



Building scalable video solutions and services for the Enterprise

BRKAPP-2006



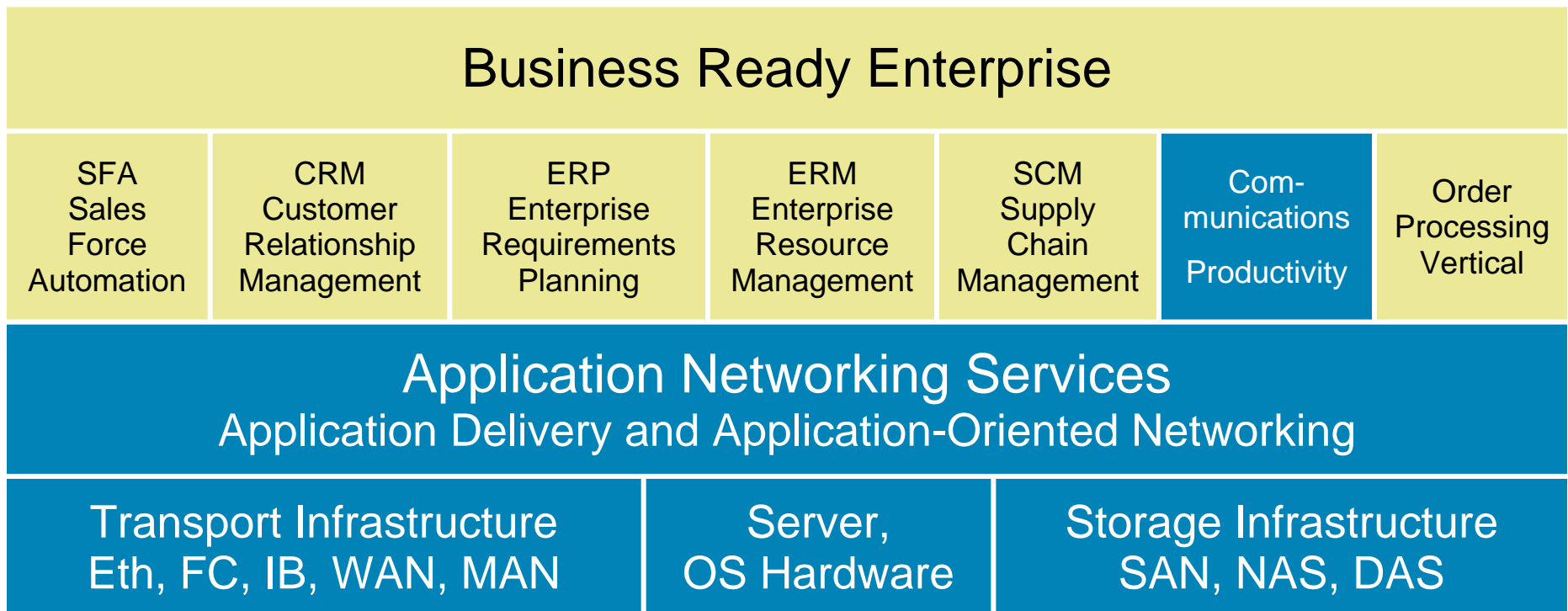
Fabio Ganzaroli

Cisco Networkers
2007

HOUSEKEEPING

- We value your feedback, don't forget to complete your online session evaluations after each session and complete the Overall Conference Evaluation which will be available online from Friday.
- Visit the World of Solutions on Level -01!
- Please remember this is a 'No Smoking' venue!
- Please switch off your mobile phones!
- Please remember to wear your badge at all times including the Party!
- Do you have a question? Feel free to ask them during the Q&A section or write your question on the Question form given to you and hand it to the Room Monitor when you see them holding up the Q&A sign.

Application Networking Business Ready Enterprise



**Optimizing Application Performance with Existing
Server, Storage, and Network Infrastructure**

Application Optimization Infrastructure

Network Classification

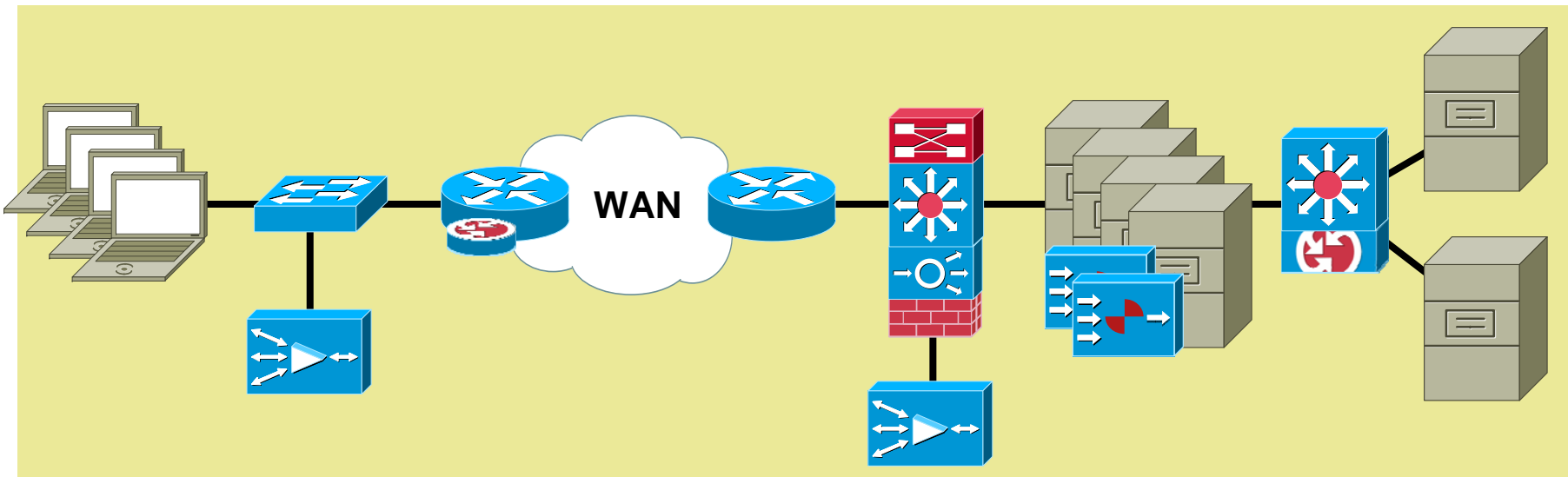
- Quality of Service
- Network-based app recognition
- Queuing, policing, shaping
- Visibility, monitoring, control

Application Scalability

- Server load-balancing
- Site selection
- SSL termination and offload
- Video delivery

Application Networking

- Message transformation
- Protocol transformation
- Message-based security
- Application visibility



Application Acceleration

- Latency mitigation
- Application data cache
- Meta data cache
- Local services

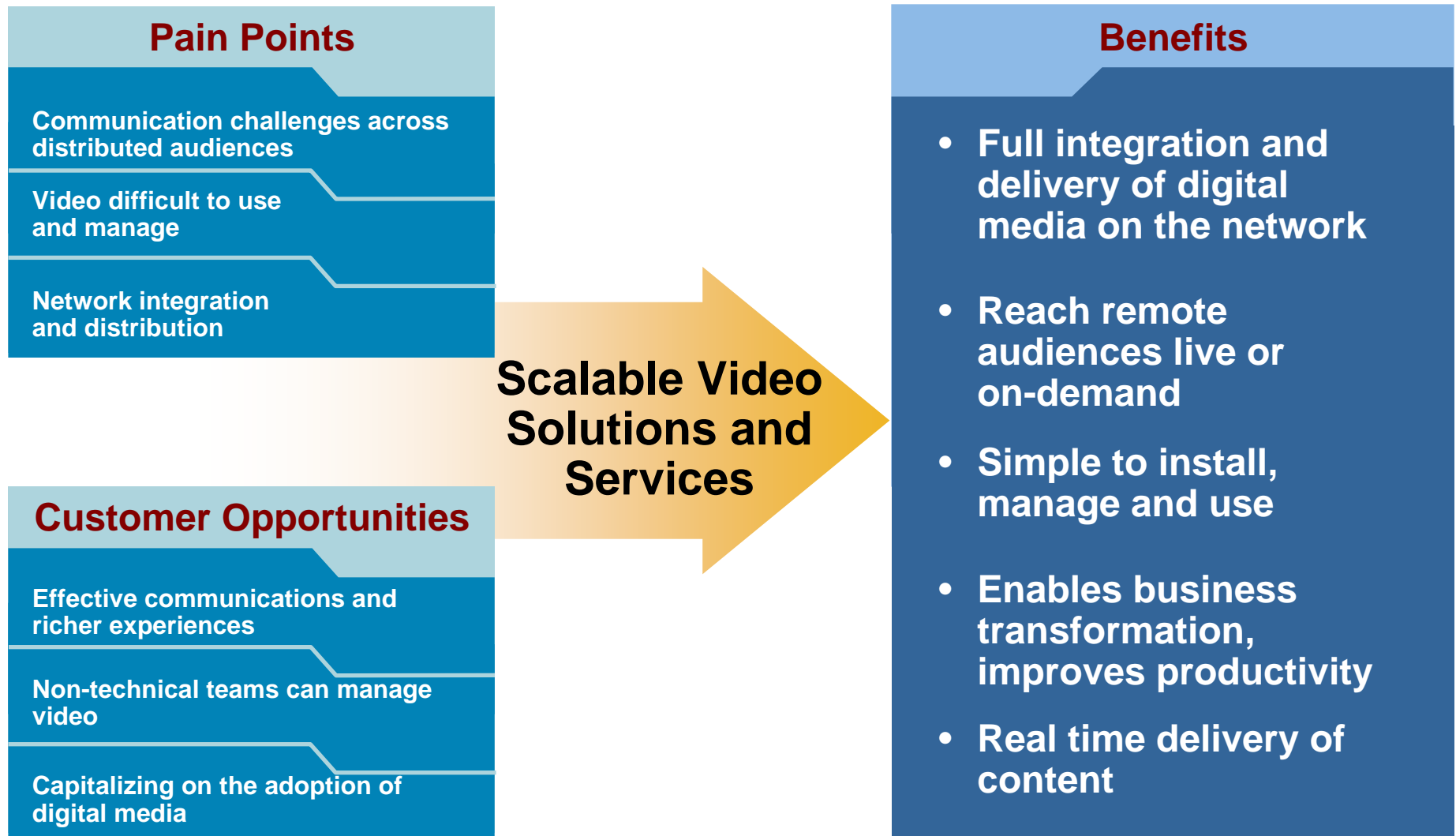
WAN Acceleration

- Data redundancy elimination
- Window scaling
- LZ compression
- Adaptive congestion avoidance

Application Optimization

- Delta encoding
- FlashForward optimization
- Application security
- Server offload

Addressing Customer Challenges & Opportunities



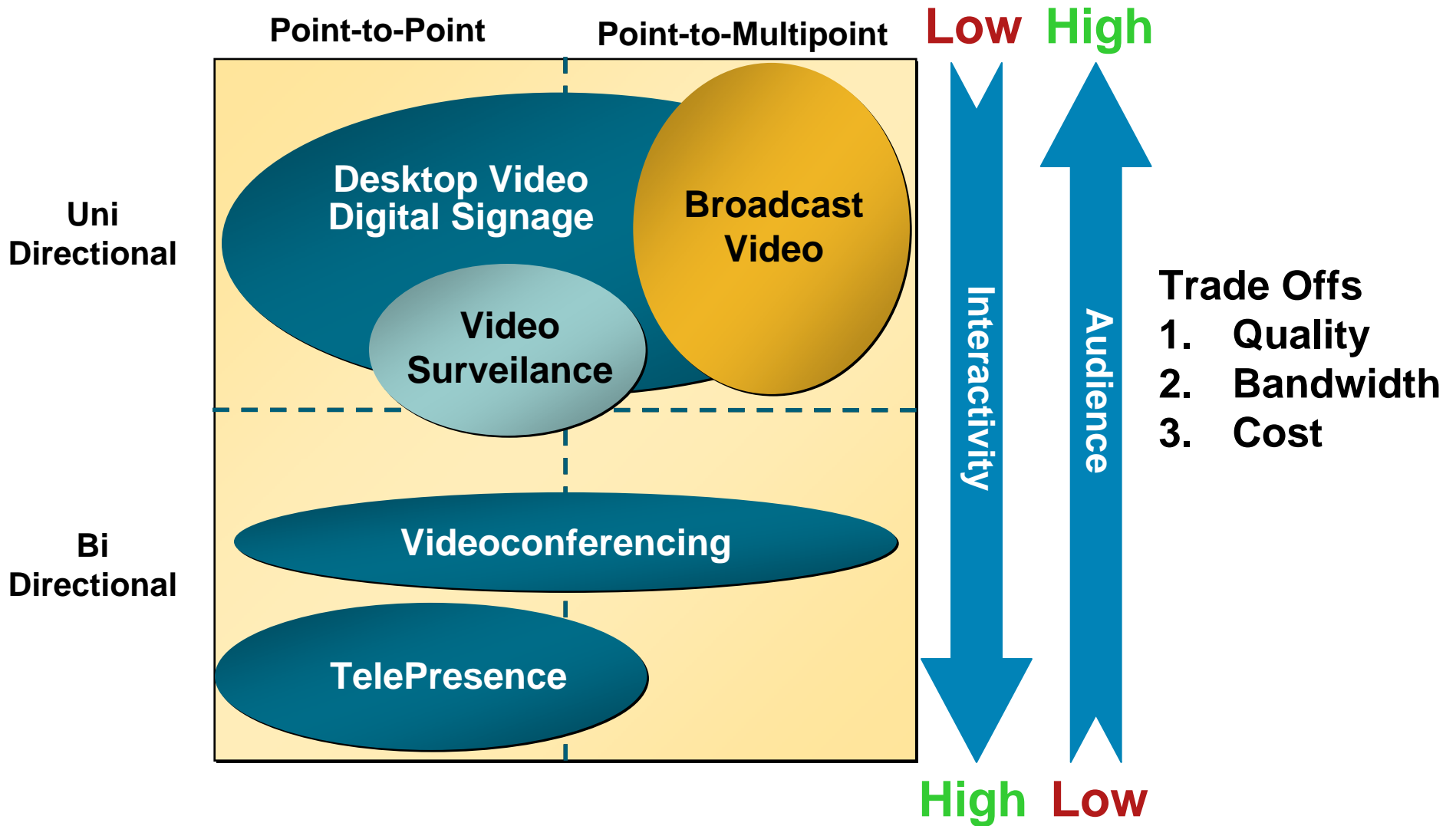
Agenda

- Overview
- Basic Concepts
- Planning
- Video Architectures
- Video Pre-Positioning
- Deploying Video
- Video and Digital Media Services

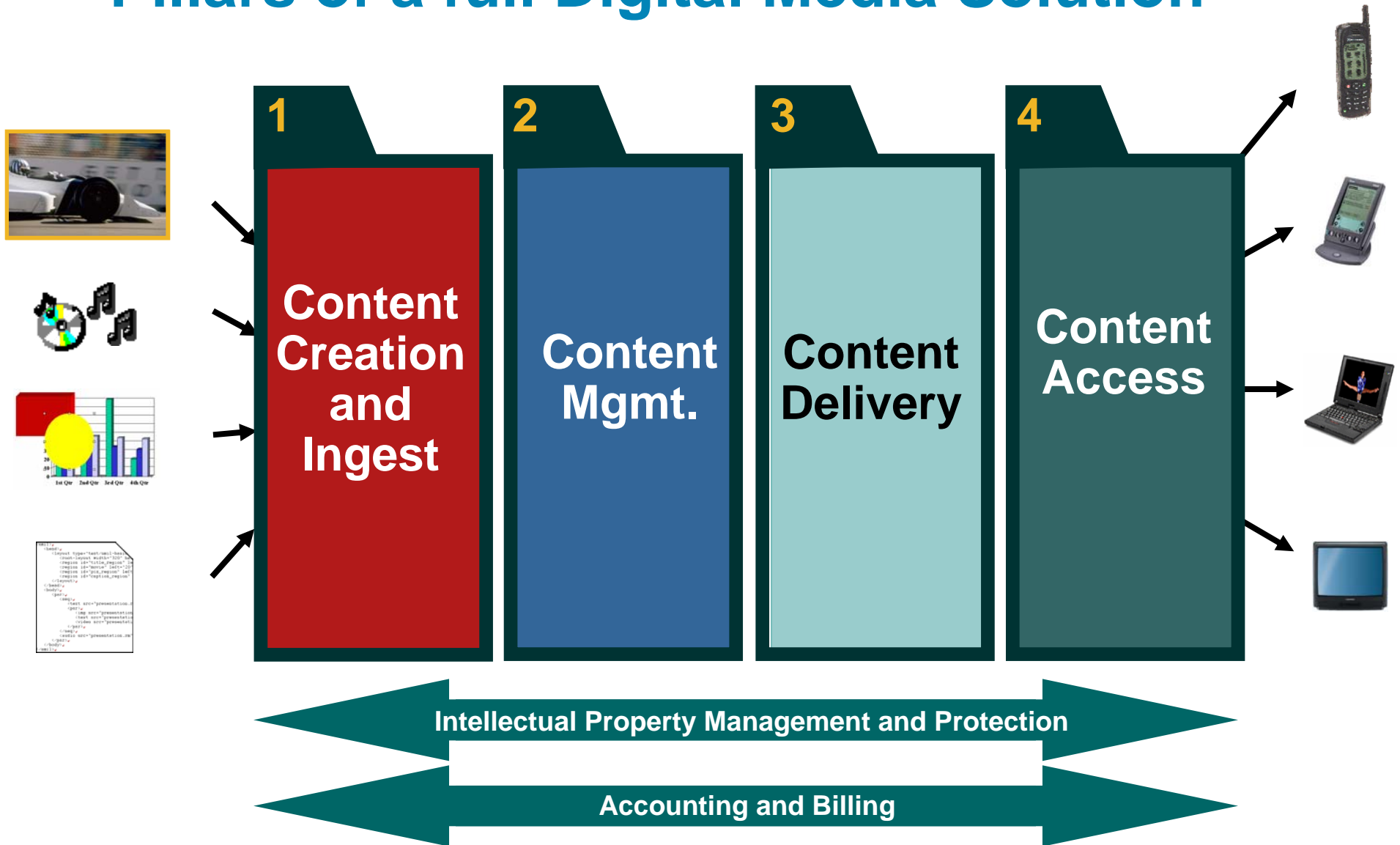
Overview



There are different Video Applications and different Delivery Models

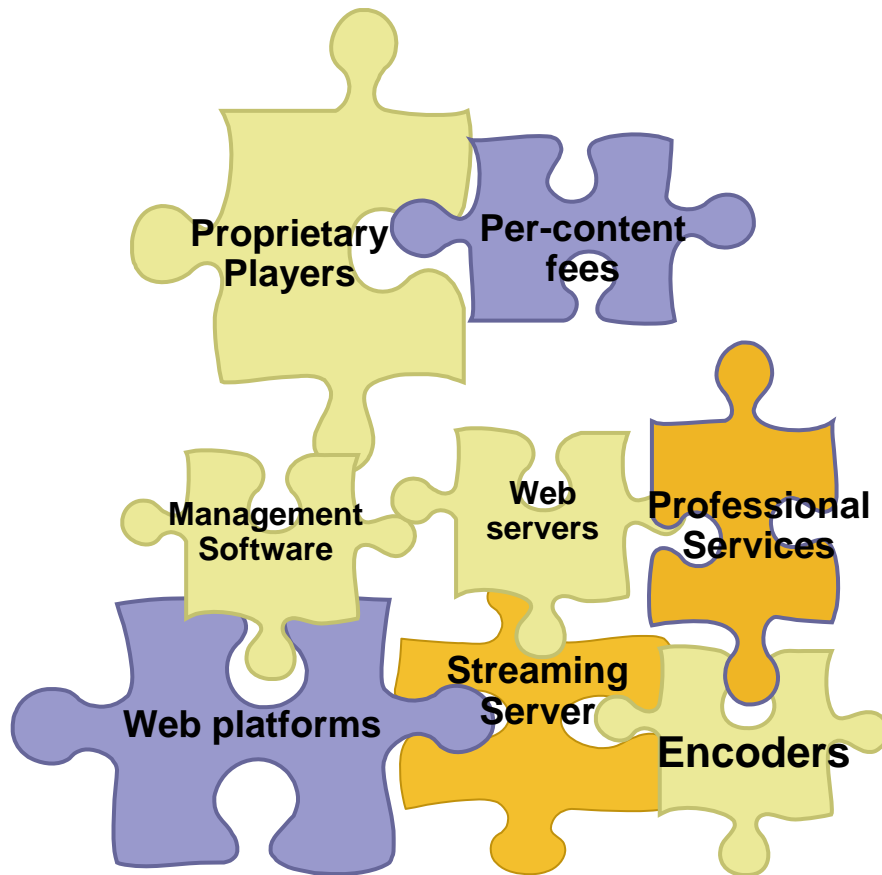


Pillars of a full Digital Media Solution

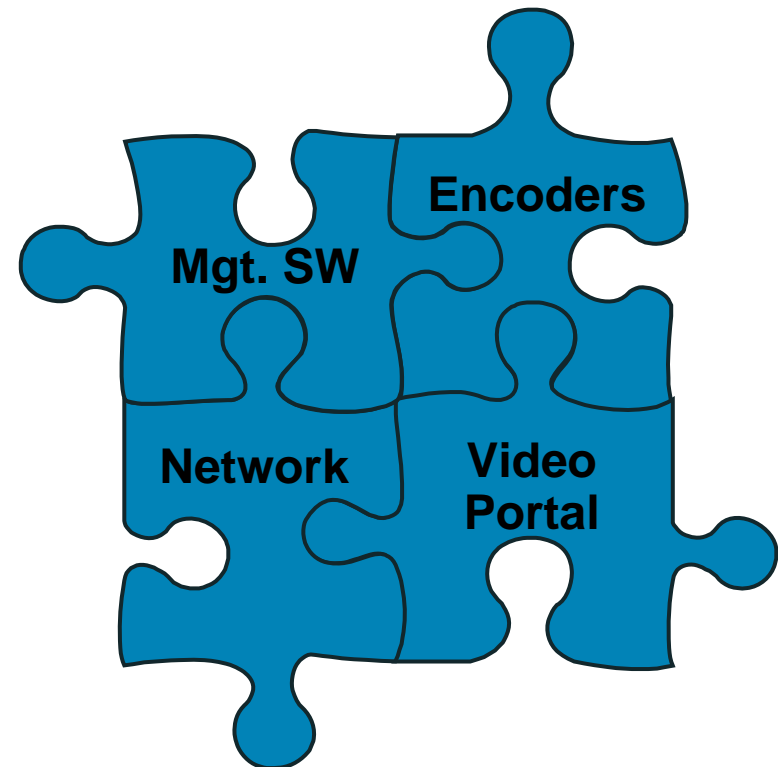


The reality on the Value Chain, and what we want

Reality: Not Integrated, Overlapping, Not End-to-End



What we want: Integrated solution spanning the entire value chain



Video and Network Concepts



Video

Terms and Components

- Camera → converts light to analog video signal
- Microphone → converts sound to analog signal
- Encoder → converts analog signal to digital
- Codec → algorithm enabling compression or decompression
- Resolution → describes the detail an image holds
- Recorder → stores digital
- Network → transports digitized media
- Media Server → publishes recorded and re-publishes live streams
- Decoder → digital to analog converter
- Media Player → decodes and displays streams

Video Protocols

- Announcement

 - Session Description Protocol (SDP RFC2327)

 - Windows ASX, WSX, NSC

 - Real RAM

- Request

 - Real-Time Streaming Protocol (RTSP RFC2326)

 - Microsoft Media Streaming (MMS)

- Transport

 - UDP

 - Real-Time Transport Protocol (RTP RFC1889)

 - Microsoft Media Streaming over UDP (MMSU)

 - TCP

 - HTTP (progressive download, MMSoHTTP)

 - Microsoft Media Streaming over TCP (MMST)

Video SDP Announcement

- A session description protocol for multimedia connections
- Developed by IETF mmusic WG
- Simple/flexible
 - Text-based
 - Extensible
- Need to be announced

```
v=0
o=- 12049 56 IN IP4 iptv1.cisco.com
s=900k Test Stream
t=0 0
a=tool:IP/TV Content Manager 3.2.24
a=type:broadcast
m=video 61496/1 RTP/AVP 32
c=IN IP4 239.192.255.65/40
m=audio 30336/1 RTP/AVP 14
c=IN IP4 239.192.255.66/40
```

MPEG1 VIDEO

MPEG1 AUDIO

SDP Announcement Methods

- Session Announcement Protocol (SAP)
 - Used for live broadcasts
 - Multicast of SDP data to well-known multicast group
- Session Initiation Protocol (SIP)
- Real-Time Streaming Protocol (RTSP)
- E-mail (mime format)
- Via Web (HTTP)

Video

RTSP

- Establishes the video session
- Controls single or several continuous streams
- Interleaves continuous media stream with control stream
- Uses discrete session id (RTSP) or UDP (rtspu)
- Server and client can issue requests
- Server maintains state (Play, Pause, Record, Stop)
- Request-URI always contains absolute URI
- Data delivery takes place out-of-band
- RTSP is not tied to RTP
- Support for proxies, tunnels and caches as in HTTP/1.1

Video

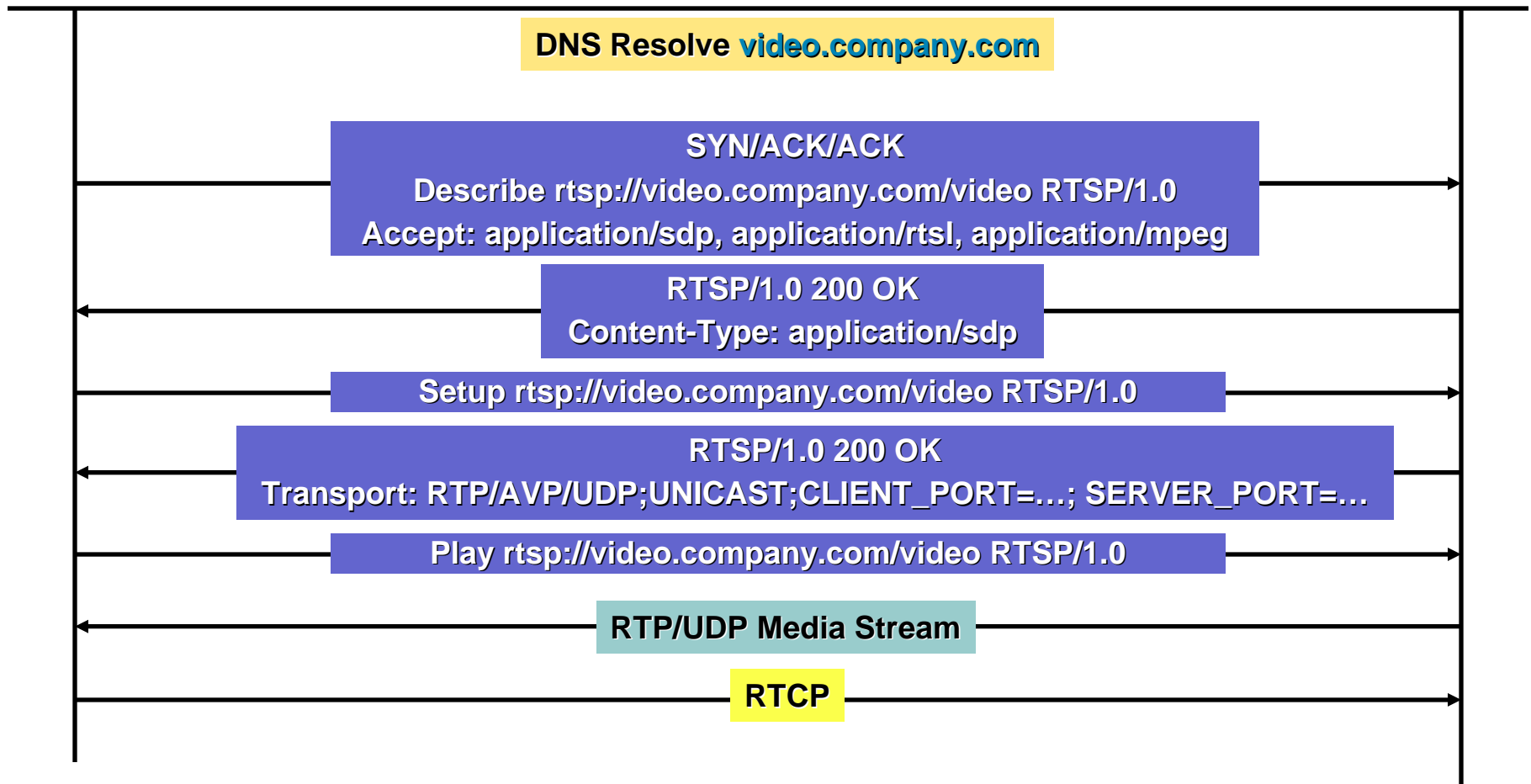
RTSP Methods

- DESCRIBE—retrieves the description
- SETUP—start an RTSP session
- PLAY—starts stream transmission
- PAUSE—temporarily halts a stream
- RECORD—saves stream transmission
- TEARDOWN—session ceases to exist
- OPTIONS—ANNOUNCE, GET_PARAMETER, REDIRECT, SET_PARAMETER

Video RTSP High-Level Flow Diagram

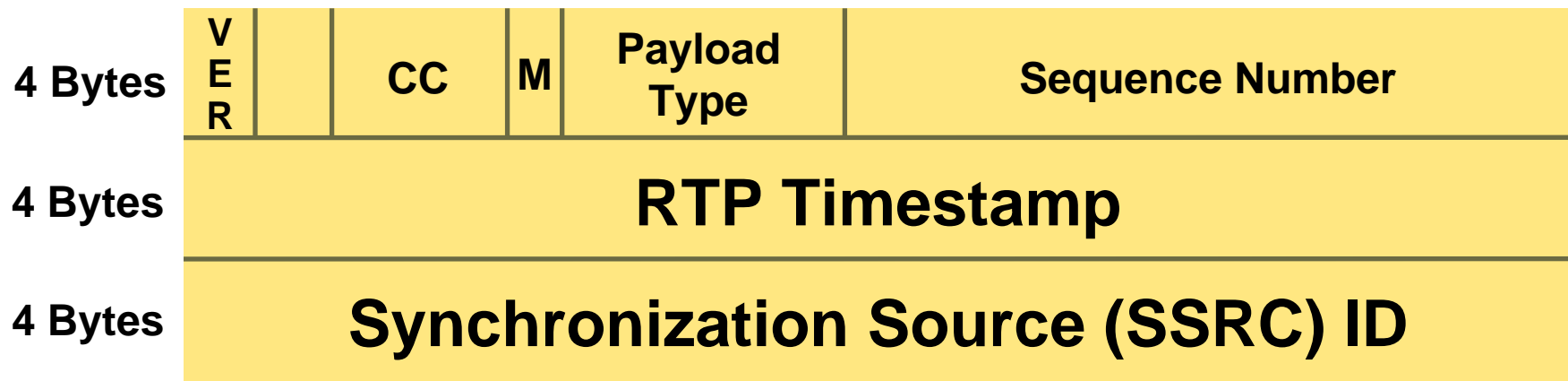


Video



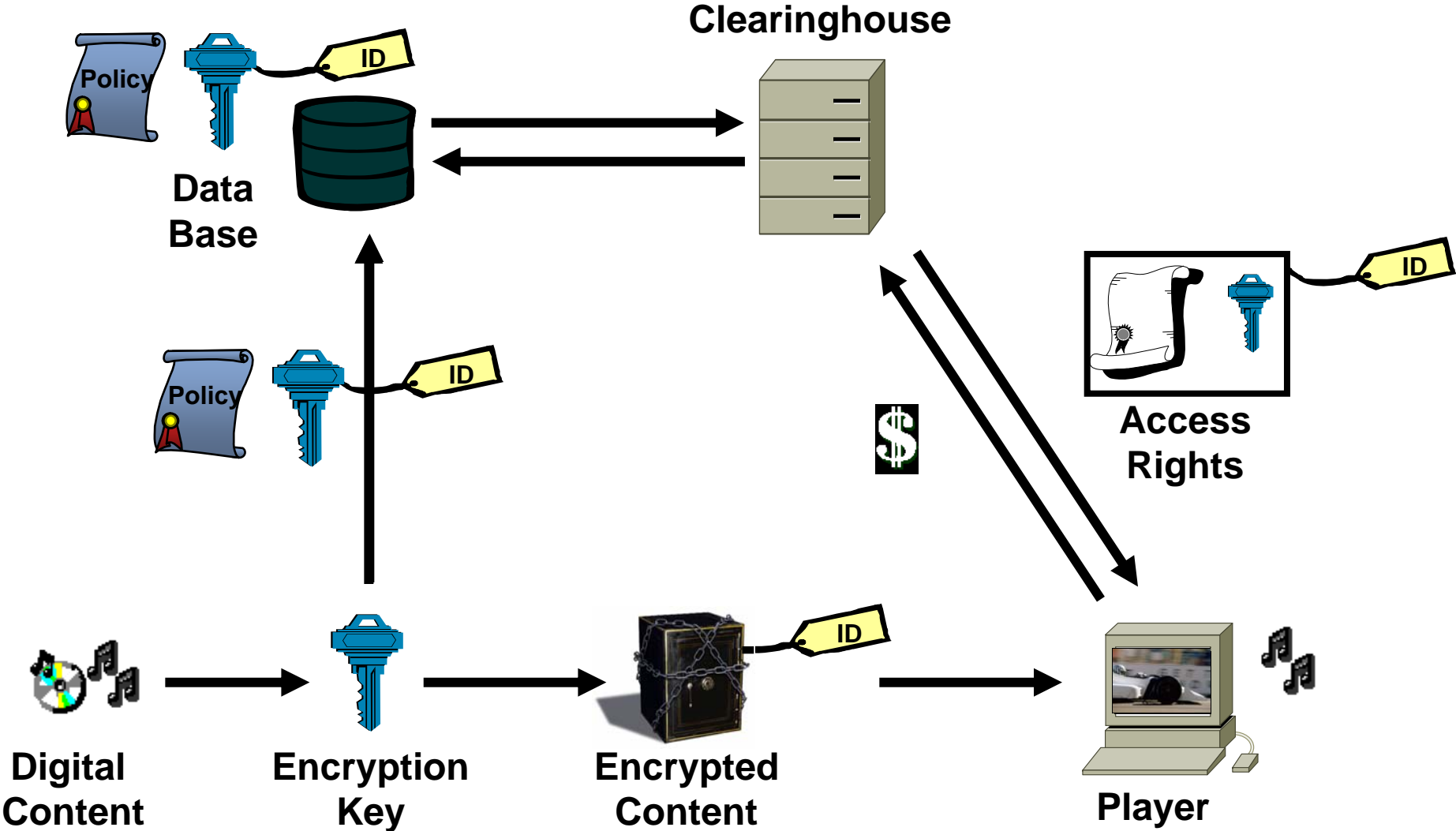
Video RTP

- Payload type identification—voice, video, compression type
- Sequence numbering
- Time stamping
- Delivery monitoring
- Carried on the odd port number with RTCP



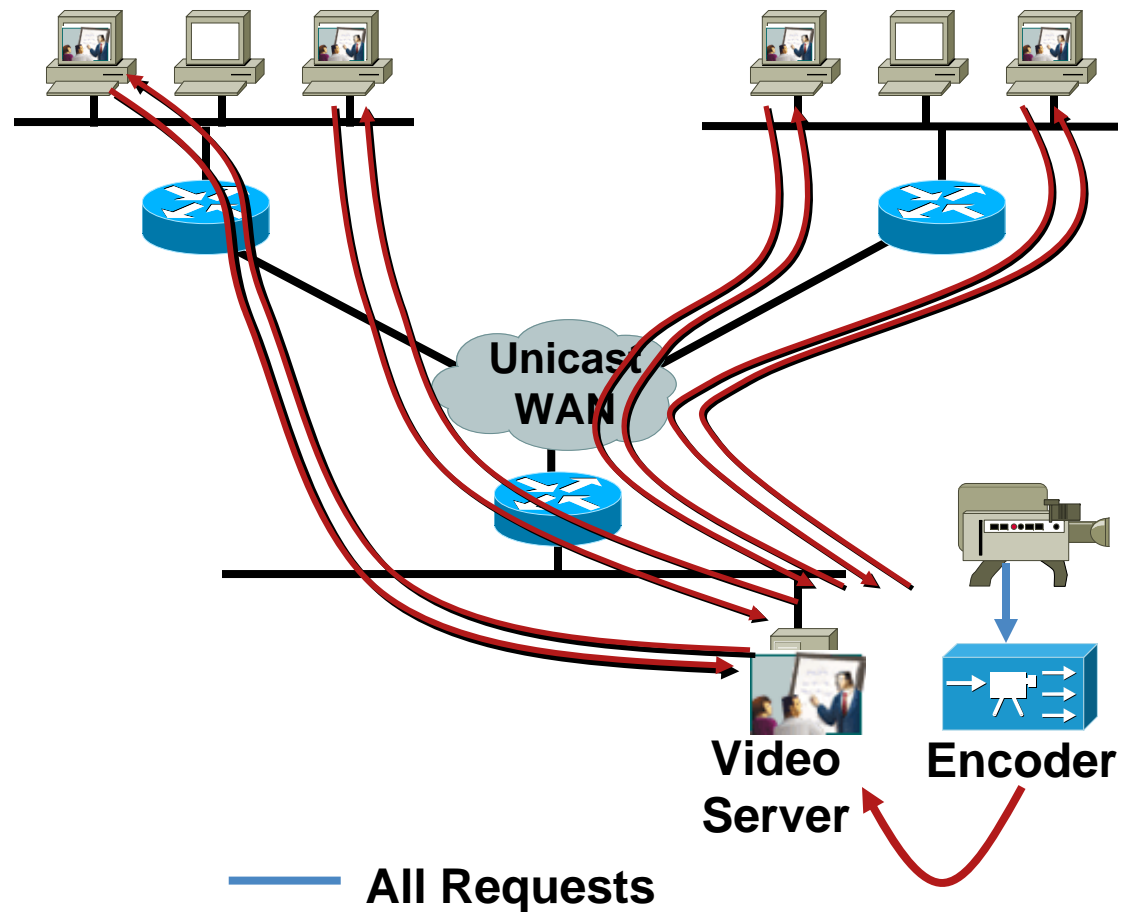
Intellectual Property Protection

Digital Right Management



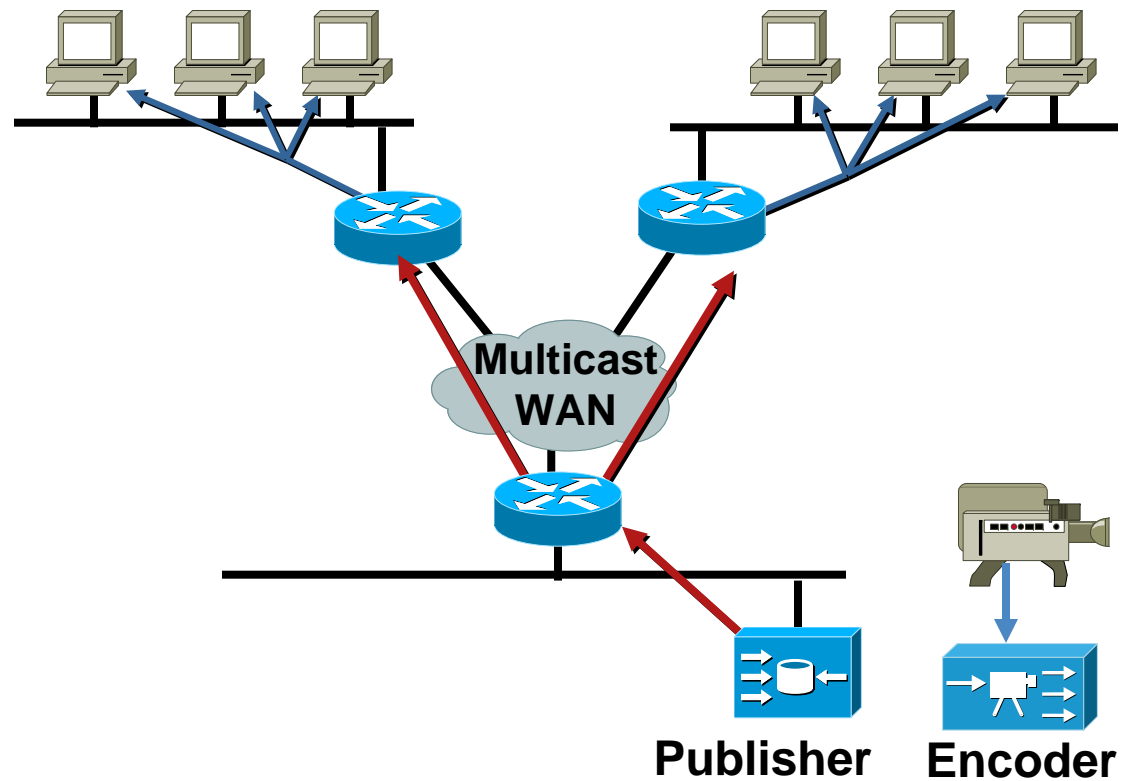
Live Video on Unicast Network

- Separate stream for each client across the WAN
- Sum of all clients must be less than WAN bandwidth
- Not practical on anything but optical infrastructure



Live Video on Multicast Network

- Multicast enabled LAN and WAN
- Requires event planning and administration



— Single Multicast Stream
Replicated by WAN Network

— Single Multicast Stream
Replicated by LAN Network

DEMO #1

Video Concepts

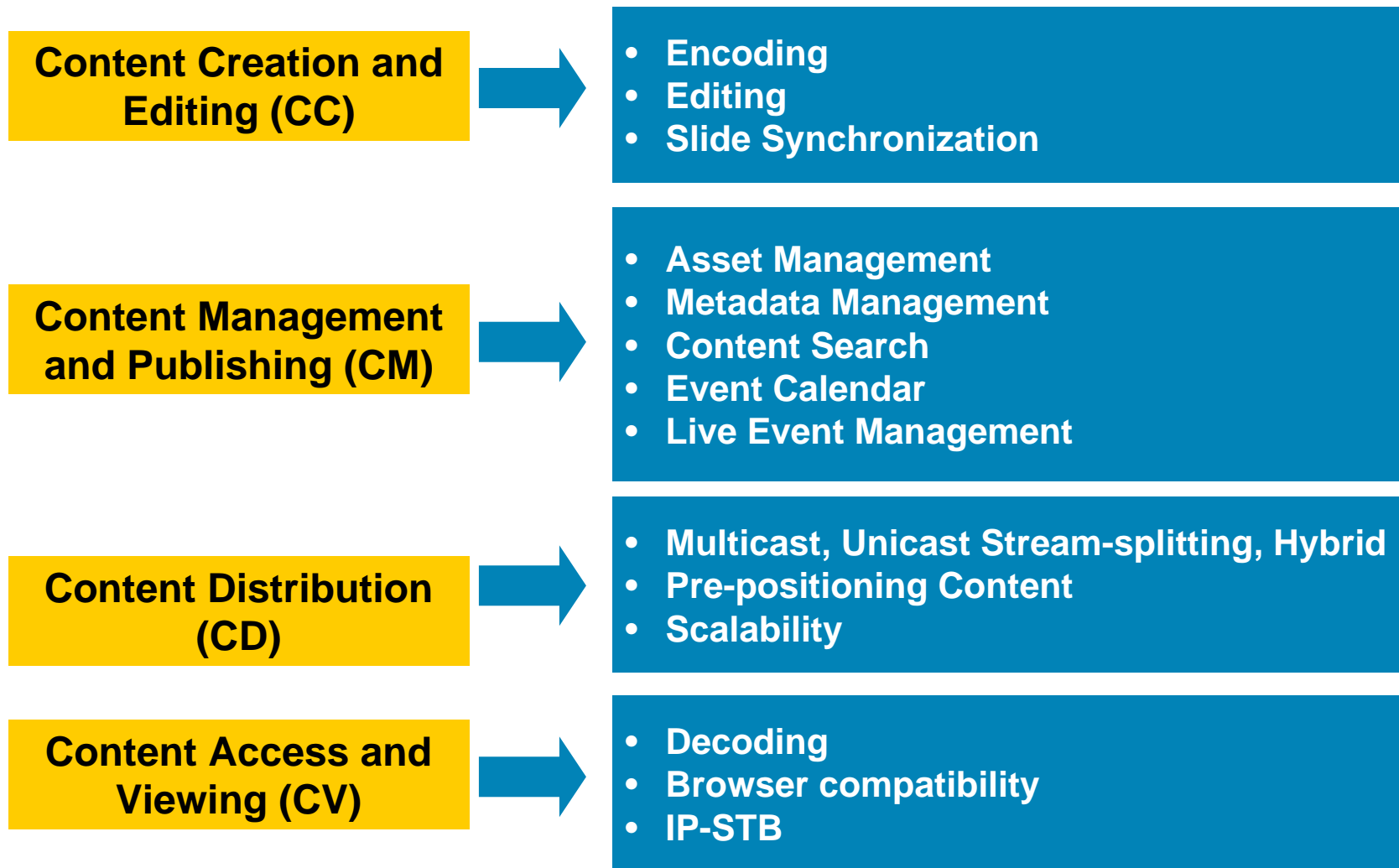


Planning



Planning

End-to-End Business Video Solution



Planning

Many Organizations are Involved

- Video
- Network
- Desktop
- Server and Application

**ALL Groups Must Work in Concert
for Successful Streaming**

Planning Video Team

- Studio operations and maintenance
- Read/write access to video server home video directory (i.e., c:\asfroot)
- Encoder operation
- Video infrastructure operation
- Coordinate with Business Unit
- Event planning
- Announcements
- Pre-event programming
- Post processing of recorded videos

Planning Network Team

- Multicast as necessary
- Client Interception (i.e. WCCP)
- WAN bandwidth capacity planning
- LAN uplink bandwidth capacity planning
- Duplex mismatches
- Quality of Service (QoS) when necessary
- Integration with encoder
- Operations and Maintenance of video network equipments (i.e. Wide Area Application Engine)

Planning Desktop Team

- Multimedia enablement
- Processor performance
- Operating systems
- Players
- Installed CODECs
- Local rights to download and install new CODECs
- Ability to push out CODECs
- Client protocol configurations

Planning

Server and Application Team

- Video on Demand (VoD) server maintenance
- Encoder server maintenance
- OS maintenance
- Portal maintenance
- Security patches

Planning

Streaming Video Event Planning

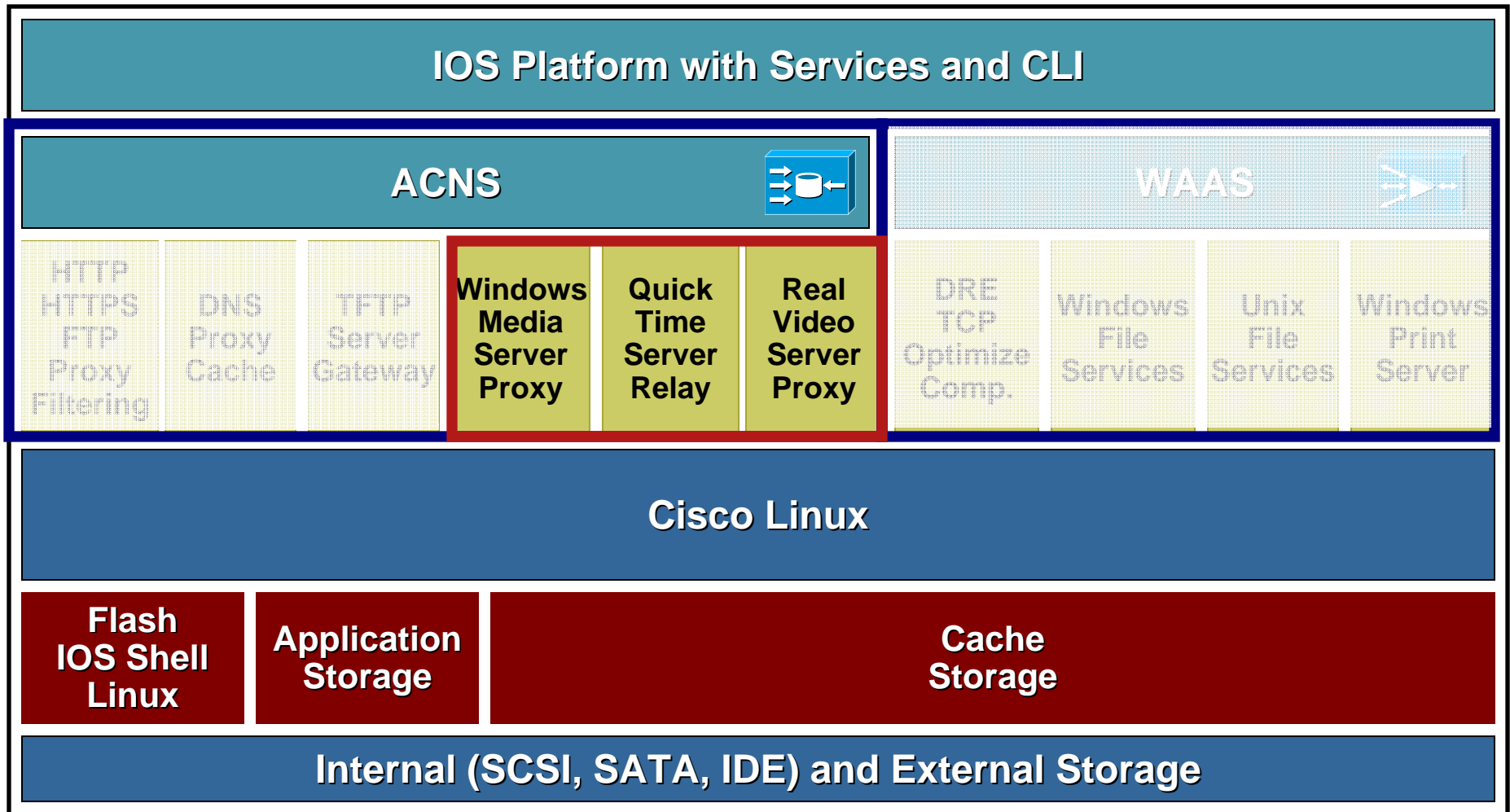
- Pre-event
 1. Content/collateral authoring
 2. Announce
 3. Registration
 4. Lobby
- Event
 1. Slides
 2. Content download
 3. Polling
 4. Questions
 5. Chat
 6. Recording
- Post-event
 1. Processing
 2. Editing
 3. Publishing
 4. Data mining
 5. Distribution

Video Architectures



Wide Area Application Engine (WAE)

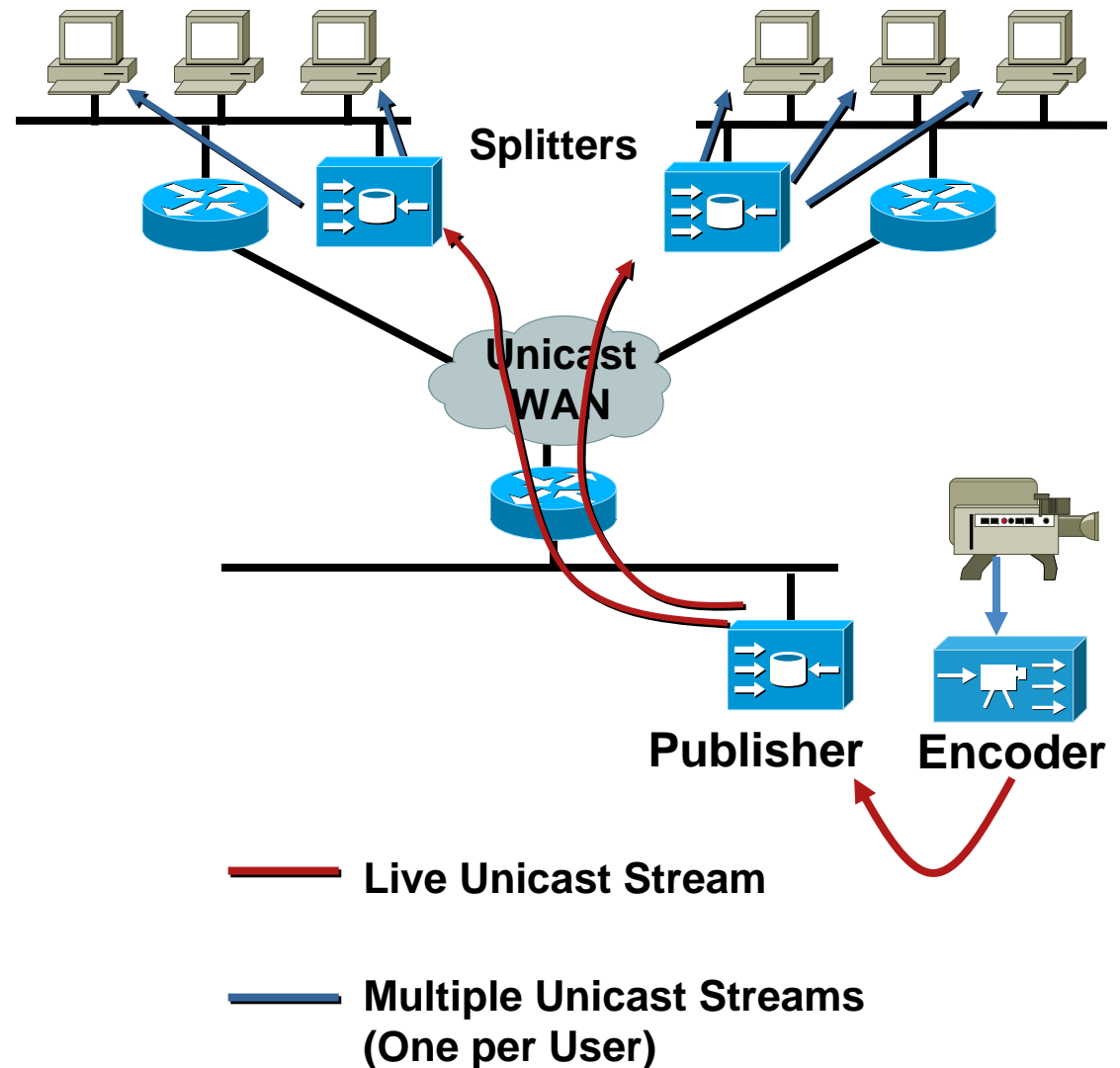
Application and Content Networking Software (ACNS)



Video Architecture

Live Unicast Stream Splitting

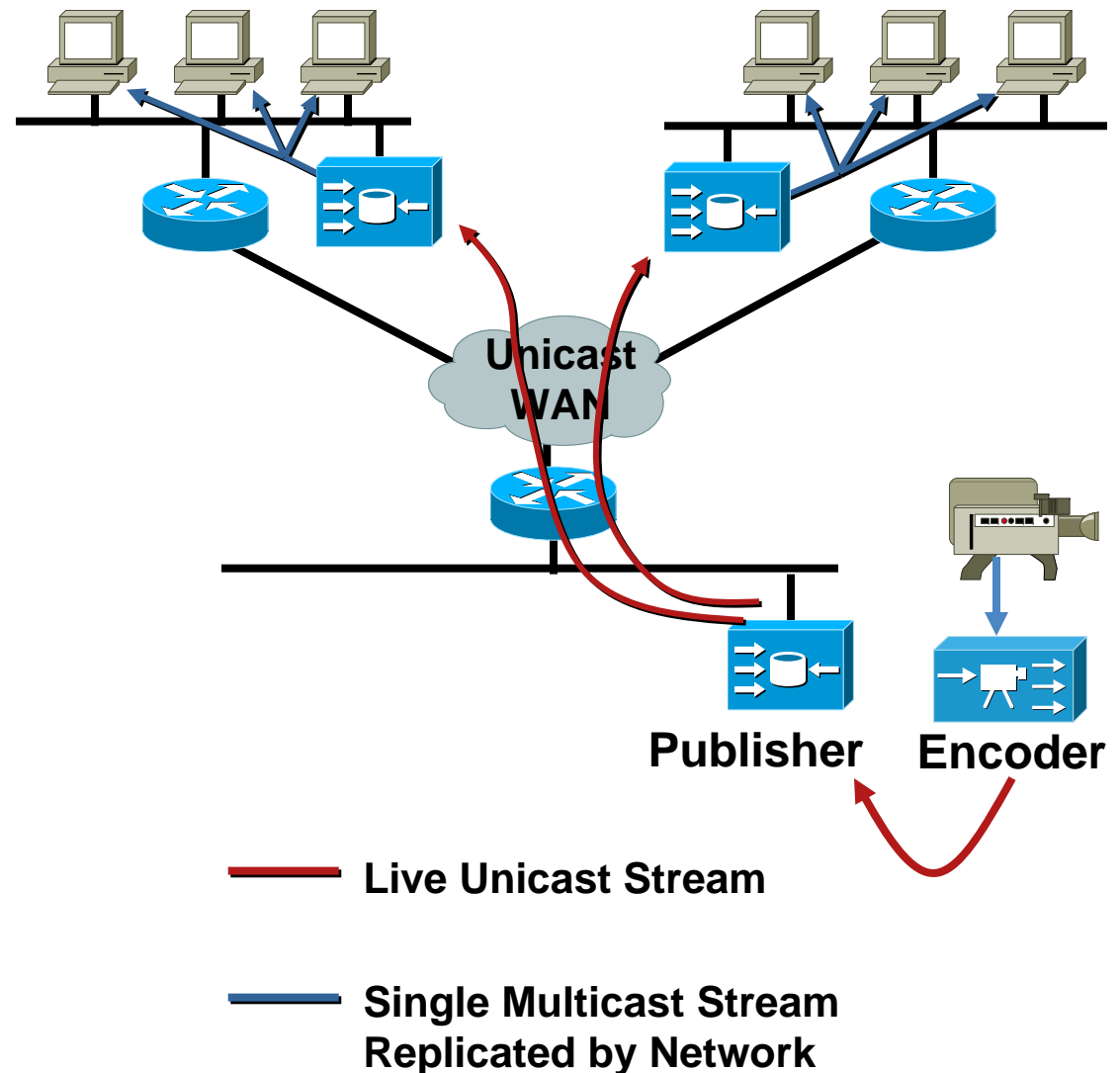
- Overcomes WAN bandwidth bottleneck
- Only solution for adhoc Internet streaming
- Easy to administer since no event planning
- Requires WAE capacity planning



Video Architecture

Live Hybrid Unicast to Multicast

- Multicast enabled LAN only
- Multicast islands require separate Rendezvous Point (RP)
 - Auto-RP
 - Bootstrap router
 - Anycast RP
- WAE scales to many simultaneous programs
- Requires event planning and administration



Video Architecture

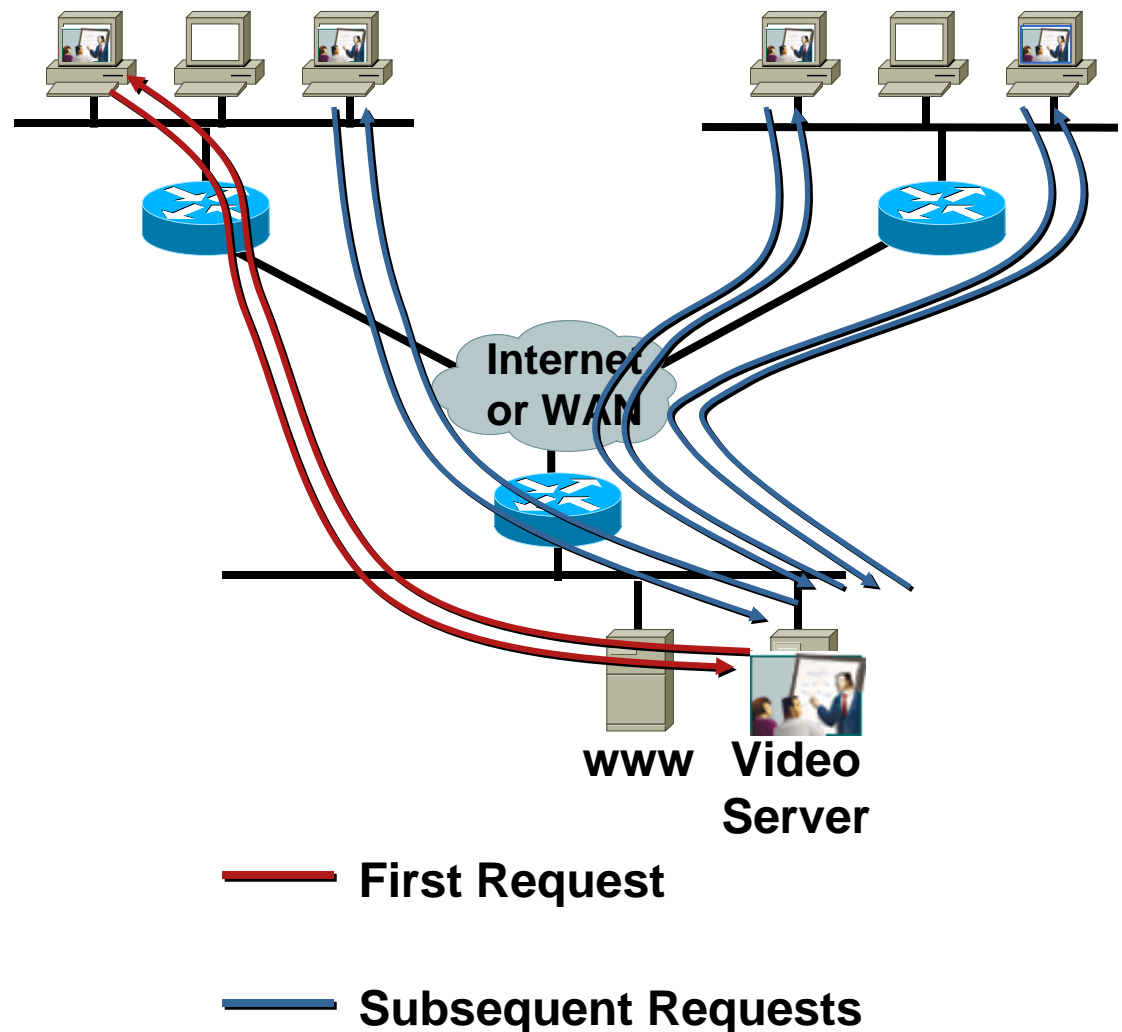
Live Capacity Planning

- Identify
 - All participating sites
 - Number of employees/participants per site
 - Percentage of simultaneous participants per site
 - WAN bandwidth per site
 - Maximum portion of WAN bandwidth allocated for streaming
 - Format (Windows Media, QuickTime, Real, IPTV)
 - Standard encoding rate in Kilo Bits per Second (Kbps)
- Cisco provides streaming capacity for WAE's
- Unicast stream capacity in Maximum participants = (Node Stream Capacity)/(Encoding Rate)
- Example: 500 participants @ 300 Kbps Windows Media streams requires 150 Mbps (WAE-611 with 224 Mbps license)

Video Architecture

Video on Demand on a non-optimized Network

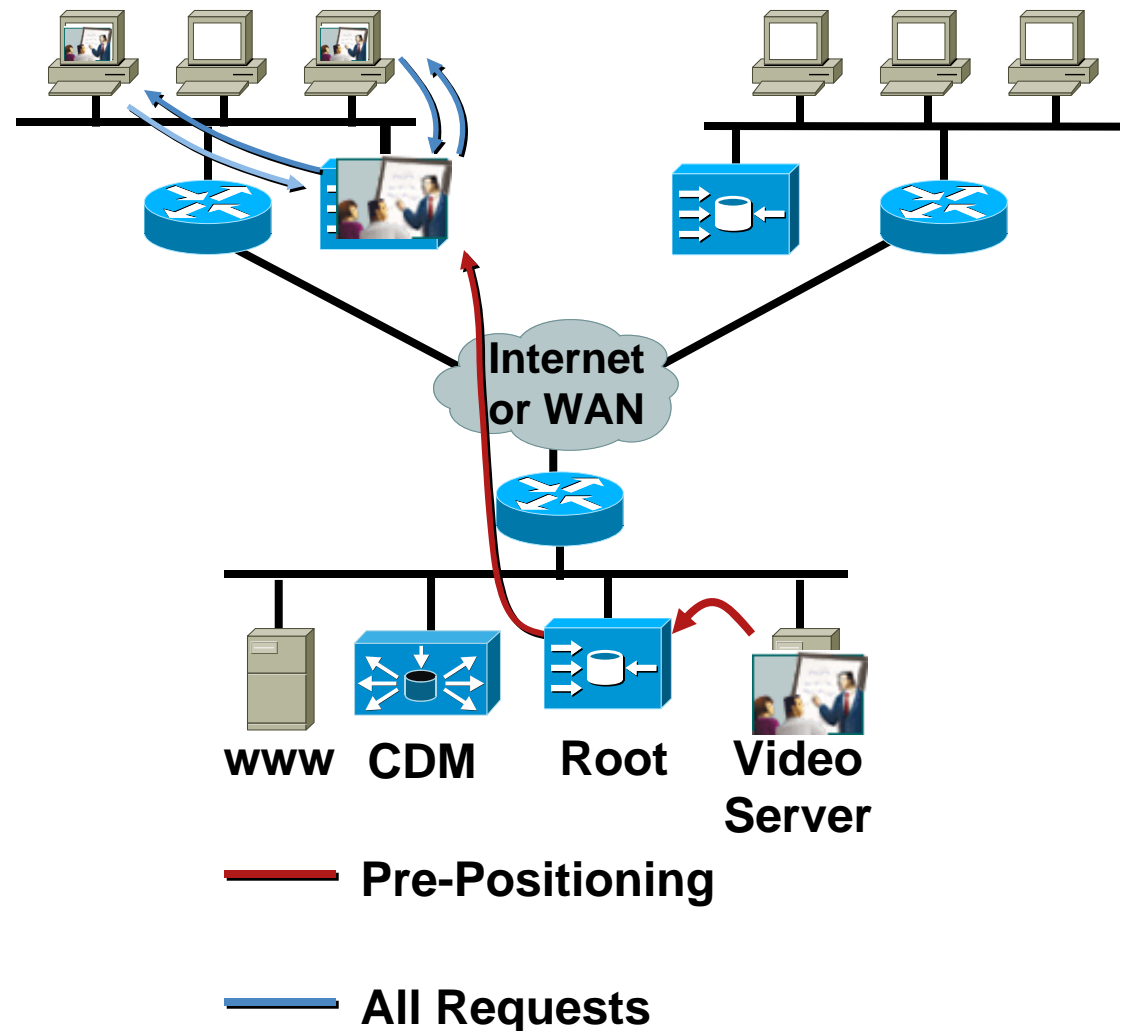
- Separate stream for each client across the WAN
- Sum of all clients must be less than WAN bandwidth
- Expect <5% of clients normally
- VoD is like live
 - Announced VoD
 - Compliance training deadline



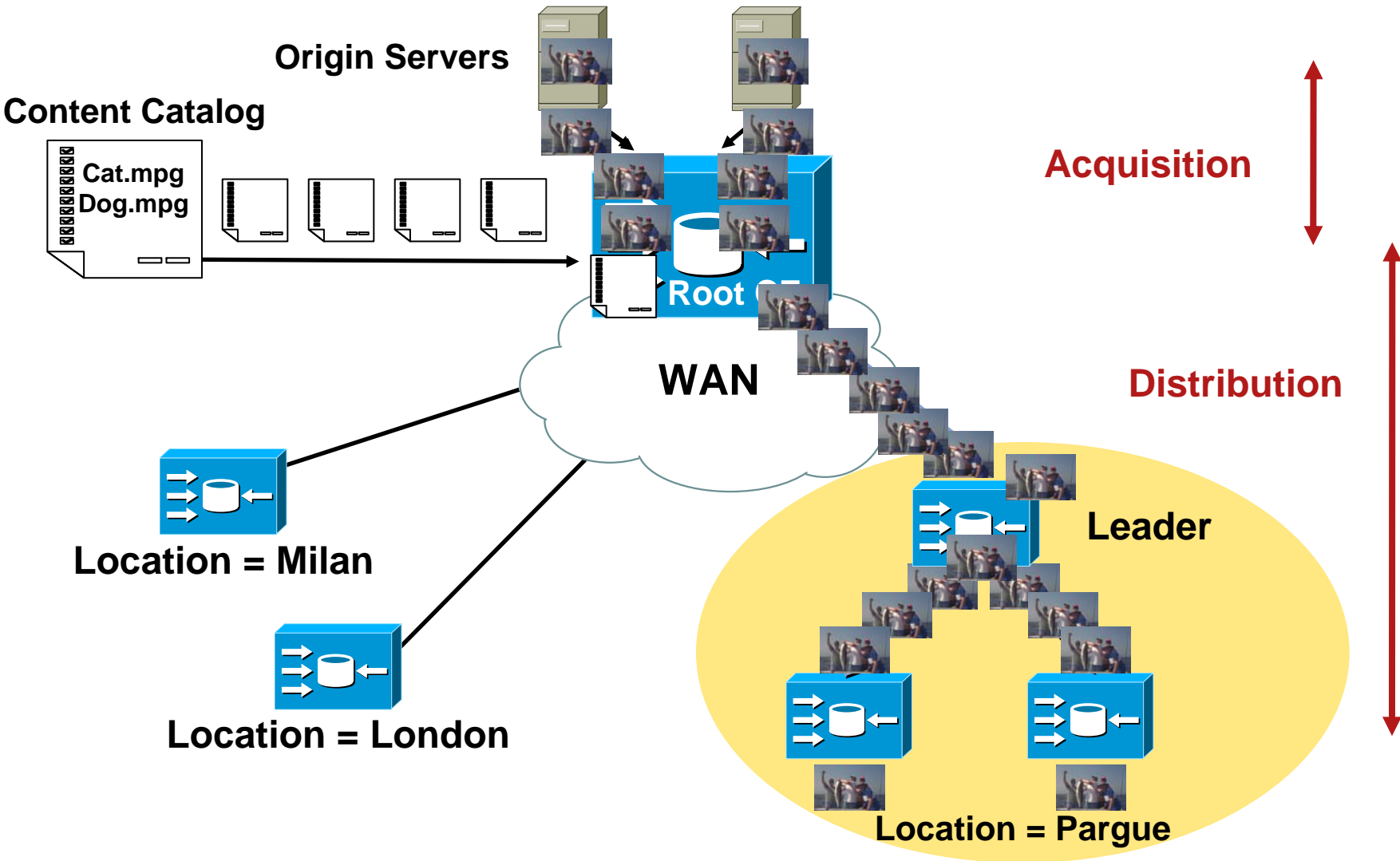
Video Architecture

Video on Demand Pre-Positioned

- Streamed bandwidth may be greater WAN bandwidth
- Extreme quality capable
- Edge WAE mirrors contents of video server
- Video files securely and controllably distributed



Scalable Content Distribution Solution



Video Architecture

VoD Capacity Planning

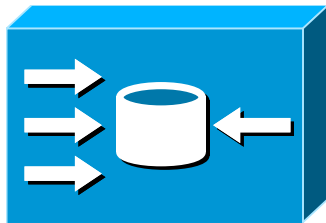
- Same as live
- Generally WAE performance required is less than live
- Identify
 - Total existing hours or bytes of video
 - Shelf life of video
 - Popular life of video
 - New video added each week
 - Storage planning horizon
- Storage planning
 - One Hour Storage (Bytes) = (Encoding rate bps * 3600 seconds) / (8 Bits/Byte)

Deploying Video



Video Serving Flexibility *must* be considered

1. Intelligent Redirection
2. Splitter
3. Server
4. Bandwidth Control



INTERNET STREAMING MEDIA ALLIANCE

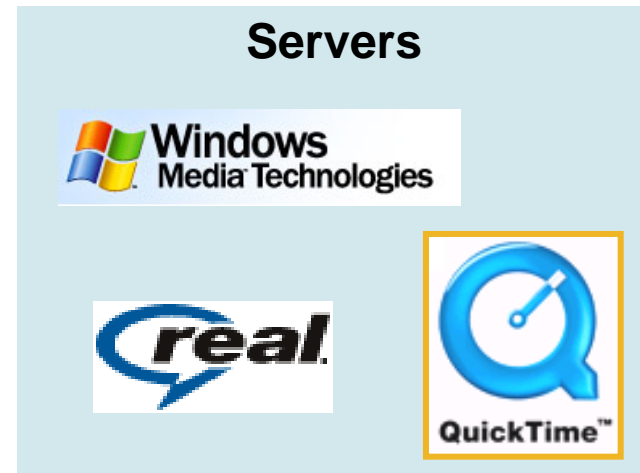
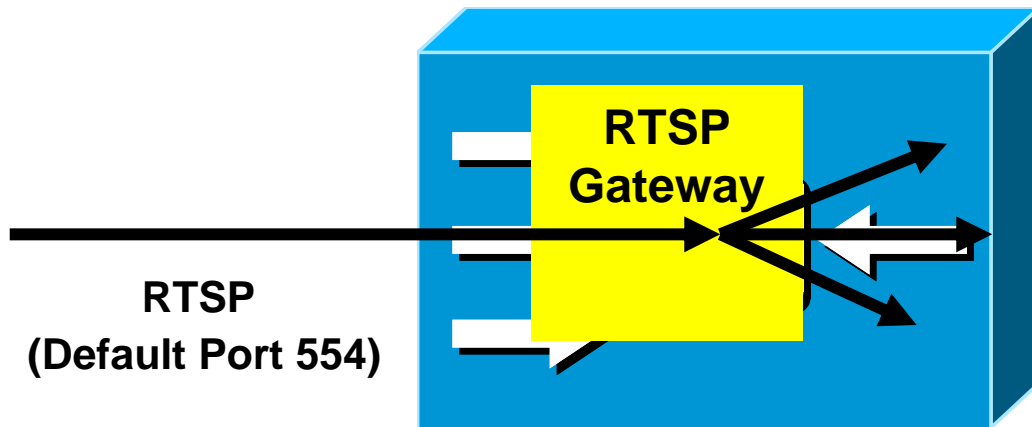
MPEG4 P.10 (Advanced Simple AV, Advanced 2D level1) , MPEG2, MPEG1 over RTP/RTSP

HTTP

Flash and
Progressive
Download

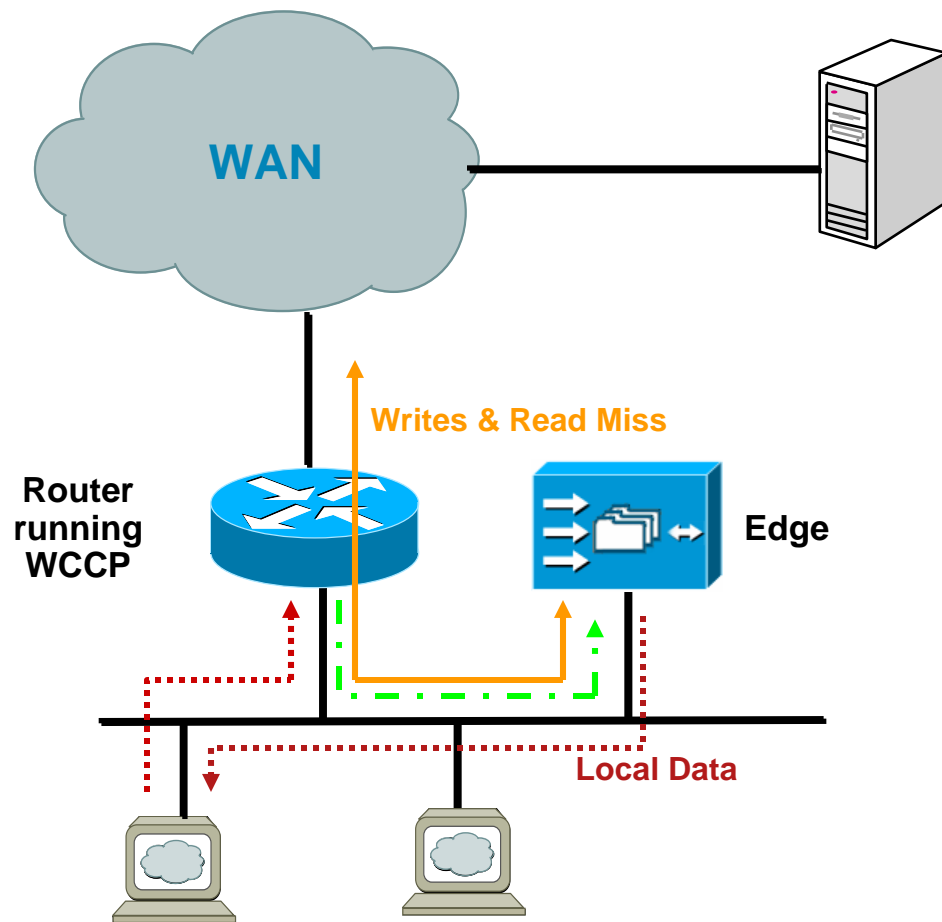


Session Protocol Flexibility *must* be considered



- Check browser type
- Check manifest file
- Check server availability
- Forward to server

1 - Choose a Redirection Method Transparent Interception (WCCP)



■ Global

```
ip wccp web-cache
ip wccp 80
ip wccp 81
ip wccp 82
ip wccp 83
```

■ Interface Ethernet/Serial

```
ip wccp 80 redirect in/out
ip wccp 81 redirect in/out
ip wccp 82 redirect in/out
ip wccp 83 redirect in/out
```

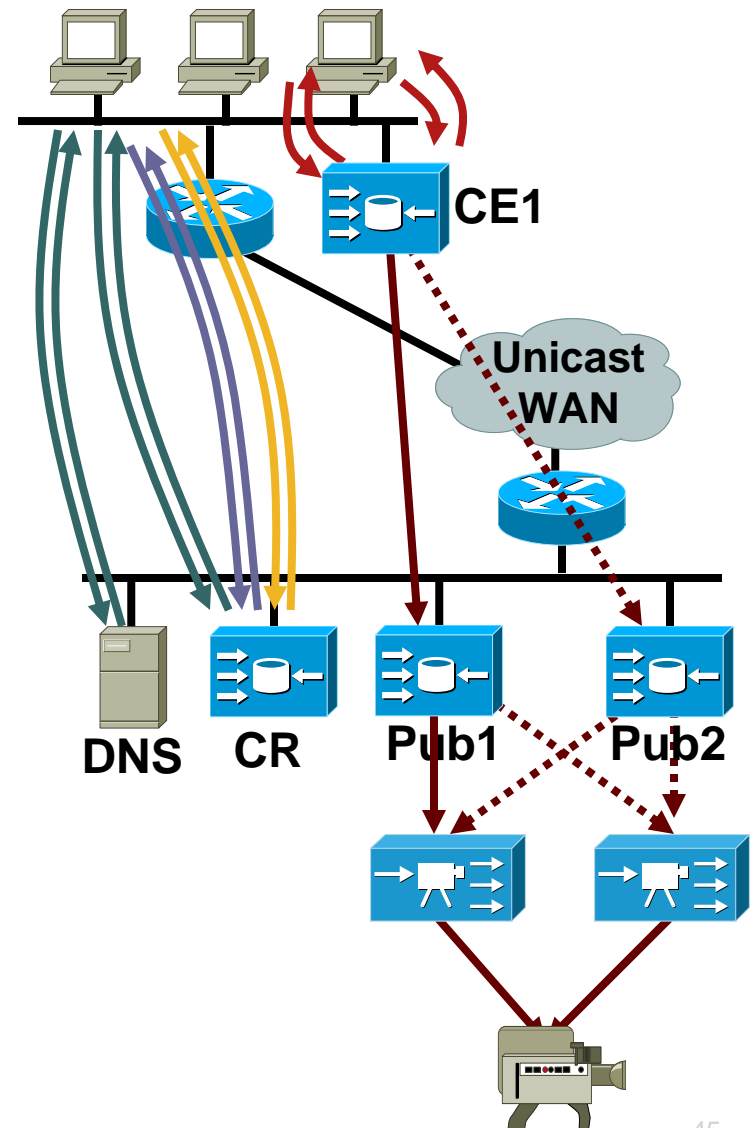
■ Content Engine

```
wccp web-cache router-list 1
10.1.1.254
wccp rtsp router-list-num 1
wccp wmt router-list-num 1
wccp rtspu router-list-num 1
wccp version 2
```

1 - Choose a Redirection Method

Simplified Hybrid Routing

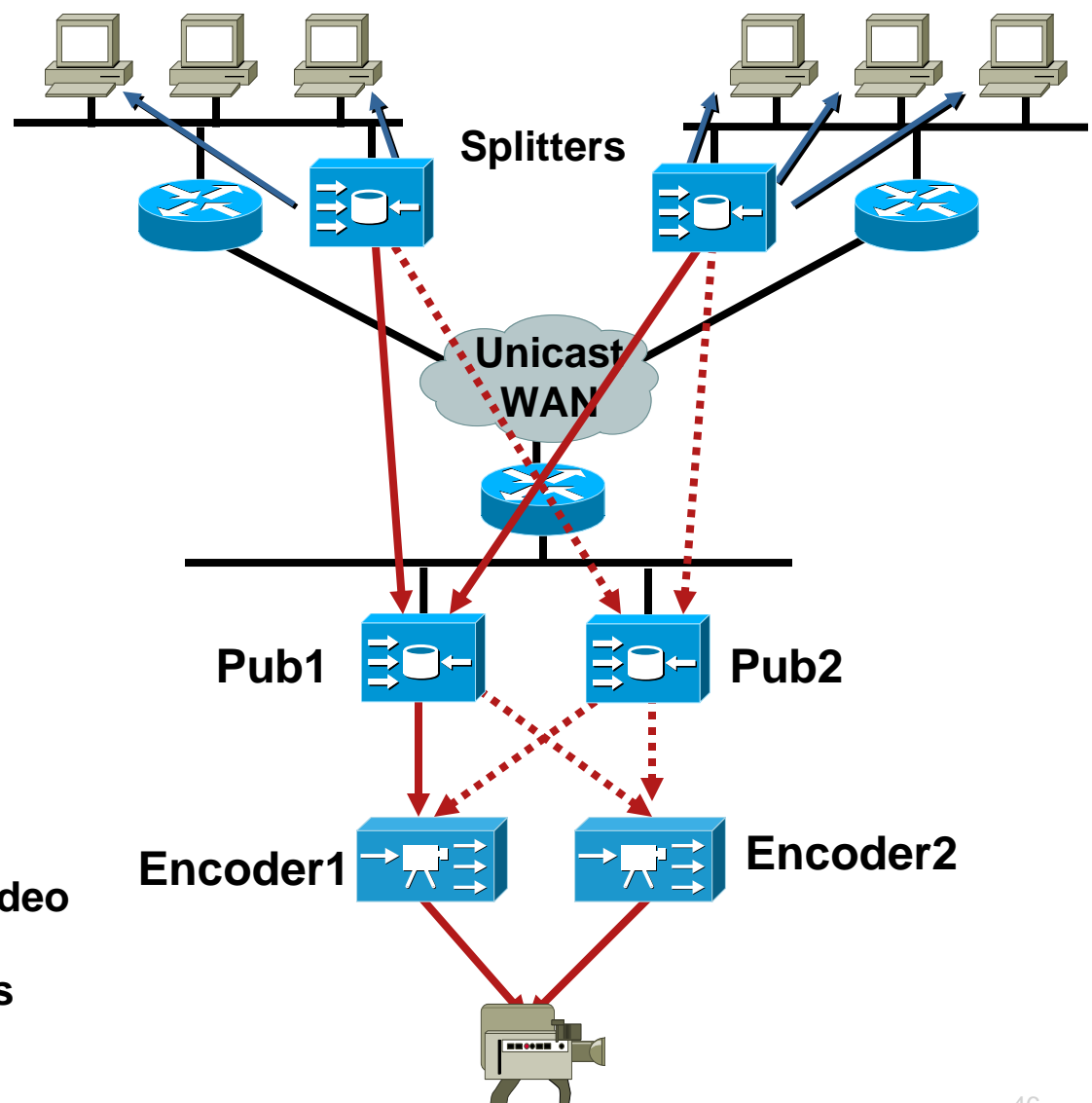
1. DNS admin delegates domain cdn.company.com to Content Router (CR)
2. Web publisher publishes video with <http://cdn.company.com/video.asf.asx>
3. Client clicks on link
4. Client makes DNS query for cdn.company.com
5. DNS sends NS record for CR
6. PC sends DNS query to CR for cdn.company.com
7. CR returns its own IP address for cdn.company.com
8. PC requests <http://cdn.company.com/video.asf.asx> request to CR
9. CR sees client IP address (not DNS) and sends a 302 location redirect to <http://ce1.ce.cdn.company.com/video.asf.asx>
10. Client resolves ce1.ce.cdn.company.com from CR
11. CR returns local [ce1-ip](http://ce1.ce.cdn.company.com) based on coverage zone routing
12. Client makes request <http://ce1.ce.cdn.company.com/video.asf.asx> to ce1
13. [CE1](http://ce1) generates a dynamic [video.asf.asx](http://ce1-ip/video.asf) file with an MMS/RTSP link in the form of mms://ce1-ip/video.asf
14. [CE1](http://ce1) servers the VoD or live stream as appropriate



2 - Choose Headend and Edge architecture Unicast Program

- Redundancy
- Streams pulled to edge WAEs regardless of client join
- All streams must be directed through WAEs via proxy, WCCP, or CR
- WAE logs all delivered streams

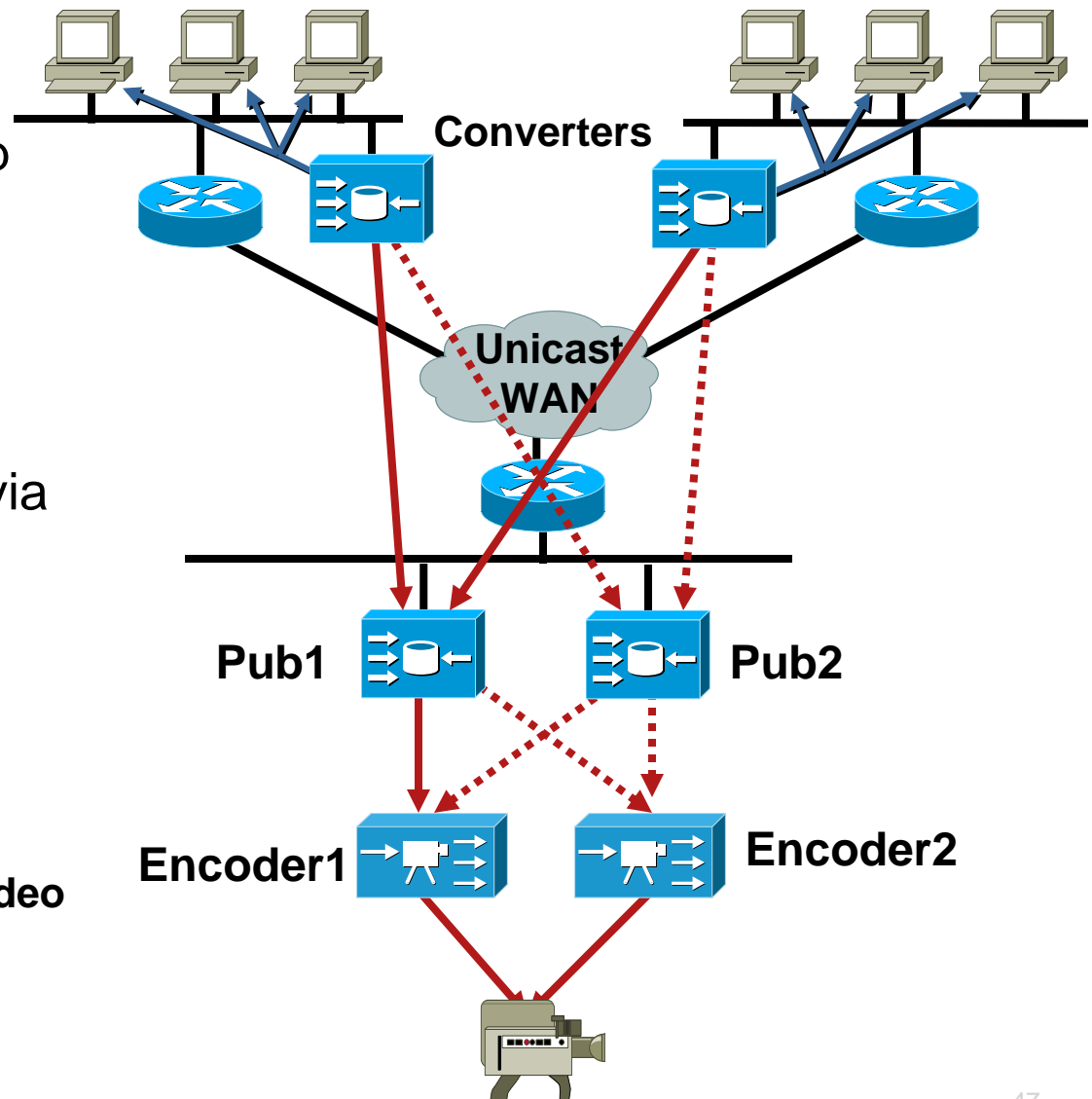
- Live Unicast Video
- ⋯ Back-Up Live Unicast Video
- Multiple Unicast Streams (One per User)



2 - Choose Headend and Edge architecture Multicast Program

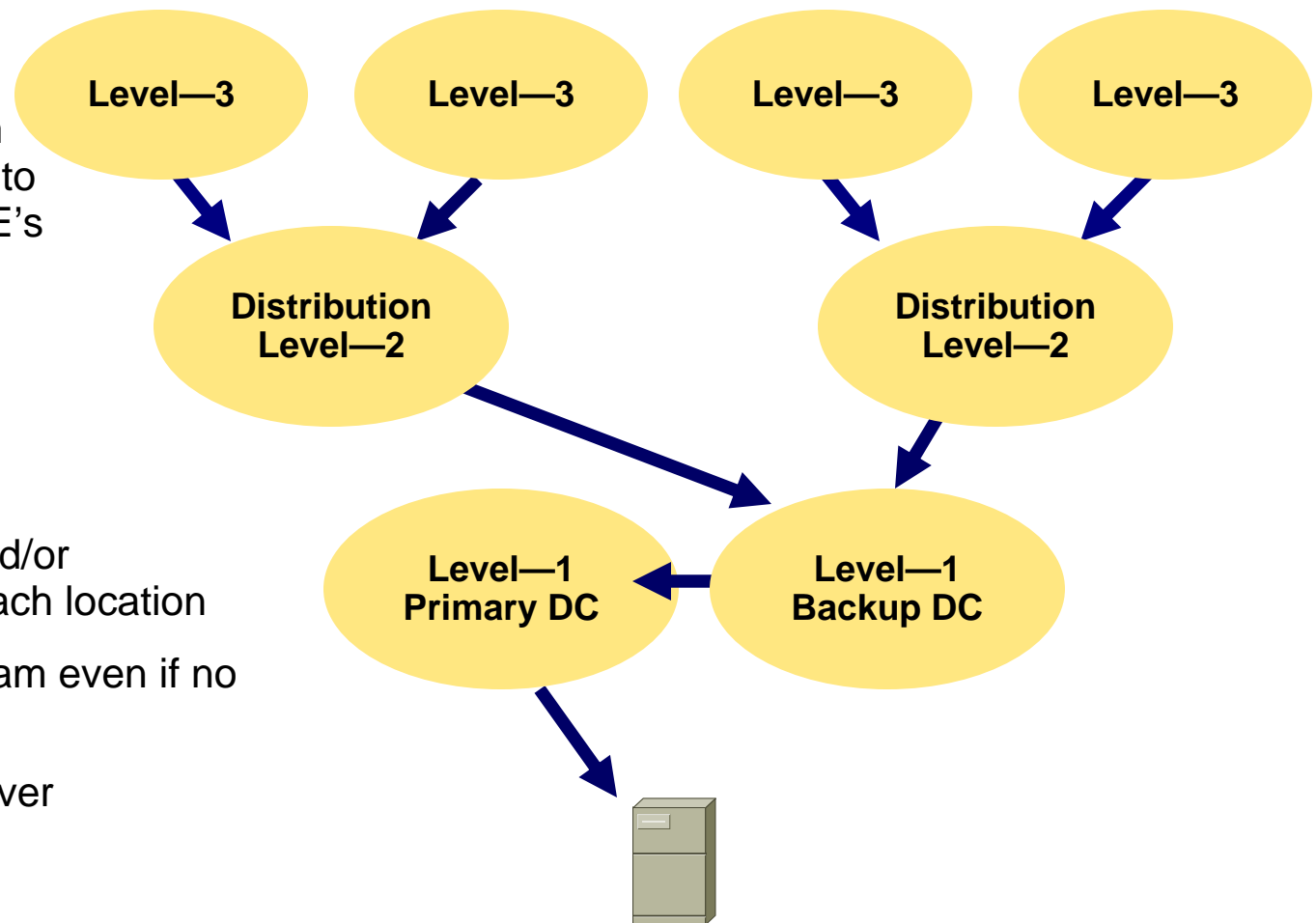
- Redundancy
- Common multicast group
- Streams pulled to edge WAEs regardless of client join
- All streams must be directed through WAEs via proxy, WCCP, or CR
- Web published nsc delivered by publisher

- Live Unicast Video
- ⋯ Back-up Live Unicast Video
- Multicast



3 - Choose the Video Hierarchy

- Live split tree
- Distributes stream source meta data to all participating CE's based on location hierarchy
- Pull unicast from location parent (MPLS support)
- Deliver unicast and/or multicast inside each location
- Multicast pull stream even if no interested parties
- Scheduled or forever



4 - Choose Bandwidth Constraints

The screenshot displays the Cisco Application and Content Networking System interface in Microsoft Internet Explorer. The browser address bar shows `https://10.1.1.1:8443/`. The main navigation bar includes **Devices**, **Channels**, **Network**, **Monitoring**, **System**, and **Admin**. The breadcrumb trail indicates the current location: **CDM > Content Engines > Content Routers > Device Groups**.

The page title is **Default and Max Bandwidth for Device Group, all-ce**. A red box highlights the **Content Services Default/Max Bandwidth Settings** table:

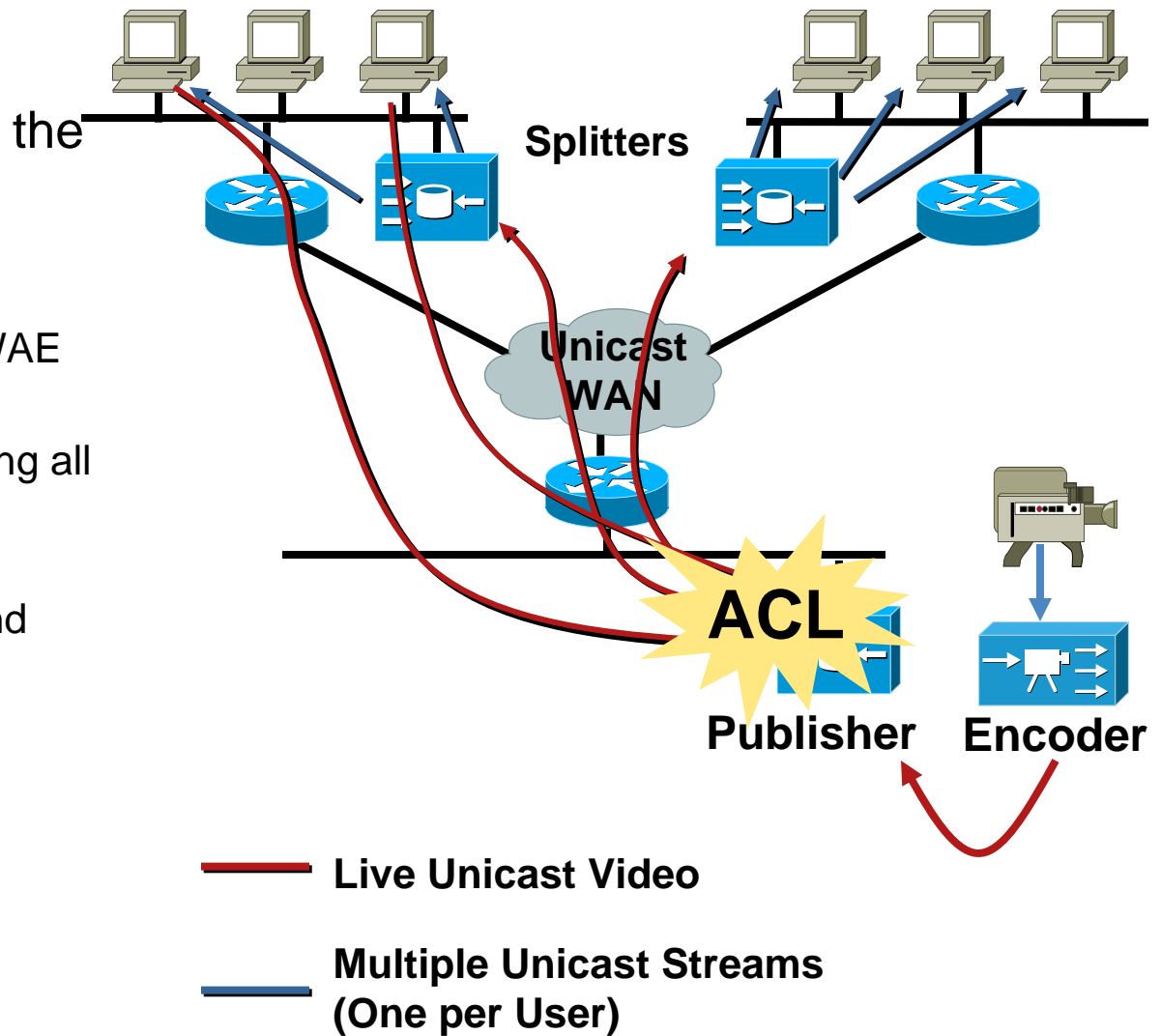
Service	Default Bandwidth	Max Bandwidth
WMT Incoming	1500 Kbps	1500 Kbps
WMT Outgoing	28000 Kbps	28000 Kbps
Real Proxy Incoming		
Real Proxy Outgoing		
Real Server		
Cisco Streaming Engine		
HTTP		

Below the table, a green checkmark and the text **Change submitted.** are visible. A legend at the bottom of the page indicates: **Max WMT Incoming** (blue square), **Default WMT Incoming** (yellow square), and **Max WMT Outgoing** (green square).

An inset window titled **Bandwidth Graph - Microsoft Internet Explorer provided by Cisco Systems, Inc.** shows a line graph for **Content Service Bandwidth for Device Group: all-ce**. The graph displays bandwidth usage over a full week (Sun to Sat). The Y-axis ranges from 0 to 28000 Kbps. The legend indicates that the graph shows **Max WMT Incoming** (blue), **Default WMT Incoming** (yellow), and **Max WMT Outgoing** (green).

5 - Choose how to protect against failures

- Upon failure, clients will pull streams over the WAN
- Solutions
 - Branch ACL allowing WAE video requests only
 - Data center ACL allowing all branch WAEs
 - Publisher WAE ACL allowing local clients and branch WAEs only



Everything need to be centrally managed... (example: Group Management & Configuration)

Cisco Application and Content Networking System - Microsoft Internet Explorer provided by Cisco Systems, Inc.

File Edit View Favorites Tools Help

Address <https://cdm.allcisco.com:8443/servlet/com.cisco.unicorn.ui.LoginServlet>

CISCO SYSTEMS Application and Content Networking System **System Status** Devices: 1 Device, Major Content: 2 Channels, Critical Home | QuickStart | Help | Logout

Devices **Device Groups** Locations Multicast Clouds Statistics

Expand All Modifying Device Group, all-ce

Contents

- Device Group Home
- Software Update
- Assignments
- Prepositioning
- Request Routing
- Request Processing
- Applications
 - Default and Maximum Bandwidth
 - Bandwidth Schedules
- Streaming
- Web
- DNS
- Set Top Box
- File Sharing
- General Settings

Device Group Information

Name: * all-ce Device Type: Content Engine

Comments

All Content Engines

Note: * - Required Field

Submit Cancel

...Monitored and Operated (example: Global Protocol Statistics and Faults)

System Status
 Devices: 1 Device, Major
 Content: 2 Channels, Critical

System Home

Current Configuration:
 Devices: 1 Content Engines, 0 Content Routers, 1 Content Distribution Manager
 Content: 2 Channels, 5 Programs
 Software Version:
 5.3.0.b.200 on 2 Devices.
 0 Devices have a lower version than the CDM.

System-Wide Bytes Served:

KB/sec

21-Feb 28-Feb 7-Mar 14-Mar

■ HTTP ■ HTTPS ▲ FTP ◆ Windows Media ■ CSE ▼ Real Proxy - CIFS
 ▶ TFTP

[View Detailed Report](#)

System-Wide Bandwidth Efficiency Gain:

KB/sec

21-Feb 28-Feb 7-Mar 14-Mar

■ In ■ Out ▲ Efficiency Gain

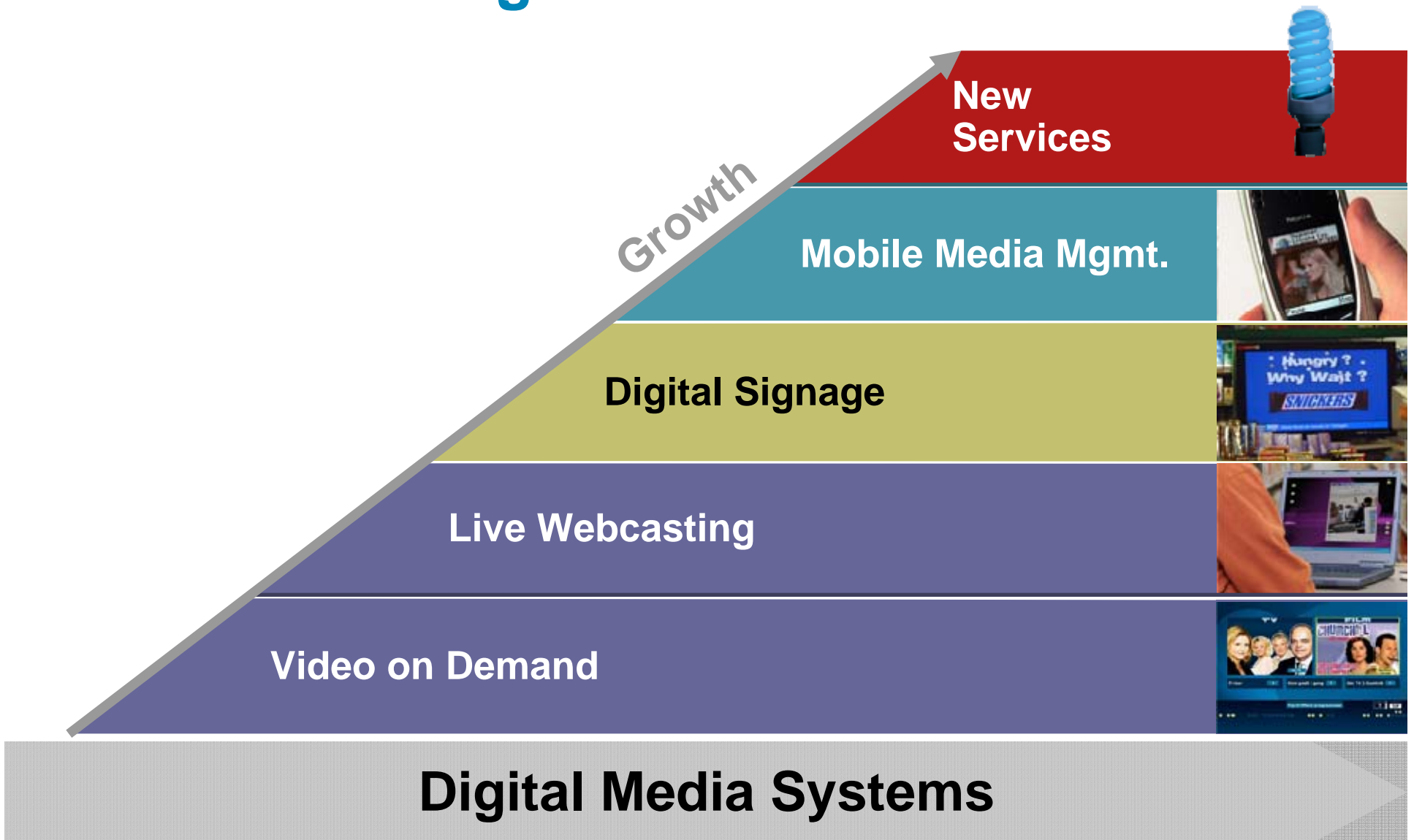
[View Detailed Report](#)

Other System-Wide Statistics: [Streaming Sessions](#)

Video Services



Video and Digital Media Services



Digital Media Systems

Content Creation



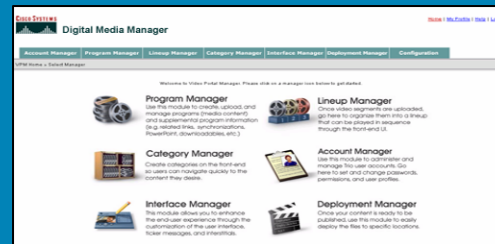
Digital Media Encoder 1000



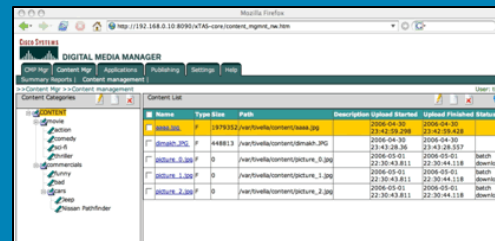
Digital Media Encoder 2000

Content Management

Digital Media Manager



Video Portal Enabler



Digital Signage Enabler

Content Presentation



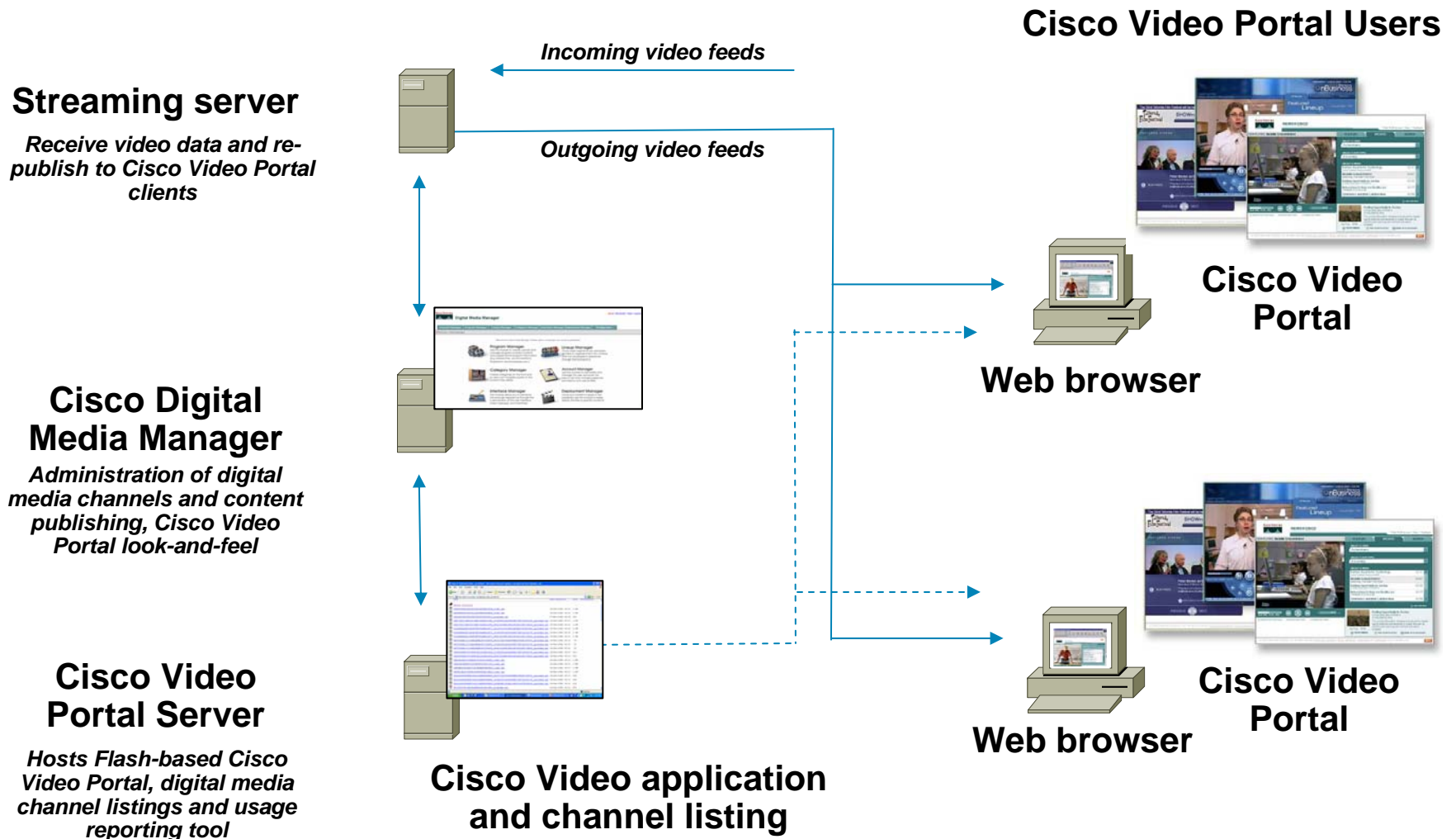
Video Portal



Digital Media Player

Solution that Spans Across the Digital Media Value Chain

Cisco Digital Media System Overview

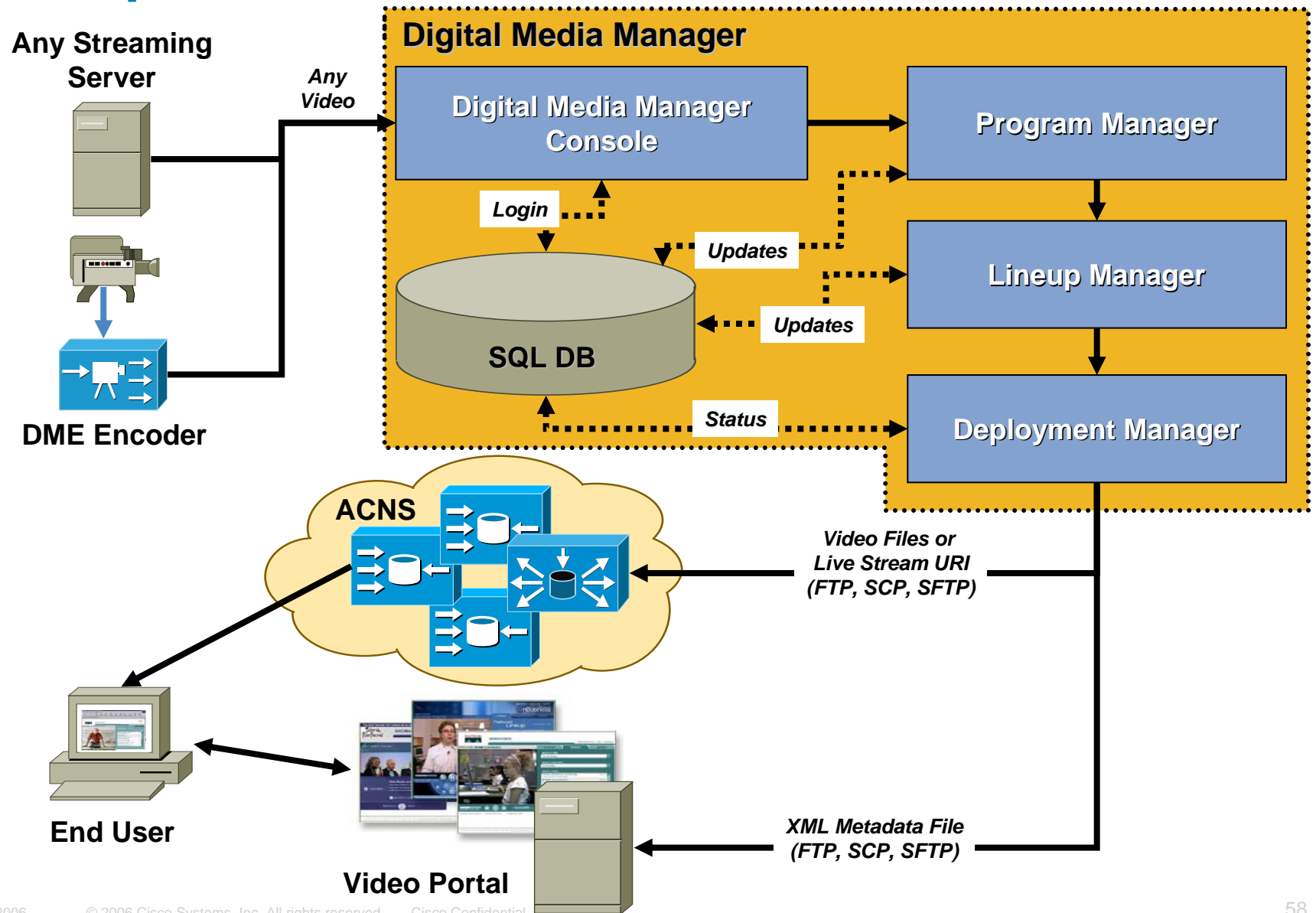


DEMO #2

Desktop Video



There is a strong relations between DMS components



Digital Media Manager




DIGITAL MEDIA MANAGER

SETUP | USERS | VIDEO PORTAL | ENCODERS

Home | My Profile | Help | Logout


DMM HOME » SELECT MANAGER

Welcome, Super, to the Digital Media Manager 3.5.



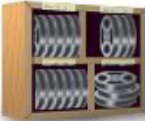
Programs

Upload and manage content and supplemental information.




Playlists

Organize content into a playlist for playback in a dynamic sequence in the Video Portal.




Categories

Organize content into categories within the Video Portal's Program Guide.




Users

Assign and manage user accounts, passwords, permissions and profiles.



User Interfaces

Customize Video Portal interface design and manage interface behaviors.



Deployments

Schedule and manage content deployments.

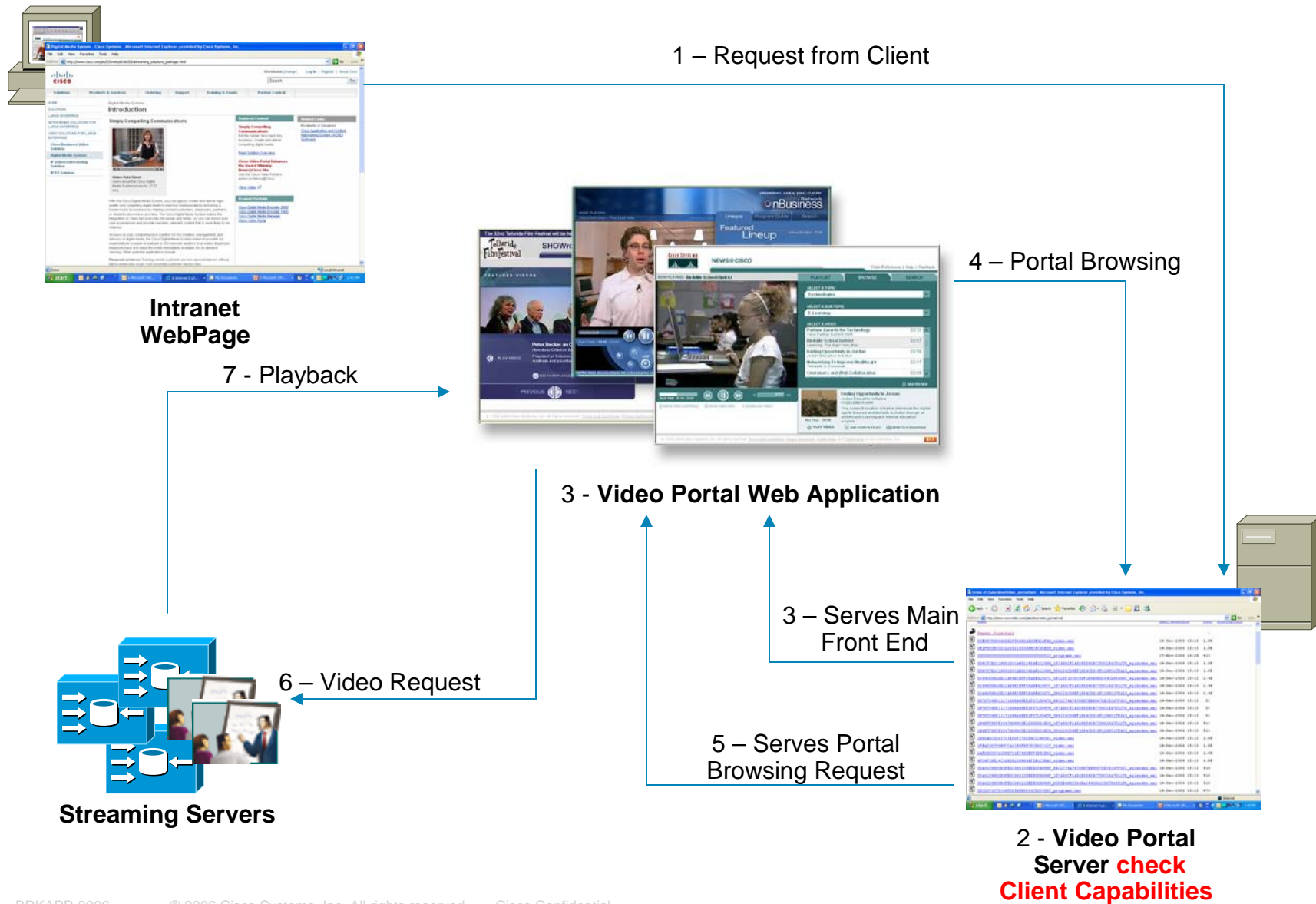
Cisco Video Portal with Video Player

The screenshot shows the Cisco Video Portal interface in Microsoft Internet Explorer. The browser window title is "Cisco Video Portal - Microsoft Internet Explorer provided by Cisco Systems, Inc." and the address bar shows "File Edit View Favorites Tools Help". The page content includes a date and time stamp "THURSDAY, FEBRUARY 23, 2006 :: 4:32 PM" and "poweredbyCisco.".

The interface is divided into several sections:

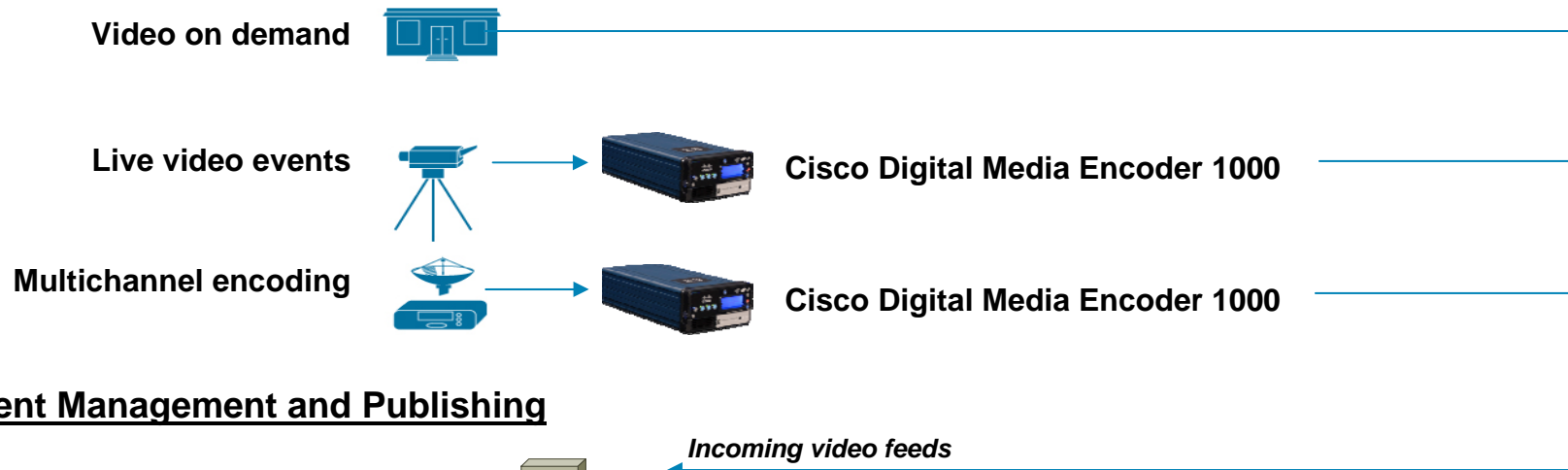
- Video Playback Area or Supplemental Video Information:** A large area on the left displaying a video player with a "real world marketing" logo and the text "HOW BRANDS CREATE MARKETS".
- Navigation Area:** A right-hand column containing a "Lineups" section with a "Program Guide" and "Search" tab. It lists featured lineups such as "Cisco Digital Media System Powerful Tools for Media Delivery" (03:20), "On the Case Managing Your Team Through..." (04:10), "Tech Revolution The First Email" (02:17), "Sales Commission Knowing Your Customer" (05:20), "Real World Marketing How Brands Create Markets (1 of 4)" (02:56), and "CEOs Upclose With Dale Fuller - CEO of Borland..." (04:53). A "TOTAL LINEUP DURATION 22:56" is also shown.
- Basic Video Playback Controls:** A control bar at the bottom left showing "RUN TIME :: 00:09 / 02:56" and standard playback buttons (play, stop, previous, next, full screen, etc.).
- Advanced Video Controls:** A set of more detailed playback controls below the basic ones.
- Ticker Messages:** A message at the bottom of the page: "Thank you for installing the Cisco Video Portal".
- Preview Pane:** A small pane at the bottom right showing a preview of the "Real World Marketing" video with a "Play Video" button and an "Add to My Lineup" button.

Day in a “user-click” life

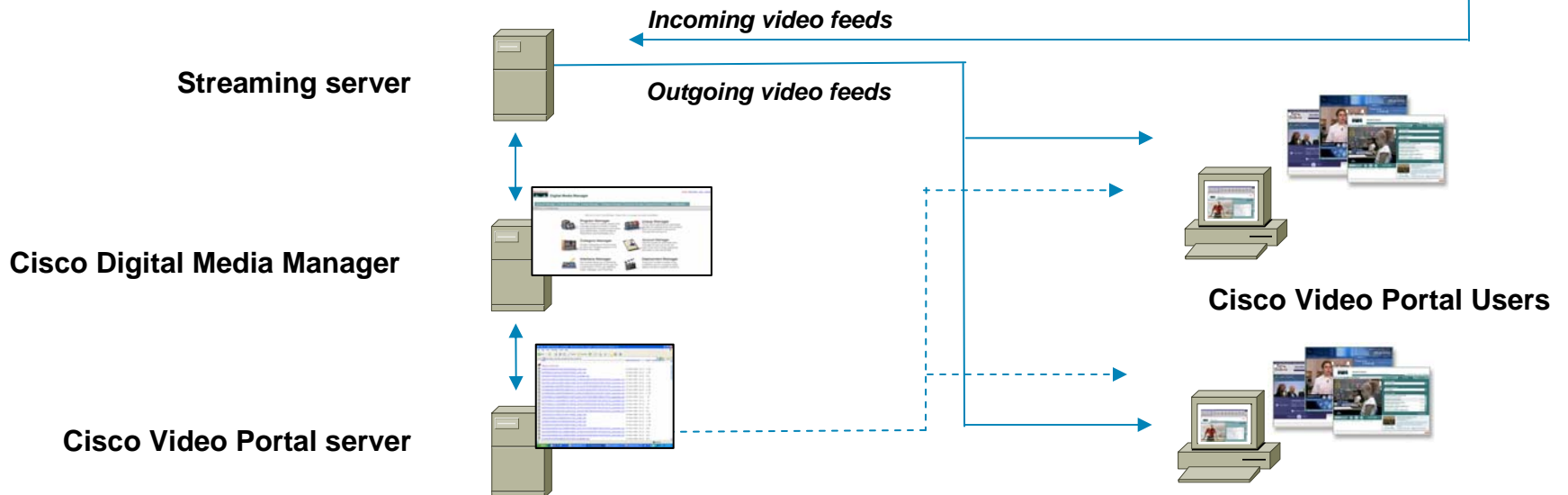


Live Video and Video on Demand

Digital Media Encoding



Content Management and Publishing

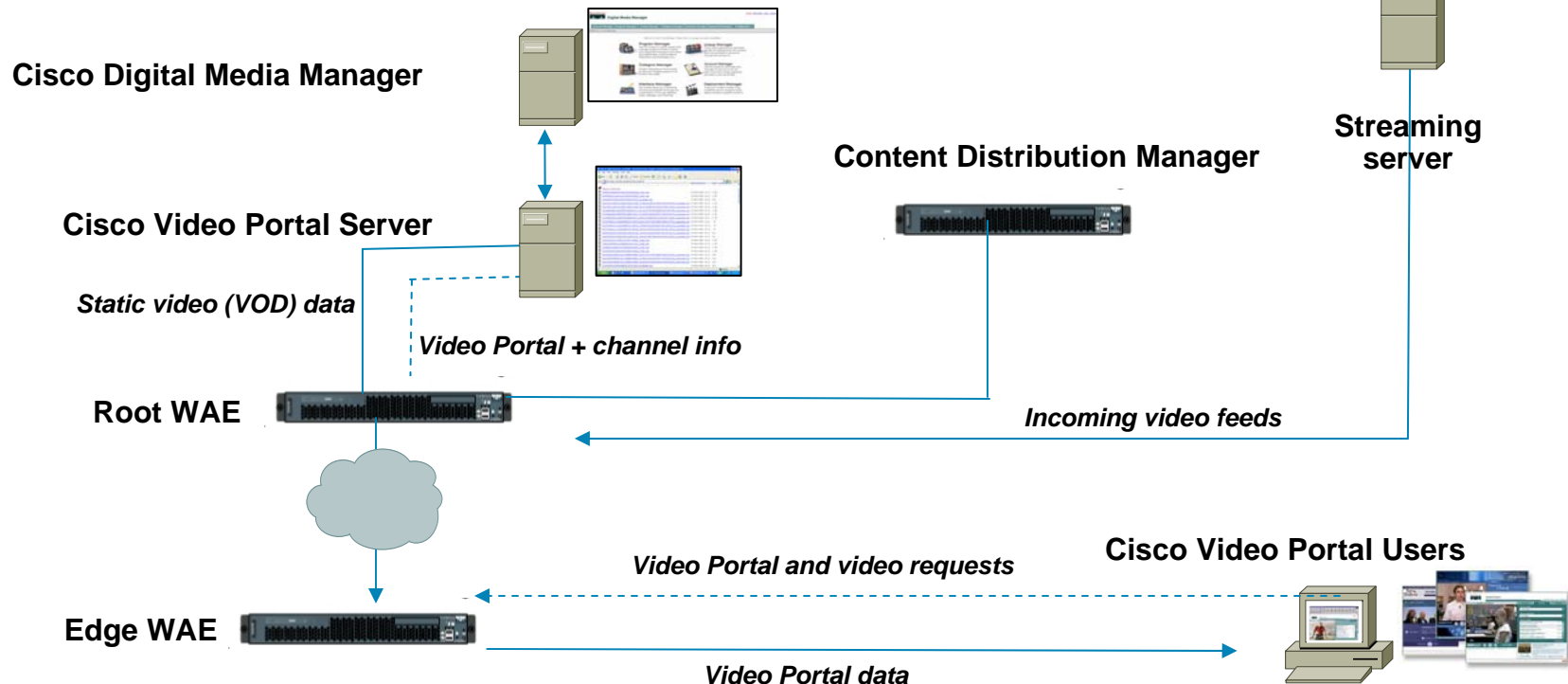


Video Publishing with ACNS

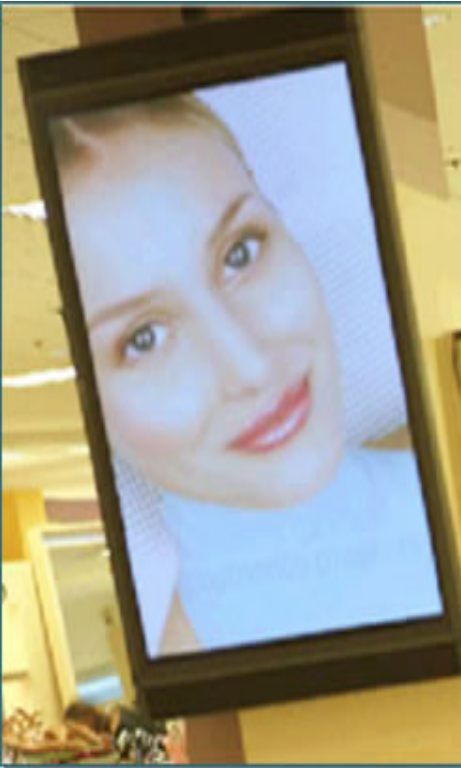
Digital Media Encoding



Content Publishing and Distribution with Cisco ACNS and multiple WAE's



Digital Signage Examples...



Digital Signage

Benefits, Features and Applications

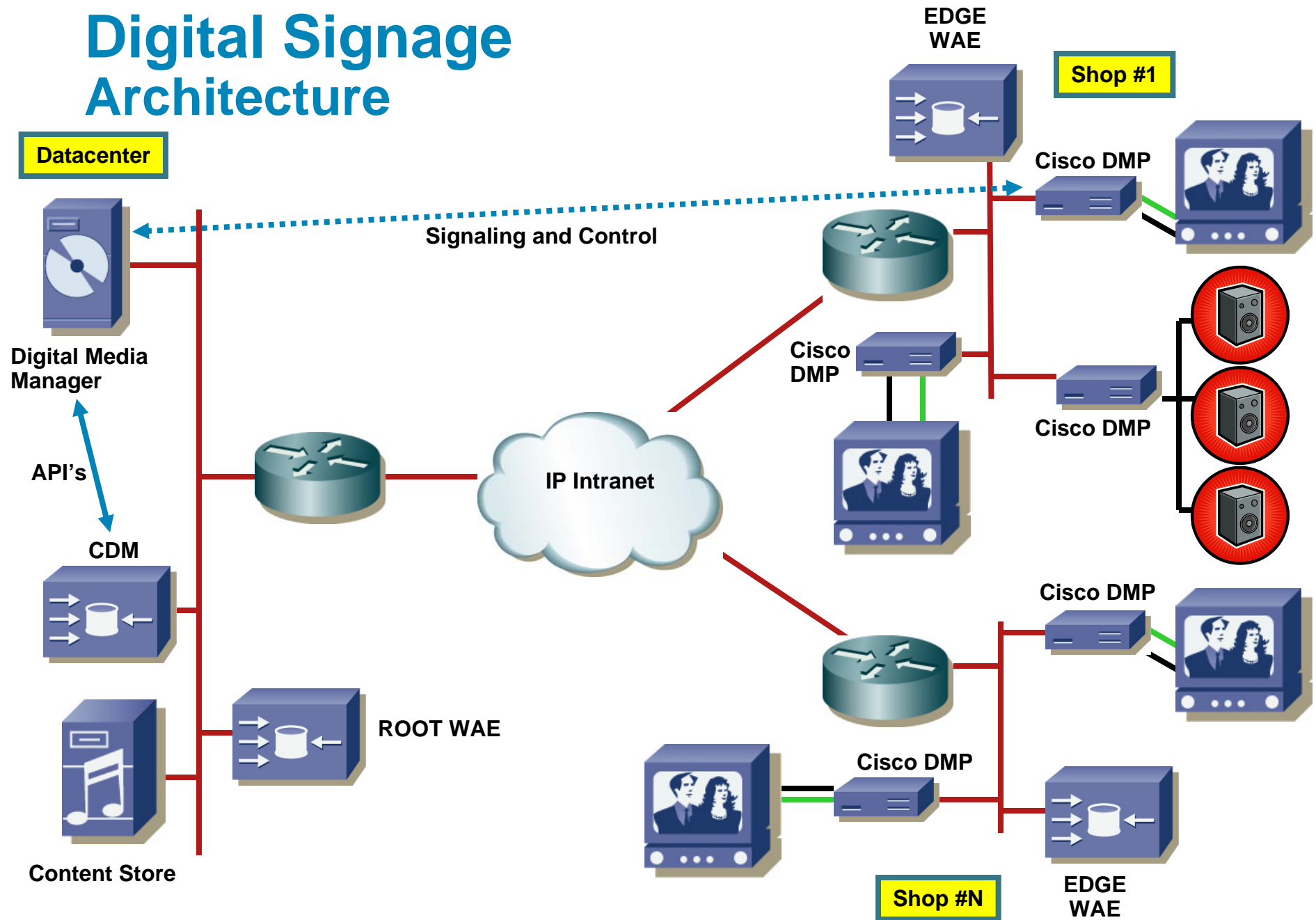
Benefits and Features

- **Leverages IP infrastructure (low \$/channel)**
- **Media player discovery, grouping, management, and monitoring/reporting**
- **Multiple formats: Audio, Video, Graphics, Text**
- **Full screen video or on-screen zoning**
- **Remote management of display (on/off, volume, contrast, brightness)**
- **High reliability--25 yr MTBF**
- **Integration with Cisco ACNS/WAE for robust networking**

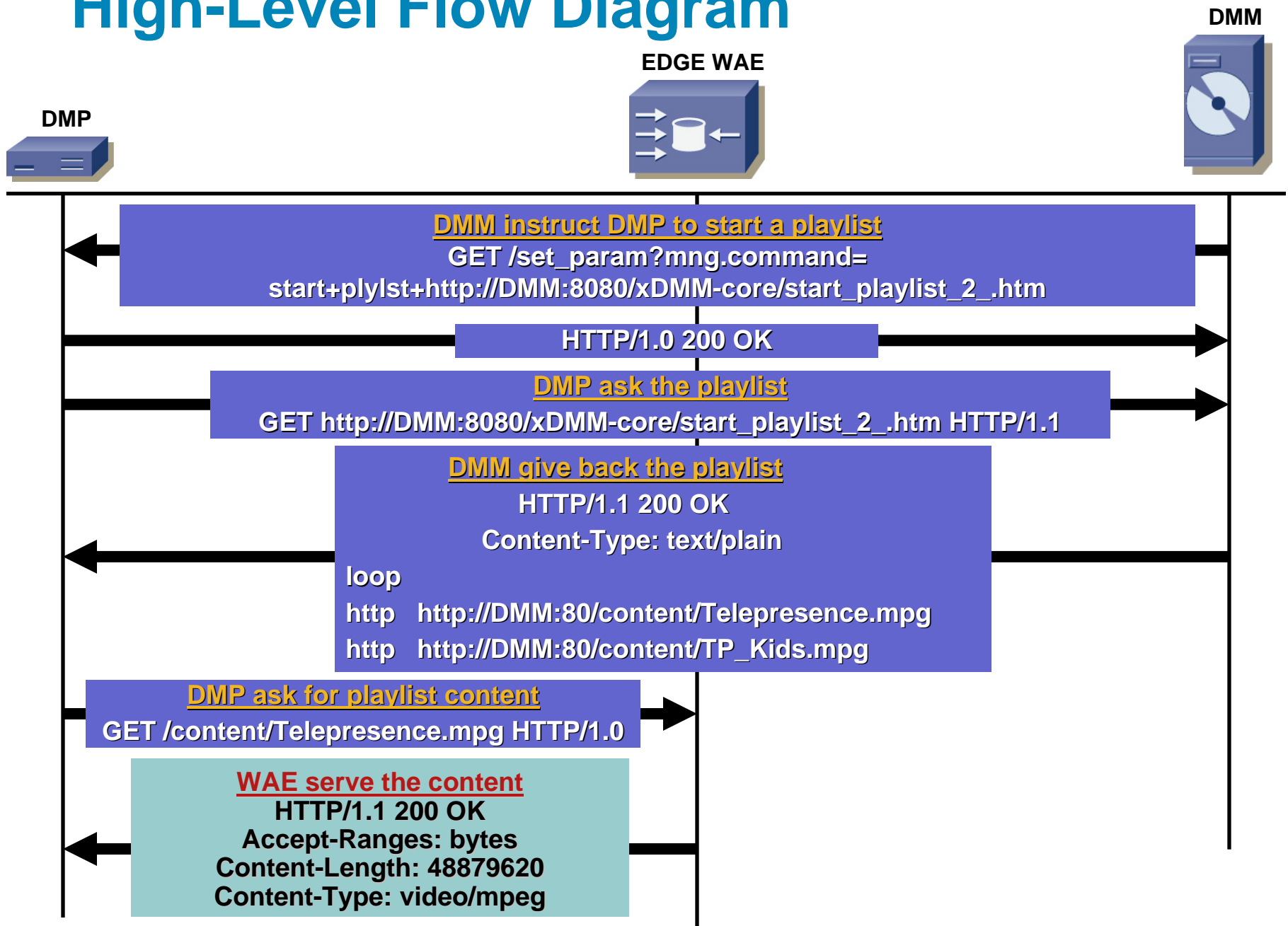
Applications

- **Promote, cross, and upsell**
Generate advertising revenue
- **Product and service differentiation**
- **Enhance store experience**
Reduce perceived wait times
Brand enhancement
- **Training and employee development**
Executive communications
- **“Way-finding”/informational signage**

Digital Signage Architecture



High-Level Flow Diagram



Content Management Playlist and Zoning

CISCO SYSTEMS DIGITAL MEDIA MANAGER

DMP Mgr Content Mgr Applications Publishing Settings Help

Applications Management | User: cisco

>>Applications >>Applications Management

Application Types

- Discovery
- DMP Video/Audio Settings
- DMTECH LCD Control
- External Browser Based Applications
- Multicasts
- Playlists**
- Startup URL
- System Tasks
- Upgrade DMP
- Zoning

Change Playlist

Name: Video
Description:
Play: In Loop

Content Categories

- CONTENT
- Video
- Flash

Available Content

Name	Type	Size	Path	Description
<input type="checkbox"/> TP_Kids.mpg	F	5951768	/var/tivela/content/TP_Kids.mpg	
<input type="checkbox"/> Telepresence.mpg	F	48879620	/var/tivela/content/Telepresence.mpg	

Selected Content

Name	Pic.	Show time	Type	Path
<input type="checkbox"/> Telepresence.mpg			F	/var/tivela/content/Telepresence.mpg
<input type="checkbox"/> TP_Kids.mpg			F	/var/tivela/content/TP_Kids.mpg

Cancel Submit

CISCO SYSTEMS DIGITAL MEDIA MANAGER

DMP Mgr Content Mgr Applications Publishing Settings Help

Applications Management | User: cisco

>>Applications >>Applications Management

Application Types

- Discovery
- DMP Video/Audio Settings
- DMTECH LCD Control
- External Browser Based Applications
- Multicasts
- Playlists
- Startup URL
- System Tasks
- Upgrade DMP
- Zoning**

Change Zoning Application

Name: Complex
Description:
Background Color: [Pick](#)
Foreground Color: #FFFFFF [Pick](#)
Template Type: Logo-Video-Flash-Ticker

Content Categories

- CONTENT
- Video
- Flash

Available Content

Name	Type	Size	Path	Description
<input type="checkbox"/> TP_PressLaunch.swf	F	343208	/var/tivela/content/2/TP_PressLaunch.swf	

Cancel Submit

Scheduling and Publishing


CISCO SYSTEMS
DIGITAL MEDIA MANAGER

DMP Mgr | Content Mgr | Applications | Publishing | Settings | Help

ACNS Channels Status | Scheduler |

>>Publishing >>Scheduler User: cisco

Server Date/Time: Fri Nov 10 19:33:44 UTC 2006 CISCO ACNS CDM 192.168.1.2 Channel: DigitalSignage

Select Target Date

 Current Target Date
 11/10/06

Applications: DMP Groups: How Often:

From: To: Duration:

DMP Groups	18:00	19:00	20:00	21:00	22:00
ALL DMPs			Complex		
Saturn					
Mediamarket					

- ◆ Status: scheduled
- ◆ App: Complex
- ◆ Group: ALL DMPs
- ◆ From: 11/10/06 7:30 PM
- ◆ To: 11/10/06 8:30 PM
- ◆ How often: Once
- ◆ Start Cmd Result(Total/Ok/Failed): 1/0/1
- ◆ Stop Cmd Result(Total/Ok/Failed): 0/0/0

DEMO #3

Digital Signage



Simply Compelling Communications

Cisco makes it safe to deploy:

- QUALITY
- SCALABLE
- AVAILABLE
- ANYWARE, ANYTIME

Video and Digital Media Architectures, Solutions and Services



Meet the Experts

Application Optimisation Technologies

- Floris Grandvarlet
Consulting Engineer



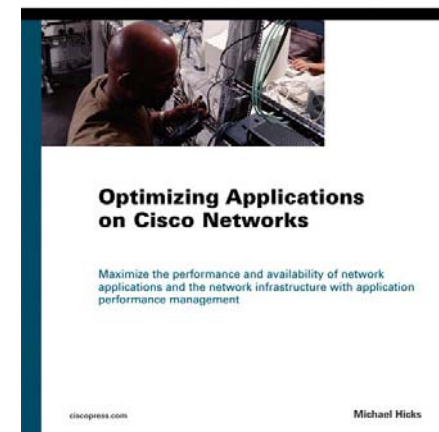
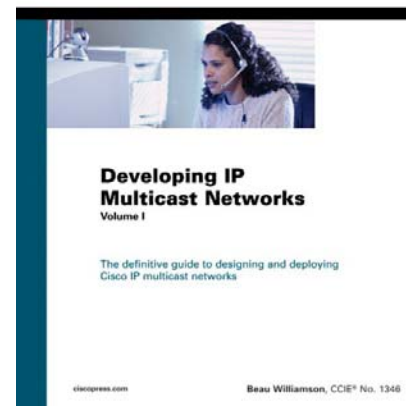
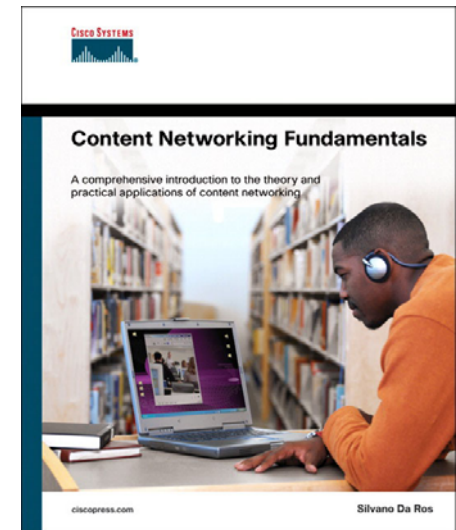
- Horst Dumcke
Consulting Engineer



Recommended Reading

BRKAPP -2006

- Video and Video Conferencing Fundamentals (Apr07)
- Developing IP Multicast Networks, Volume I
- Content Networking Fundamentals
- Optimizing Applications on Cisco Networks



Available in the Cisco Company Store

Q and A





Reference Material

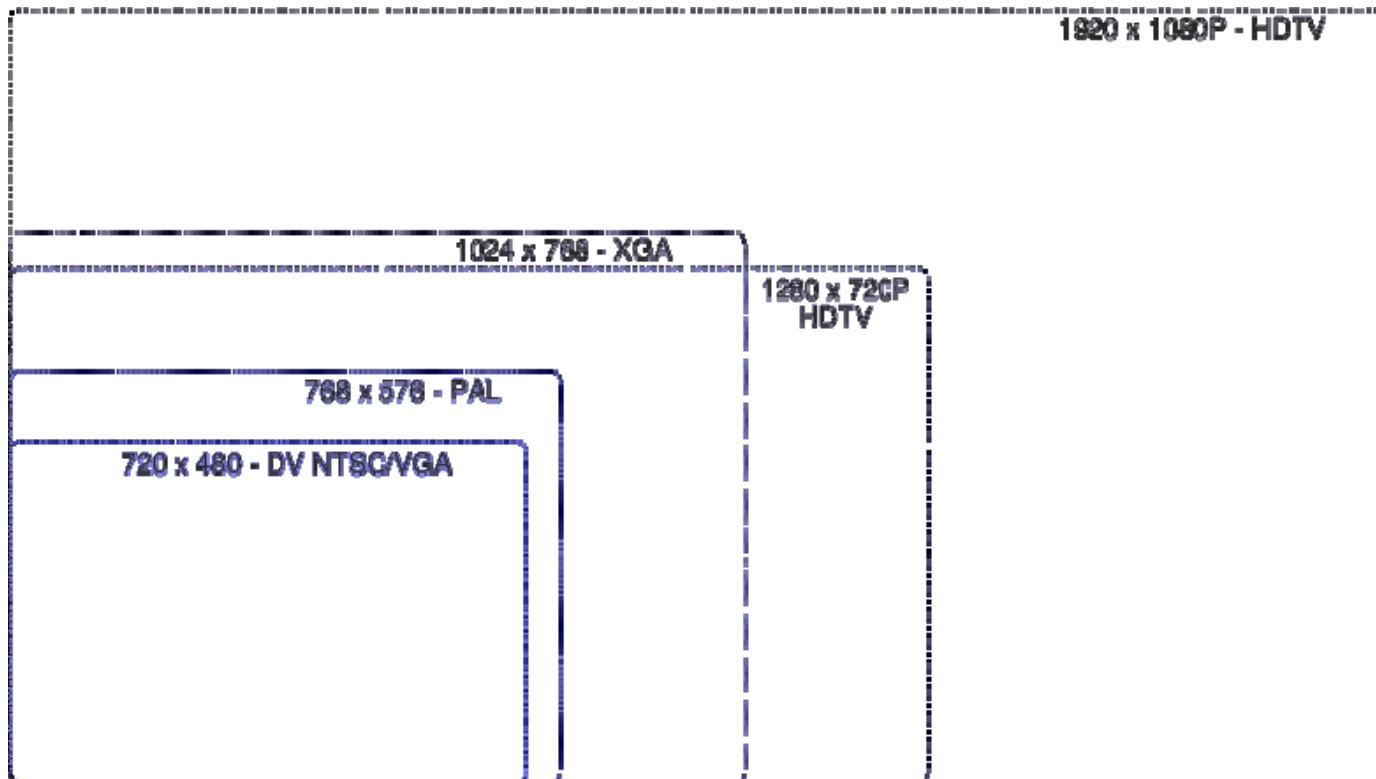


Video CODECs (CODe/DECode)

	Application	Bandwidth	
MPEG1	VCR	0.5 to 1.5Mbps	Motion Pictures Engineering Group
MPEG2	VCR-HDTV	1.5 to 20Mbps	
MPEG4 P.2	Internet-VCR	64Kbps to 4Mbps	
MPEG4 P.10	Internet-HDTV	500Kbps to 12Mbps	
H.261	Video Conferencing	N x 64Kbps	ITU
H.263	Video Conferencing	32Kbps to 2Mbps	
H.263+	Internet	24-64Kbps	
H.264 AVC	Internet-HDTV	500Kbps to 12Mbps	
H.264/M	3G Mobile	64-128Kbps	
Microsoft™	Internet-HDTV	128Kbps to 15Mbps	
Real™	Internet-HDTV	64Kbps to 8Mbps	
Sorenson™	Internet-DVD	128Kbps to 15Mbps	

Video Resolutions

CIF Formats		
Format	NTSC-based	PAL-based
SQCIF		128 × 96
QCIF	176 × 120	176 × 144
QCIF+	176 × 220	176 × 220
CIF	352 × 240	352 × 288
2CIF	704 × 240	704 × 288
4CIF	704 × 480	704 × 576
9CIF	1056 × 720	1056 × 864
16CIF	1408 × 960	1408 × 1152



Video Streaming Media Options

Characteristic	Real	Windows	Flash	QuickTime
Announcement	RAM	ASX, WSX	HTTP+SWF	SDP
Request Protocol	RTSP	MMS, RTSP	HTTP, RTMP	RTSP
CODEC	Proprietary	Proprietary	Proprietary	MPEG
Transport Protocol	RTP/UDP	MMS, RTP/UDP	RTMP	RTP/UDP
Cost	Player: Free Server: Fee Encoder: Fee Stream: Fee	Player: OS Server: OS Encoder: OS Stream: Free	Player: Free Server: Fee Encoder: Fee Stream: Fee	Player: Free Server: Free Encoder: Fee Stream: Free
Player OS	Windows, Linux, Unix, Mac	Windows	Windows, Linux, Unix, Mac	Windows, Mac
Digital Rights Mgmt (DRM)	Yes	Yes	Yes	No
Recording	RM, MP	ASF, WMV/A	FLV	MOV, MP