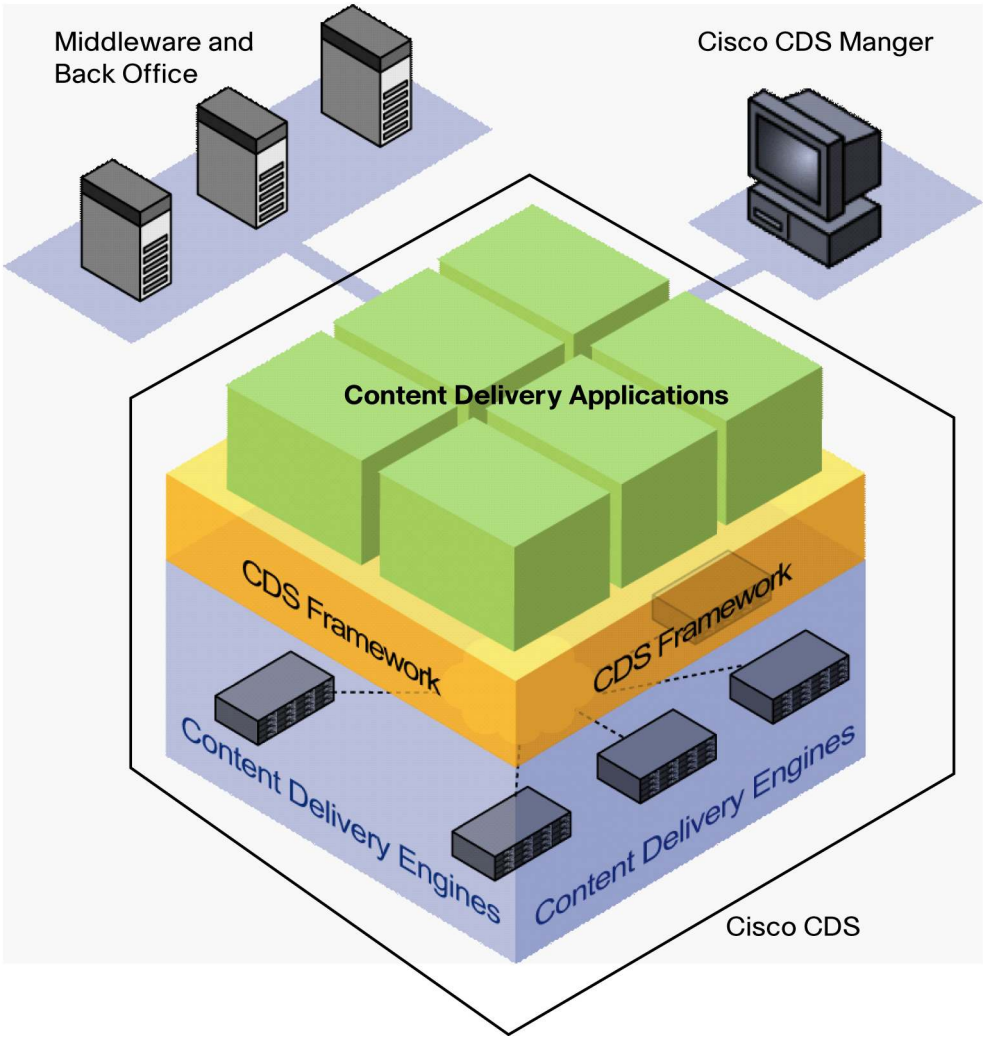
Table 1. Cisco Content Delivery Applications

Content Delivery Applications	Description
Cisco Content Acquirer	The Cisco Content Acquirer provides content ingest and storage functionality. It supports both pull- and push-based models to ingest content from a variety of sources including the web.
Cisco Internet Streamer	The Cisco Internet Streamer provides edge caching, content streaming, and download to subscriber IP devices such as PCs.
Cisco Service Router	The Cisco Service Router is used to mediate requests from the subscriber IP devices. It is responsible for choosing the most appropriate Internet Streamer based on location and load conditions of individual Internet Streamers.
Cisco Content Delivery System Manager	The Cisco Content Delivery System Manager is a graphical, browser-based application designed to manage the elements of a Cisco CDS network. It offers a workflow-based approach, automating and centralizing the major system management functions, including configuration, monitoring, troubleshooting, reporting, and maintenance.

Cisco CDAs bring application-level intelligence to Internet streaming, and use the Cisco Content Delivery Engines (CDEs) to deliver revenue-generating services. The Cisco CDEs are a family of carrier-class appliances at the foundation of the Cisco Content Delivery System. Networked Cisco CDEs work together to provide scalable and flexible content ingest, storage, distribution, personalization, and streaming capabilities.

Figure 1 illustrates the components of the Cisco CDS.

Figure 1. Cisco Content Delivery System Components



Anystream Media Lifecycle Platform

The Anystream Media Lifecycle Platform™ provides automated digital media production and asset management solution for the Cisco CDS solution. Anystream's platform of integrated solutions enables service providers to produce, manage, and monetize their content for delivery across multiple outlets and to all end-user devices. Anystream automates production workflows and centralizes asset management, scheduling, distribution, and reporting for advertising, content security, user-generated content (UGC), and globalization initiatives.

As a software solution, Anystream is easily implemented and can be configured to accommodate evolving industry standards and requirements, including new codecs, distribution channels, supporting platforms, and capture hardware.

The following Anystream solutions are integrated in the Cisco Managed Media Solution; each is described in detail throughout this white paper:

- Asset management: Anystream Velocity™
- Video production: Anystream Agility®
- Content rights and usage: Anystream DRM Fusion

- Content distribution: Anystream Entitlement Server
- Content tracking and delivery: Anystream Portal

Asset Management: Anystream Velocity

Anystream automates the workflows for asset management for on-demand services with Anystream Velocity, the first purpose-built intelligence platform for on-demand and multiplatform digital media. Anystream centralizes scheduling, metadata management, and reporting capabilities to enable service providers to track and comply with contract terms and agreements. Anystream unites video production with operations and business management to provide insight into asset inventory and usage and provides reporting to enable efficient response to new business opportunities and increase utilization of existing media assets.

Anystream Velocity manages and enforces the deal terms and contract rights between all parties – those between the content rights owner and the content distributor, as well as the distribution deal terms between the content provider and the service provider. Metadata, stored in Anystream Velocity for each title, is packaged and readied for review and approval. Content ingest and post production tasks, including QC and approval, are completed and titles are then linked to their respective scheduling windows.

Once content is prepared, approved, and ready for distribution, titles are scheduled and availability and expirations are set. Additional rights and contract validation help ensure distribution accuracy and the schedule is published to the service provider for review. Upon schedule approval, the final full packages are published and sent to the service operator or distributor.

Video Production Automation: Anystream Agility

Anystream automates video production and prepares digital media in any format for delivery to any platform. Workflow automation replaces manual, time-consuming, and error-prone steps in the media production and delivery cycle. Anystream Agility, the established solution for automated digital media production, encodes media for easy exchange between broadcast hardware systems, non-linear editors, asset management systems, media storage systems, and web and streaming servers.

Agility addresses each stage of the production workflow used to transform analog or digital media from its original format into any number of media formats, at any transmission or bit rate in a distributed, redundant computing environment. Anystream captures from tape, live feeds, and linear editors and can ingest file-based user-generated content and broadcast formats. Noncreative production tasks such as editing, assembly, trimming, and audio/video extraction are performed and then content enhancement, including graphic overlays, branding, and advertising can be added. Content is readied for global distribution through standards conversion and the application of subtitles and captions to meet necessary regulatory compliance. Finally, content and its associated metadata is formatted and transcoded and converted for consumption on any platform.

Anystream Agility can be configured for on-demand delivery including:

- Web and mobile: Prepares media for online premium services and syndication with faster-than-real-time encoding for web, mobile, IPTV, and VoD.
- Broadcast: Automates conversion and exchange of media between non-linear editing systems, play-to-air servers, news production systems, and streaming and web servers in any major digital format.

- Live: Captures media from baseband feeds and simultaneously encodes into any number of output formats and bit rates.
- VoD: Automates the workflow components for producing standards-based CableLabs®-compliant VoD content.

Entitlement Server: Anystream Velocity

The Anystream Entitlement Server allows service providers to restrict or allow access to content depending on the end user's subscription package and also provides the hooks to the service provider's billing infrastructure. For example, the Entitlement Server allows a premium content package subscriber to access premium content at no additional charge, while a non-subscribing customer will be charged an incremental fee to view the same content.

The Entitlement Server provides the interface to the Anystream Asset Management System (Velocity) to display content listings in the end-user portal. The Portal Server generates billing records of viewed content and passes viewing information back to the service provider's billing system so end users can be charged.

The Entitlement Server also manages subscription services and guide services. It interacts with the service provider's billing system to keep the most up-to-date list of user account information and also tracks user IDs and passwords, authentication codes, and MAC addresses of the devices associated with a user's account. The system also generates a list of viewed content for each end user, which is then sent to the billing system.

The Entitlement Server also manages guide services by retrieving program listing data from the Anystream Asset Management System and storing it in its database.

Anystream DRM Fusion

Anystream DRM Fusion encrypts content and generates content license keys to ensure that only authorized users can play back content served from the Cisco CDS. DRM Fusion supports multiple authorization models including subscription, single or multiple plays, and view for period of time. DRM Fusion allows copy for a specified number of machines and prevents duplicating copies of copies, to further protect the content owner's assets.

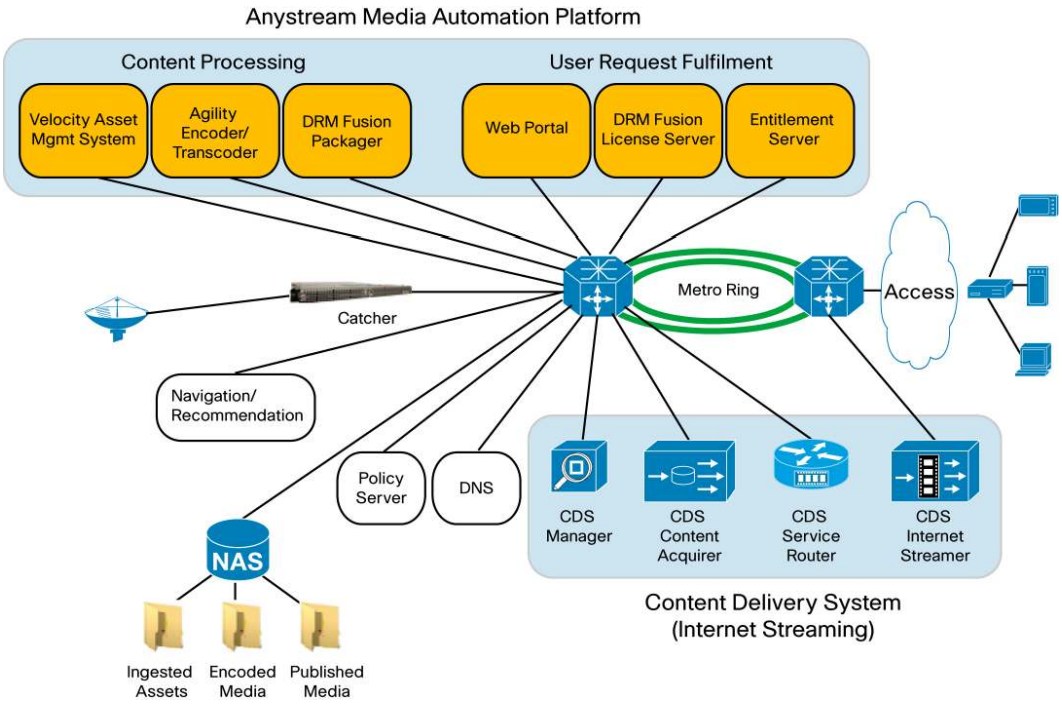
DRM Fusion includes two components: a packager and a license server. The packager encrypts the content and the license server provides users with license keys that allow them to view the content after appropriate authentication. Licenses can be delivered with the content or after the consumer provides additional information to the software.

Web Portal: Anystream Velocity

Anystream provides a web portal application that serves as a web-based user interface for users to log in, view a hierarchical listing of content to which they are entitled, and select and stream content.

Figure 2 depicts the end-to-end infrastructure for an Internet streaming solution. Primary components include (a) content delivery system, (b) asset management, (c) transcoding, (d) conditional access and digital rights management, and (e) entitlement server. (Other optional components include policy server and navigation/recommendation engine.) Each of the primary components will be discussed in the following sections.

Figure 2. Internet Streaming Solution Architecture



Content Ingest and Distribution

Content ingest and distribution is provided by the Cisco Content Delivery System (CDS). Content is ingested into the Cisco Content Acquirer from an origin server owned by the service provider. The Content Acquirer uses standard FTP or HTTP to ingest the content. After content is processed (transcoded and encrypted), it is then sent to the Content Acquirer, and can be directed to appropriate CDS streamers on request.

Asset Management System

The asset management system (AMS) automates all processes required to ingest content, process and transcode it to the specified formats, and push the finished content into the Cisco CDS for delivery. When a user requests a specific title, the AMS authorizes the transaction with an entitlement server, communicates with the policy server to ensure that appropriate QoS is provided, and communicates the transaction to the billing system.

Transcoding

Anystream provides the system transcoding, which converts standard cable video format (MPEG-2) into an “Internet-friendly” format such as Adobe Flash, Windows Media, or Apple QuickTime.

In addition to transcoding content to the correct codec, the transcoder must also modify the bitrate or the encoding parameters to be appropriate for the target device. For example, the screen size and allowable bitrate of a mobile phone are significantly lower than those for a PC, so a service that targets both device types will typically require the content to be transcoded into formats or profiles suitable for each target device.

Key benefits of Anystream's transcoding solution include:

- Anystream accepts all common codec types used by cable operators as well as on the Internet

- Anystream applications can be run on any standard Windows server
- Anystream's highly efficient algorithms maximize video quality and minimize processing time
- Automation scales to handle an unlimited number of jobs
- Automation greatly reduces processing time and reduces human error

Conditional Access and Digital Rights Management

Conditional Access (CA) and Digital Rights Management (DRM) help ensure that streamed digital content and downloads to end-user devices meet and follow the contractual obligations established with the content owner.

Traditional cable CA systems restrict content to STBs that receive specific license keys to view the content based on the programming package or purchase of that specific content.

As content is moved to less secure devices such as PCs and mobile phones, there is increased concern that any security system may be compromised. To alleviate this threat, Anystream's DRM Fusion is used to provide downloadable security. In the event of a security system breach, a software patch can quickly provide a fix for the compromised system.

Anystream DRM Fusion also provides tremendous improvements in flexibility over traditional CA systems, with policies that:

- Allow access to content for only a set time period.
- Permit content to be transferred to a set number of devices.
- Add forensic watermarks to indicate the original purchaser of the content.
- Restrict viewing to ensure an encrypted path to the end device (for example, requiring playout on an HDCP-enabled system).

Video Streaming Process: End to End

Following is a description of the end-to-end process of ingesting content, transcoding the content, encrypting it, and then delivering it to an end user.

Content Ingest And Processing

Step 1: The asset management system (AMS) directs the catcher to ingest content from a specified source.

Step 2: Ingested content is stored in an "Ingested Assets" folder, on a network attached storage (NAS) device, for example. When the Anystream AMS determines that the file ingest is complete, it directs the Anystream Agility Encoder/Transcoder to convert the content into files with appropriate codec and bitrate for the receiver devices. Once transcoding is complete, the content is stored in an "Encoded Media" folder.

Step 3: The AMS detects the transcoded content and directs the Anystream DRM Fusion Packager to encrypt the content – using policies appropriate to that content's owner.

Step 4: Once complete, the DRM encryption engine stores the content to a "Published Media" folder on the NAS. The AMS detects these files, and directs the Cisco CDS to ingest the files into the Cisco Content Acquirer.

Step 5: Once the push to the Cisco Content Acquirer is complete, the Anystream AMS determines that the content is ready for delivery to the end user, and "publishes" the content on a web portal (for Internet devices). The web portal can be provided by Anystream or by the content provider.

Content Request Fulfillment

Step 1: The end user browses the web portal and selects an asset that he or she would like to view. The viewing experience may be an on-demand experience using streaming or progressive download, or a live streaming experience. The Anystream AMS may optionally customize the web portal based on input from either a navigation/recommendation engine that tracks user preferences or from the Anystream Entitlement Server, which tracks which titles the subscriber is allowed to access (for example, based on what has been purchased, parental controls, subscription package, etc.).

Step 2: When a user clicks on a link corresponding to a specified asset, the request for the URL is directed to a DNS server. The DNS server is configured to direct all requests in the domain to the Cisco Service Router application. The Service Router, upon receiving the redirected request from the DNS server, then selects an appropriate Cisco Internet Streamer based on criteria such as load, health, and proximity of each Internet streamer to the requestor.

Step 3: The Anystream AMS receives the request and verifies with an entitlement server that the user has the rights to access the content. If the user is authorized to view the content, the AMS then directs a policy server to set up a QoS policy and has the DRM license key server provide a key to the end user's device to enable the user to decrypt the content. The Anystream AMS may also optionally notify a policy server that can set up QoS for the session to guarantee a strong quality of experience (QoE).

Step 4: The Cisco Internet Streamer streams the content to the end user. If the content is not already in the Internet Streamer's cache – as will be the case for newly ingested content – it will dynamically request the content from the Cisco Content Acquirer in real time. In this case, within 200 milliseconds (ms) the Internet Streamer receives the content from the Content Acquirer and begins streaming the content to the end user. If the content is already in the Internet Streamer's cache, streaming will begin immediately.

The system has full flexibility to support both real-time streaming and progressive download delivery mechanisms. In the case of streaming delivery, the user's hard drive never actually stores the content – and user controls such as "pause" and "rewind" are all accomplished using signaling (such as Real Time Streaming Protocol [RTSP]) into the network.

With progressive download, the file is actually stored on the user's hard drive, with pause, rewind, and other controls handled in the client software.

Summary

Cisco and Anystream together provide a full end-to-end Internet streaming solution that enables service providers to quickly and efficiently develop a strong web presence and deliver a new generation of services. As service providers evolve into "experience providers" that deliver video services to all types of devices, the system leverages the ubiquity, flexibility, and scalability of IP – providing a scalable platform that can also evolve with the needs of end users. Key advantages include:

- Comprehensive end-to-end solution enables service providers to deploy services quickly – minimizing the burden of in-house testing.

- Automates the entire workflow for an Internet streaming service, minimizing OpEx and the possibility of human error.
- Highly scalable solution enables service providers to start small and add streams as uptake increases.
- Provides sophisticated application specific functions, such as security, tracking, captioning, graphic overlays, etc.
- Integrates both live and on-demand workflows.

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Printed in USA C11-515192-00 01/09