Cisco Videoscape

SP3/L2

Martin Slinták, Systems Engineer SP, mslintak@cisco.com
Prošíme, ptejte se nás

- Twitter [www.twitter.com/CiscoCZ](http://www.twitter.com/CiscoCZ)
- Talk2cisco [www.talk2cisco.cz/dotazy](http://www.talk2cisco.cz/dotazy)
- SMS 721 994 600
Program

• SP Video Trends

• Videoscape Experience

• Videoscape Architecture
  1. Acquisition Suite
  2. Distribution Suite
  3. Media Suite
  4. Videoscape Clients
  5. Conductor
SP Video Trends
Experiences Consumers Want Now
But SP’s Struggle to Deliver

Online Content on TV/STB

Intuitive Unified Navigation for All Content

Multiscreen TV Experience

Web 2.0 Experiences on TV/STB
Experiences Consumers Want Now
But SP’s Struggle to Deliver

Online Content on TV/STB
Multiscreen TV Experience
Web 2.0 Experiences on TV/STB
Intuitive Unified Navigation for All Content

Without Forklift Upgrade of Existing Infrastructure
Three Dimensions of the Problem: Content, Transport and Devices

Managed & Unmanaged Content

Managed & Unmanaged Networks

Managed & Unmanaged Devices
<table>
<thead>
<tr>
<th>Network</th>
<th>Devices</th>
<th>Content</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managed</td>
<td>Managed</td>
<td>Managed</td>
<td>Existing Linear, VOD</td>
</tr>
<tr>
<td>Managed</td>
<td>Managed</td>
<td>Unmanaged</td>
<td>YouTube-to-TV</td>
</tr>
<tr>
<td>Managed</td>
<td>Unmanaged</td>
<td>Managed</td>
<td>Linear, VOD to the PC, Game Console</td>
</tr>
<tr>
<td>Managed</td>
<td>Unmanaged</td>
<td>Unmanaged</td>
<td>Existing HSD Service w/ optional QoS</td>
</tr>
<tr>
<td>Unmanaged</td>
<td>Managed</td>
<td>Managed</td>
<td>Netflix/Roku, Amazon Unbox/2Wire, AppleTV</td>
</tr>
<tr>
<td>Unmanaged</td>
<td>Managed</td>
<td>Unmanaged</td>
<td>Google Android</td>
</tr>
<tr>
<td>Unmanaged</td>
<td>Unmanaged</td>
<td>Managed</td>
<td>Sling, Linear, VOD to the PC while traveling, Comcast The Fan</td>
</tr>
<tr>
<td>Unmanaged</td>
<td>Unmanaged</td>
<td>Unmanaged</td>
<td>Yahoo/Google</td>
</tr>
</tbody>
</table>
Traditional Service Provider video is in the bottom left front quadrant. Using a Managed Network (HFC, DSL, FTTH) and Managed Devices (Set Top Boxes) to provide Managed Content (HBO, ABC, ESPN, grid guide, VOD, Etc)
As seen by the SP, established Over The Top content occupies the rear upper right quadrant. Consumers using an unmanaged network with the subscribers' devices (PC, Mac, cell phone, game adapter) to receive Content from a variety of sources.
Netflix etc can be characterized as using unmanaged networks and Managed/Unmanaged devices to deliver managed content.
The challenge is to provide a solution that covers each of these quadrants, without introducing complexity and cost. Design to the most general case, optimize where appropriate.
From Best-Effort to Fully-Managed Offerings
Challenge is to Provide a Solution that Covers All
From Best-Effort to Fully-Managed Offerings
Challenge is to Provide a Solution that Covers All
From Best-Effort to Fully-Managed Offerings
Challenge is to Provide a Solution that Covers All

Design to the most general case
Optimise where appropriate
Session Shifting between Different Services
Pause and Resume across Devices
Today’s Over-the-Top (OTT) Adaptive Streaming Delivery

Service Providers have little control and visibility into OTT services
Content Providers have little control of the delivery of their content
Two Worlds are Coming Together

**Internet**
- Simple access business model
- Built for scale
- Limited security/privacy
- No SLAs

**Managed Services Network**
- Multiple business models
- Focused on services
- Built for performance
- Security, privacy, SLA guarantees
Two Worlds are Coming Together

- Flexible business models
- Massive scale and performance
- Secure, privacy option, guaranteed
- Services anywhere on any device
Videoscape Experience
Introduction: Fragmentation

- Fragmented Consumer Experience
  - Linear programming confined to TV
  - OTT content confined to separate devices and platforms
  - Separate navigation and UI for each content source

- Fragmented Business Models
  - Hard for SP to differentiate and demonstrate value
  - Content value diminishing
Solution: Videoscape

- Infinite content choices
- Managed and unmanaged networks
- Managed and unmanaged devices
- Demo today will show STB, iPad, Android, and PC/Mac
- Reinvent the TV experience
- Let’s see how your SP uses Videoscape across all your devices
Videoscape Strategy

Integrated & Consistent Experience

Unified experience beyond TV

Unified experience beyond Android & Apple devices

SP Customized UI and UX

Universal Guide

Infinite Content Sources

Managed & Unmanaged Networks

Managed & Unmanaged Devices

Multi-screen, cloud services

QoE

Quality of Experience
Videoscape TV UI
Introduce Home Screen

- “10-foot” experience
- Purpose-built for big-screen TVs
- Navigation with one thumb and a remote control
**Videoscape TV UI**

**Home Screen Features**

- **Your Queue**: Content you’ve bookmarked, purchased, or recorded. New episodes of your favorite shows.
- **Friends Feed**
  - Recommendations; what’s trending now
  - Share and comment on content
  - Start a text or video chat
  - SP-managed social networking plus OTT services (Facebook, Twitter, etc.)
- **What’s Hot**: Promote and monetize content
- **Rich navigation**
- **Full integration**
  - Aggregated metadata across all content sources
  - Content cached at STB or gateway for higher-quality experience
  - Content can be downloaded for targeted experience
Videoscape TV UI
Recommendations / Unified Theme

- Share Favorites
  - Recommend content to your friends
- Show “Recommendation wheel” on iPad, PC
- Unified Theme
  - Same UI “theme” across different devices
  - Each device UI tailored for specific form factor and capabilities
  - All recognizable as being part of the same Videoscape “experience”
Videoscape TV UI
On Now

- Rich, dynamic Video Wall
  - Browse linear programs more visually
  - Watch, record, share with friends
- Monetization
  - Related Content available for purchase
  - Browse and purchase while viewing
- Personalization
  - Toggle Favorites menu
  - See what’s “Trending” among friends
Videoscope iPad UI

On Now

• “On Now” EPG also available on iPad and other devices
  • Browse linear programs on iPad, Android or other device without interrupting big screen experience
Videoscape TV UI
On Demand

• Rich content choices
  • Movies, TV, music, games, eBooks, etc.
  • Purchase on TV, view on any other device
  • Browse hottest content based on popularity among SP customers

• Multiservice integration
  • Browse SP VOD library plus OTT: Amazon, Netflix, etc.
  • One-stop shop for all video services

• Share content with friends
• Multiservice integration
  • Videoscape can aggregate offers from multiple content providers
  • Offer consumers a broader choice of content sources and catalogs
• Related Content
  • Service Provider can suggest related content from their catalog
My Library

- Personalized content
  - Recorded, purchased, or downloaded content in one place
  - Consume all content (video, music, etc.) on your TV
- Monetization
  - Browse and purchase related and popular content
  - Recommendations based on what other SP customers are watching
- Recommendations
  - Open architecture integrates recommendations from multiple sources
  - Workflow, content management, all integrated in the cloud by VMS
Videoscape TV UI
Universal Search

- Search across all content sources, both on SP network and off
- Discover results from linear TV, SP VOD library, OTT sources, etc.
- Delineate content already in your library from new content
- Key differentiator versus OTT platforms:
  - Integrates SP VOD library
  - Universal rights locker across multiple screens
  - Easy, powerful customer experience
Videoscape TV UI
My Friends

- Rich social networking
  - SP social networking tool
  - OTT services (Facebook, Twitter)
- Trending and recommendations
- Comment
- Launch text or video chat
Videoscape TV UI

Apps

- Access SP and third-party apps for your TV
- Social networks (Facebook, Twitter)
- Local news, weather, etc.
- Personalized stock ticker
- Games
Videoscape TV UI

TV Experience Conclusion

- Amazing experience in its own right
- Now, let’s look at how your SP extends it to all your other devices
Videoscape iPad UI
General iPad UI Controls

Back button (works within app)

Universal Search

Switch View (Tiled or List)

Main Navigation
My Library, On Now and OnDemand
**Launching app to Home Screen**

- Consistent experience
  - Same metadata and content across screens
  - Content cached locally for better experience
  - Downloadable content for anytime/anywhere consumption
- Platform-agnostic
  - Differentiator over Google or Microsoft
  - Customers can use any device they choose
  - SP can shift some capex costs to consumer
- Universal rights locker
  - Purchase content on one screen, consume on any other
Videoscape iPad UI
Introduce Home Screen

• Consistent experience and interface with TV
• Access to My Library, On-Demand and linear programming
• No need to learn new UI for new device
Videoscape iPad UI
Demonstrate iPad Search and Navigation

- Faster, easier navigation and search
- Full integration with iPad
- Rich, visual browsing
- Multitouch experience (gestures, swipe) enhance navigation
Videoscape iPad UI
Managed and OTT Integration with Social Media Links

- Painless device registration
- Multiple touchpoints for social media
Videoscape iPad UI
Introduce Advanced Playback

- Bookmarks
  - Bookmark favorite scene or place for later viewing
  - Bookmarks stored in cloud, not device, extend to all screens
- Program chapters
- Browse special features and content associated with title
Videoscape iPad UI
Demonstrate My Library

- All of your personal media content: movies, TV, music, apps
- Content cached for easy consumption, can be streamed through SP portal
- Integrates content from multiple sources: managed service provider sources and OTT
- Rich experience with multiple views
Videoscape iPad UI
Introduce On Now (Linear TV)

• Access linear programming across multiple screens
• Rich navigation
  • Scroll wheel showing most watched programs
  • Browse channels with iPad gestures
  • Full time-shifting capabilities
Videoscape iPad UI
Introduce Video On Demand Features

- Rich two-screen experience
- Discover on iPad, play on TV
- Navigate secondary content during playback
  - Browse chapters, bookmarks, special features
  - Social networking, recommendations, monetization
General Android UI Controls

Main Navigation
- My Library, On Now and On Demand

Home Screen
- Navigate Main Options by pressing icons

App Menu Options
- (not always actionable)

Universal Search for content

- Native Android app takes full advantage of UI
- Consistent Videoscape experience
  - Same metadata and content provided by VMS
  - Same universal rights locker
  - Single Android client runs on phone and tablet
  - Experience tailored for different form factors

Back button (works within app)
Videoscape Android UI
Introduce On Now (Linear)

• Linear programming on the go
• Remote recording of live content
• Additional monetization options
• Content downloaded and cached on mobile device with same integrated rights locker
• Content added to library, now available on other screens
Introduce On Demand

- On Demand content from SP and OTT is equally accessible on the go
- Access bookmarks to resume watching from where you left off
- Content protected by DRM and authenticated with universal rights locker
- Tightly integrated options to bookmark, share, send to second screen
Videoscape on PC Experience

• Extend personalized Videoscape experience to PC or Mac
• Consistent experience, now designed for keyboard and mouse
• All content, metadata, friends, bookmarks, etc. persist
• Access content through SP portal or download Silverlight player
Videoscape Architecture
Next-Gen Video Infrastructure
Key Tenets of IP Video Driving the Architecture

**Built on Web Services Protocols**
Cloud Service APIs - Accelerates universal reach and 3rd party innovation;
Designed for virtualisation

**Exponential scale for large-scale unicast services**
Leveraging caching technologies for efficient distribution
Whilst addressing the challenges of large scale concurrency (i.e. Linear)

**Video intelligence propagates deep into the network edge**
Providing media, device, and network awareness

**Open Client Architecture**
Multi-device support – for PCs, gaming consoles, tablets, mobile devices, set-tops, etc. Leveraging the cloud to provide adaptation in concert with network intelligence

**Services Across Managed and Unmanaged Networks**
Common experience no matter where the user connects
Design for unmanaged, optimised for managed
Videoscape Architecture
Videoscape Architecture
Videoscape Architecture
Videoscape Architecture
Videoscape Architecture
1) Videoscape Acquisition Suite
Flexible Media Processing
Media Acquisition and Processing Portfolio

- MEP D9036 Modular Encoder
- DCM Video Processor / Transcoder
- Media Processor/Encapsulator
- Live ABR Transcoding & Packaging
- Transcode Manager
- File Based Transcoding
- D9800 Series Receivers
- Receivers / Decoders
- Virtual Origin Services
- VoD, Linear, nDVR Origin Server
- Cisco ROSA®
- Control Systems

Encoders
Multi-Service Video Processing
Live ABR Transcoding & Packaging
# HTTP ABR – Format Comparison

No clear common ground apart from H.264/AAC

<table>
<thead>
<tr>
<th></th>
<th>HSS (Microsoft)</th>
<th>HLS (Apple)</th>
<th>HDS (Adobe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Protocol</td>
<td>HTTP</td>
<td>HTTP</td>
<td>HTTP</td>
</tr>
<tr>
<td>Fragment Size (typical)</td>
<td>2 seconds</td>
<td>10 seconds</td>
<td>Variable</td>
</tr>
<tr>
<td>#TCP connections</td>
<td>1 or 2</td>
<td>1</td>
<td>Variable</td>
</tr>
<tr>
<td># Content Files on Origin Server</td>
<td>#profiles</td>
<td>#profiles x 720/Hr</td>
<td>#profiles (VOD) #profiles x frag duration/Hr (Live)</td>
</tr>
<tr>
<td>Codec Support</td>
<td>VC-1, H.264, WMA</td>
<td>H.264</td>
<td>H.264</td>
</tr>
<tr>
<td>Wire/Xport Format</td>
<td>MP4 fragments</td>
<td>MP2TS fragments</td>
<td>MP4 fragments</td>
</tr>
<tr>
<td>Content File Format on Origin Server</td>
<td>.ismv, Fragmented mp4</td>
<td>.ts, Segmented TS</td>
<td>.f4f, .fmf, Fragmented mp4</td>
</tr>
<tr>
<td>Byte Range Mechanism</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Std HTTP Origin Server</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Encryption/DRM</td>
<td>Windows DRM PlayReady</td>
<td>AES-128</td>
<td>Adobe Access</td>
</tr>
<tr>
<td>Client</td>
<td>Silverlight 2+ OSMF (OpenSource)</td>
<td>iPhone OS 3.0+ Quicktime X</td>
<td>Flash Player 10.1 with ZERI extensions</td>
</tr>
<tr>
<td>Manifest file</td>
<td>.ismc (.ism/Mfest or .isml/Mfest)</td>
<td>.m3u8</td>
<td>.fmf</td>
</tr>
<tr>
<td>Origin server</td>
<td>Helper integrated with IIS server</td>
<td>HTTP server</td>
<td>HTTP server with Helper module</td>
</tr>
</tbody>
</table>
## Multi-Language Audio, Metadata Processing

**Still no convergence (actually worse)**

<table>
<thead>
<tr>
<th></th>
<th>HSS</th>
<th>HLS</th>
<th>HDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multi-Language Audio</strong></td>
<td>• Single audio track per language</td>
<td>• HLS supports multiple audio tracks, but each segment contains all audio tracks (pre-iOS5)</td>
<td>• RTMP has no support for multiple audio tracks/IDs</td>
</tr>
<tr>
<td></td>
<td>• Track has language descriptor</td>
<td>• iOS5 now allows for separable audio streams, TBD when non iOS devices will support (Roku, etc.)</td>
<td>• HDS supports multiple audio tracks, but each segment contains video and all audio tracks</td>
</tr>
<tr>
<td></td>
<td>• URL fragment request contains descriptor</td>
<td>• Change result of Cisco working with Apple on requirements – Apple has tended to be very NA focused</td>
<td>• Cisco applying pressure on Adobe on both of these issues</td>
</tr>
<tr>
<td><strong>Metadata Processing</strong></td>
<td>• Data Tracks (Name, Language, Sub-type)</td>
<td>• Timed metadata introduced earlier this year</td>
<td>• Cue points</td>
</tr>
<tr>
<td></td>
<td>• Sparse (has Parent Track)</td>
<td>• Private TS stream</td>
<td>(Name, Multiple Parameters)</td>
</tr>
<tr>
<td></td>
<td>• Non-Sparse (always present)</td>
<td>• ES=ID3 tag payload</td>
<td>• Each parameter is (tag,value) pair</td>
</tr>
<tr>
<td><strong>Captions/Subtitles</strong></td>
<td>• Source converted to TTML – natively supported by client</td>
<td>• 608 user data on AVC ES for Closed Captioning</td>
<td>• No formal support</td>
</tr>
<tr>
<td></td>
<td>• Different approach highly desired to support bitmap-based subtitles (DVB)</td>
<td>• No subtitle support</td>
<td>• Client specific customer implementations (BBC)</td>
</tr>
<tr>
<td><strong>Ad Splicing</strong></td>
<td>• SCTE-35 like metadata in sparse track</td>
<td>• Cloud based manifest manipulation</td>
<td>• Client based reaction to some form of metadata</td>
</tr>
<tr>
<td></td>
<td>• Client based reaction to metadata</td>
<td>• Client unaware of ad splice, additional metadata can be used to control trickmodes, etc.</td>
<td>• Little effort to standardise this data</td>
</tr>
<tr>
<td></td>
<td>• Dual timelines to track parent and child (ad) streams</td>
<td>• Scale, cacheability implications of supporting highly targeted – manifest file management</td>
<td></td>
</tr>
</tbody>
</table>

**Divergent views across providers on cloud-based only vs client-based only – based splicing, as well as combination of the two – implications on different ecosystems**
So how do we address the divergence? Look at a generic ABR Content Flow
Encoding, Encapsulation, & Origin on a single UCS platform (multiple VMs)
Media Encapsulator

- External ABR Fragmenter/Encapsulation from Adaptive Transcoding Systems
  - X86 Linux-based Software
  - Extensible to new formats, manifest forms (DASH)
- Based on ATS (Adaptive Transport Stream)
- Linear (today) and soon VOD and JIT (Cloud DVR) Workflows
- Integration with DRM/Encryption and Advertising Subsystems
What is Just-in-Time Processing (JITP)?

- Single flavor in storage (Intermediary ABR-conditioned Format)
  - Result of VoD Transcode or Linear Recording
  - Assets Indexed to assist JIT
- On-demand, JITP produces Target-specific Manifest (HLS, Smooth)
  - Complete VoD Manifest if source asset is complete
  - Linear Manifest starting at beginning of asset if still recording
- Client makes requests against provided manifest
  - Fragments: Random seeks against known fragments
  - Updated Manifest in case of manifest updates (HLS)
- JITP continues to update Manifest if required
- JITP only produces fragments on-demand that are requested
JIT Processing Flow

- Stored and Indexed Intermediary Format
- Dynamic Manifest, Encapsulation and DRM based on requests
- Provides significant Storage savings (only store common, ABR-independent format) and Network savings (only deliver requested fragments, not full ABR set)
Virtual Origin Server

• Separates the Encapsulation, Encryption, Storage, and Helper functions into flexible processes that can be instantiated in different locations of the architecture

• Provides a unified architecture for VOD, Linear, and Timeshifting (CloudDVR). Supports multiscreen deployments (Legacy STB & ABR clients)

• Proximity Routing, Load Balancing and Resiliency

• Supports External Origins as well as direct ingest from Transcoders

• Multi-vendor solution (Microsoft, Apple, Adobe).
  For protocols with Helper functions (IIS & FMS), implements Helper functionality directly in VOS, eliminating the need for a layer of servers in the Data Center.
  Removes a point of failure, increases ability to scale, deployment approaching the edge of the network

• Adapts to evolving standards like DECE UV and DASH
Virtual Origin Server (VOS)

Optimising H.264 ABR and Introducing Time-Shift TV

Traditional ABR Infrastructure
Origin Server Complexity and Redundant Storage
Inefficient CDN Distribution and Edge Cache Efficiency
Virtual Origin Server (VOS)
Optimising H.264 ABR and Introducing Time-Shift TV

Virtual Origin Server optimises the H.264 Origin and CDN Infrastructure
Introduces new CloudDVR Revenue-generating Service

- HTTP H.264 ABR (HLS, HDS, HLS)
- Live, VOD, Time-Shift
- Fragmentation, Encapsulation, Caching, Security
- Hardware Independent Software
- Core, Aggregation, Edge
- Multi-Tier Storage
- Unified Head-End In a Box
VOS Example: Multi-Screen Cloud DVR
Cloud DVR - Architecture Principles

- Record Once – Play-out in multiple screens
- Unified Control Plane for TV & Internet Screens
- Virtual Origin based Dynamic packaging and Play-out – expands to multiple Use case (Linear, VOD)
- Support Integrated and Distributed JIT Packaging – Computing scales independent of Capture resources
- Support 3rd Party Storage
2) Videoscape Distribution Suite
HTTP ABR – CDN Challenges

- ABR = Adaptive Bit Rate
  Unicast HTTP-based delivery (and hence TCP congestion control)
  **Client-driven** adaptation to available BW and CPU
- Large number of (relatively) small objects
  File Storage vs. Wire Formats
- Transaction Load, File System Load
- Challenges to Reporting and Analytics
- No Inherent Server Side Session State
- Variability in client delivery implementations
- Lack of standard Content Access Protection methods
  Prevent deep URL linking (including ABR fragments)
  Prevent certain types of DoS attacks (e.g. Origin Server overload, cache poisoning*)
Challenges with Distributing ABR Objects

Old World
Progressive Download

New World
ABR Delivery

- Short fragment sizes translate to very high request TPS
- TCP connections can be short-lived (client and network conditions)
- Different standard fragment sizes (HLS v. Smooth) mean object sizes are different for each Delivery Service. CDS object handling can be configured on a per-DS basis

Transaction Rates

<table>
<thead>
<tr>
<th>Obj Length (sec)</th>
<th>Client Request TPS</th>
<th>TPS for 2000 clients</th>
<th>Objects/Hour/Asset</th>
<th>Obj/HR 200 Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth</td>
<td>2</td>
<td>0.500</td>
<td>1,000</td>
<td>1800</td>
</tr>
<tr>
<td>HLS</td>
<td>10</td>
<td>0.100</td>
<td>200</td>
<td>360</td>
</tr>
<tr>
<td>PDL</td>
<td>3600</td>
<td>0.000</td>
<td>0.56</td>
<td>1</td>
</tr>
</tbody>
</table>

Object Size (MB)

<table>
<thead>
<tr>
<th></th>
<th>3000 kbps</th>
<th>1500 kbps</th>
<th>500 kbps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth</td>
<td>0.75</td>
<td>0.38</td>
<td>0.13</td>
</tr>
<tr>
<td>HLS</td>
<td>3.8</td>
<td>1.9</td>
<td>0.6</td>
</tr>
<tr>
<td>PDL</td>
<td>1.350</td>
<td>675</td>
<td>225</td>
</tr>
</tbody>
</table>

3600 fragments x 7 profiles = 25,000 possible objects
Videoscape Distribution Suite
Content Distribution System (CDS)

Content Ingest & Storage
- Managed VoD Library Origin Server
- Scheduled & Dynamic Ingest to CDN
- Live Streams Ingest / Timeshifting
- VoD Prepositioning or Dynamic Cache-Fill
- Live Stream Splitting
- HTTP, FTP, CIFS, RTSP

Content Services Routing
- Content Request Routing
- Global Load Balancing
- HTTP, RTMP, RTSP, DNS
- Content & Load Aware
- Subscriber & Network Aware
- BGP, OSPF Proximity

Content Cache & Streaming
- Low latency, caching (hierarchical & location based)
- Concurrent multi-protocol delivery
- VoD & Live streaming & download
- Stream Control HTTP, RTSP, RTMP
- High performance
- Detailed Reporting

CDN Management
- Centralised EM
- WebGUI and HTTP API's
- VoD & Live Delivery Service Mgt
- System Monitoring
- Capacity Monitoring
- AAA Server Integration

Video Application Network (Origin, Encoders, Streaming Clients, EPG, Portal)

IP Network (Core, Aggregation, Access, Wireline, WiFi, 3G, 4G)
Cisco CDS Optimisations for ABR

- Optimised TCP connection handling
  Scaling to support the large # of connections for ABR

- Optimised HTTP transaction handling
  Scaling to support the high transaction rate of ABR. CDNs designed for ordinary HTTP transaction loads will not meet the high transactional demands of ABR

- Request Bundling
  For live streaming, aggregates multiple cache-fill requests for same content into a single request from next cache-tier or Origin Server

- Small Object Cache Throughput Optimisations
  Small objects written to memory, delayed write to disk
  Large objects continue to be cached on disk
  SSD support and optimisations
  Customised object size caching behavior per Delivery Service

- Content Access Protection
  URL signing
  Access authentication through Conductor XMPP session persistence

- Live ABR and Client Request Optimisations
  Request Bundling – Multiple near-time requests result in single requests upstream
  Range Request Caching (HLS clients, Progressive DL clients)
  Client/Streamer Stickiness (Content Affinity)

- Service Visibility
  Reporting and Analytics optimisations for ABR
  Asset-level treatment of fragments, Session association across ABR profile shifts
  Streamer performance metrics associated with delivery transactions for overall system behavior views
  Exposure of service metrics and transaction logs for 3rd party monitoring/reporting systems.
Videoscape CDN Analytics
Real Time, Deep and Broad Analysis

- **Traffic Distribution**: Allocate resources according to peaks and troughs
- **Capacity Utilisation**: Better capacity planning for business growth
- **Asset Popularity**: Cache content that subscribers watch most
- **Billing Trends**: Analyse consumption trends and package offerings accordingly
- **Bandwidth Consumption**: Monitor subscriber usage and offer alerts once thresholds are met
Videoscape CDN Analytics

Dashboards

- Dashboards link real-time data that has a common theme
  - Network Utilisation
  - QoS
  - Client Access
  - Geo-location
  - Content Usage
Videoscape CDN Analytics
Network Dashboard

- CDN Bandwidth Usage
- Requests Per Second
- Cache Hit Ratio
- Origin Offload
- Server Location
Videoscape CDN Analytics

QoS Dashboard

- Average Fragment Bitrate
- Assets with 4xx Errors
- Response Codes
- 4xx Error Code Rates
- Average Time to Serve
Videoscape CDN Analytics
Client Dashboard

- Client Density Map
- Number of Unique Clients
- Top 10 Clients by Request
- Top 10 Clients by Bytes Transferred
- Average Length of Stay
3) **Videoscape Media Suite**
Media Suite: Components

- **CMS**
  - Multiple content formats
  - Sophisticated content bundling
  - Customisable metadata model
  - Metadata normalisation
  - Extensible workflow
  - Transcoding and encryption
  - Distribution to delivery network

- **Entitlement**
  - Product/Offer rules creation
  - Subscription, rental, EST, ad-supported models supported
  - Custom entitlement checks prior to authorisation
  - Accounts, devices, domains
  - Multi-DRM framework
  - Customer Care functionality

- **Publisher**
  - Feed aggregation & harmonisation
  - Multipoint catalog publishing
  - Category management
  - Playlist publishing
  - Search and Rating
  - Metering & reporting

- **Linear**
  - EPG ingest & normalisation
  - Channel maps/regionalisation
  - Uses VMS workflow, bundling & entitlement
  - Unified search - linear & VOD
  - Event framework for record controls
  - XML-based output formatting

---

Videoscape Clients

OSS/BSS

API's/Web Services
Unified Metadata Representation
Traditional and non-traditional content sources

- Normalisation
- Combining
- Enhancement

Multiple, standardised query protocols

Source-specific Pluggable modules

Multiple, standardized metadata schema

Managed Client
Unmanaged Client
SCTE-130 CIS
4) **Videoscape Clients**

![Diagram of Videoscape Clients]

**CloudVerse (B2B)**
- Videoscape Enabled Services
  - Live/Linear
  - On-Demand
  - Cloud DVR
  - Cross Screen
  - Companion
  - SP/Partner Enabled

**Cloud**
- Media Suite
  - Entitlement
  - Publisher
  - Workflow Control
  - EPG Catalog
  - Store Front

**Network**
- Content Distribution
  - Service/Proximity Routing
  - Edge Routing & Caching Tier
  - CDN Tier (Data Center)
  - CDN Tier (Core/Aggr Routing)
  - CDS Streamer
  - CDS Cache
  - ASR/IK (Video Service Module)

**Client**
- In the Home
  - Legacy RF STB
  - Cable STB with Videoscape Voyager Vantage
  - Videoscape IP STB
  - Connected TV, PC & Tablet Soft Client
- On the Go
  - Notebook/PC/Mac Soft Client
  - Smartphone/Tablet Soft Client

**Conductor**
- with Back Office
- Alert Manager
- Session Manager
- Connection Manager
- Device Manager
- Client Frameworks
- Reporting & Analytics

**End to End System Management**
Videoscape Client Software

Managed Devices

- Videoscape Reference Soft Client
- SP-Enabled
- 3rd Party Apps
- App Dev Framework
- Middleware and Libraries
- Drivers

Unmanaged Devices

- Videoscape Reference Soft Client
- Provided by Device OEM (Apple, Sony….)

Cisco
3rd Party
Device OEM
Videoscape Cloud APIs and Clients

- Videoscape Cloud APIs enable consistent user experience
- Videoscape Cloud APIs leveraging best of XMPP and HTTP
- Client SDKs facilitate Cloud API use across diverse platforms
- Open access to 3rd Party Services

Non-Videoscape Clients are able to access basic features through open Web Service interfaces

3rd Party Services

Videoscape Cloud API

RESTful HTTP Webservices

XMPP Messaging

Videoscape Cloud API

VideoSphere Managed IP STB

VideoSphere iOS Tablet

VideoSphere Android SmartPhone
5) Videoscape Conductor

CloudVerse (B2B)

Videoscape Enabled Services
- Live/Linear
- On-Demand
- Cloud DVR
- Cross Screen
- Companion
- SP/Partner Enabled

Cloud

Network

Client

In the Home
- Legacy RF STB
- Cable STB with Videoscape Voyager Vantage
- Videoscape IP STB
- Connected TV, PC & Tablet Soft Client

On the Go
- Notebook/PC/Mac Soft Client
- Smartphone/Tablet Soft Client

Media Suite
- Unified CMS
- Entitlement
- Publisher
- Workflow Control

Media Acquisition
- Digital Content Manager
- Virtual Origin Service
- Encapsulator/ABR Packager
- Mobile Content Adaptation Engine

Content Distribution
- Service/Proximity Routing
- Edge Routing & Caching Tier
- CDN Tier (Data Center)
- CDN Tier (Core/Aggr Routing)
- ASR/K Video Service Module
- CDN Content Acquirer
- CDS Cache
- CDS Streamer
- Cable, vDSL, FTTH, 4G
- 3G/4G & WiFi

Advanced Advertising
- Recommendations
- Social Networks

Conductor with Back Office
- Alert Manager
- Session Manager
- Connection Manager
- Device Manager
- Client Frameworks
- Reporting & Analytics

End to End System Management
Service Issues to Solve

• Multi-device and multi-user support on multiple access networks
  Resource management and session policies, e.g. max active users or devices in an account
  Multiple playback format(s) for nDVR recordings
  Companion Devices interaction

• Decoupling customers from hardware devices
  Accounts, users, devices, personalized services, and parental control
  Content Access Protection and Digital Rights Management (DRM)

• Service Visibility
  Statistics, audience measurements, and troubleshooting in an ABR environment

• Asynchronous messaging
  Program Guides, SW updates, Emergency Alerts, etc.

• Service Acceleration
  Introduction of new services, rapid modification of existing services, and linking to external services (e.g. social networks)
Augmenting Web Services – Persistent Connections

- Provide tools for 2-way asynchronous communications to clients over persistent connections
- Allow services to use a combination of HTTP and XMPP/WebSockets-style communications
- HTTP = short-lived, cacheable, client-initiated transactions
- XMPP/WebSockets = 2-way, long-lived, asynchronous

Asynchronous messaging via polling = tradeoff between overhead and latency
Built to Scale for millions of Devices

Adoption

- XMPP currently being used in millions of devices for IM applications today.
- Open standards Approach allows for Extensibility to a number of Device types including STB’s
- Videoscape Conductor incorporates Jabber Technology and will address STB’s and soft clients running on Smartphones, PCs, and Tablets
- XMPP framework provides asynchronous real-time messaging and presence awareness to ‘Cloud’

**Gartner research prediction; Gartner Forecast: Tablet PCs, Worldwide, November, 2010**
Conductor Services and Technology Toolkit

- Videoscape Applications deliver targeted functionality for managing devices, end-points
- Extensible through workflow, Simple (XML) data models
- Session/service rules creation
- Service, Device, User, Context, Location based control
- Custom entitlement checks prior to authorization
- Standards-based with pluggable southbound interfaces for Service, BoSH, and WebSockets
- Widely proven real-time messaging plane scales to millions of concurrent sessions

Companion Device Broker
Session Management
Audience Measurement
Video Service Management
Emergency Alert Manager
Time Shift TV
Resource Management
Linear Services
3rd Party Integration/API
Example Cloud Service
ABR Session Management

- **Session State Manager** coordinates activity from client, acquisition components, delivery components, etc.

- **Resource Manager** can optionally count resources, reserve bandwidth, etc.
Tablet & TV sign on to Conductor. Authenticated, encrypted, persistent socket to TV and Tablet.

Tablet & TV receive presence messages showing current state of any household devices signed into Conductor.

Tablet and TV advertise capabilities in presence messages. Each device can discover that the other is “companion” capable (among other things).

Tablet initiates browsing session with TV. Browsing packets can be sent via Conductor (small XML packets) between TV and Tablet.

- Search and Discover on Companion Devices
- Remote recording
- Shared viewing
- Share content

- Conductor facilitates discovery, capabilities exchange and communications
- Works whether devices are on same LAN/subnet or not (e.g., Tablet on 3G)
Závěr

• Cisco with service providers and media companies are reinventing the television experience

• Entertainment, social media, communications and mobility come together through IP technologies transforming how consumers engage with video, and how providers prosper

• Cisco’s value proposition rests on the interworking between **cloud + network + client** architectures that result in compelling end user experiences while transforming the cost structure of network operations

• Cisco is uniquely positioned to bridge the existing Service Providers’ infrastructure and the new IP video platform to seamlessly deliver new rich media Videoscape experiences
## Videoscape vs. legacy IPTV

<table>
<thead>
<tr>
<th></th>
<th>Videoscape</th>
<th>IPTV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>platform</strong></td>
<td>Open, modular, and non-proprietary platform which gives customer more flexibility and pick and chose building blocks</td>
<td>Proprietary &amp; Vertically integrated platform</td>
</tr>
<tr>
<td><strong>end2end</strong></td>
<td>capable</td>
<td>limited</td>
</tr>
<tr>
<td><strong>endpoints</strong></td>
<td>Allows SP to provide services to multiple endpoints and app eco systems, not just proprietary</td>
<td>limited to proprietary endpoints</td>
</tr>
<tr>
<td><strong>DRM</strong></td>
<td>Multiple</td>
<td>Limited or proprietary</td>
</tr>
<tr>
<td><strong>UI</strong></td>
<td>Highly customizable UI based on SP requirements</td>
<td>Very little room for customization</td>
</tr>
<tr>
<td><strong>OTT QoE</strong></td>
<td>Videoscape is the SPs friend..😊</td>
<td>??</td>
</tr>
</tbody>
</table>
Odkazy

• Articles
  “Not all packets are equal, part I: streaming video coding and SLA requirements,” IEEE Internet Computing, Jan./Feb. 2009
  “Not all packets are equal, part II: the impact of network packet loss on video quality,” IEEE Internet Computing, Mar./Apr. 2009
  “Deploying diffserv in backbone networks for tight SLA control,” IEEE Internet Computing, Jan./Feb., 2005

• Industry Tests
  Light Reading: Cisco Put to the Video Test
  EANTC Experience Provider Mega Test
  IPTV & Digital Video QoE: Test & Measurement Update
Seznam použitých zkratek

- ATS: Adaptive transport stream
- BMFF: Base media file format
- CATV: Cable TV
- CDN: Content delivery network
- CFF: Common file format
- CIF: Common intermediate format
- CMS: Content management system
- CPE: Customer premises equipment
- DASH: Dynamic Adaptive Streaming over HTTP
- DECE: Digital Entertainment Content Ecosystem
- DRM: Digital rights management
- DVR: Digital video recorder
- EPG: Electronic program guide
- QoE: Quality of experience
- GoP: Group of pictures
- QoS: Quality of service
- HLS: HTTP Live Streaming
- JIT: Just in time
- MPD: Media presentation description
- OS: Origin server
- OTT: Over-the-top
- PVR: Personal video recorder
- RTCP: RTP Control Protocol
- RTP: Real-time Transport Protocol
- SLA: Service-level agreement
- SSM: Source-specific multicast
- STB: Set-top box
- TS: Transport stream
- TVE: TV everywhere
- UV: UltraViolet
- VBO: Video back office
- VoD: Video on demand
- VoIP: Voice over IP
- VOS: Virtual origin server
Zážitek Videoscape na stánku Cisco Expo

na PC, či Set-Top-Boxu:

na tabletech:

Videoscape = Cloud + Network + Client
Otázky a odpovědi

• Twitter www.twitter.com/CiscoCZ
• Talk2Cisco www.talk2cisco.cz/dotazy
• SMS 721 994 600

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  2.den 16:30 – 17:00
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