Building scalable video solutions and services for the Enterprise

BRKAPP-2006

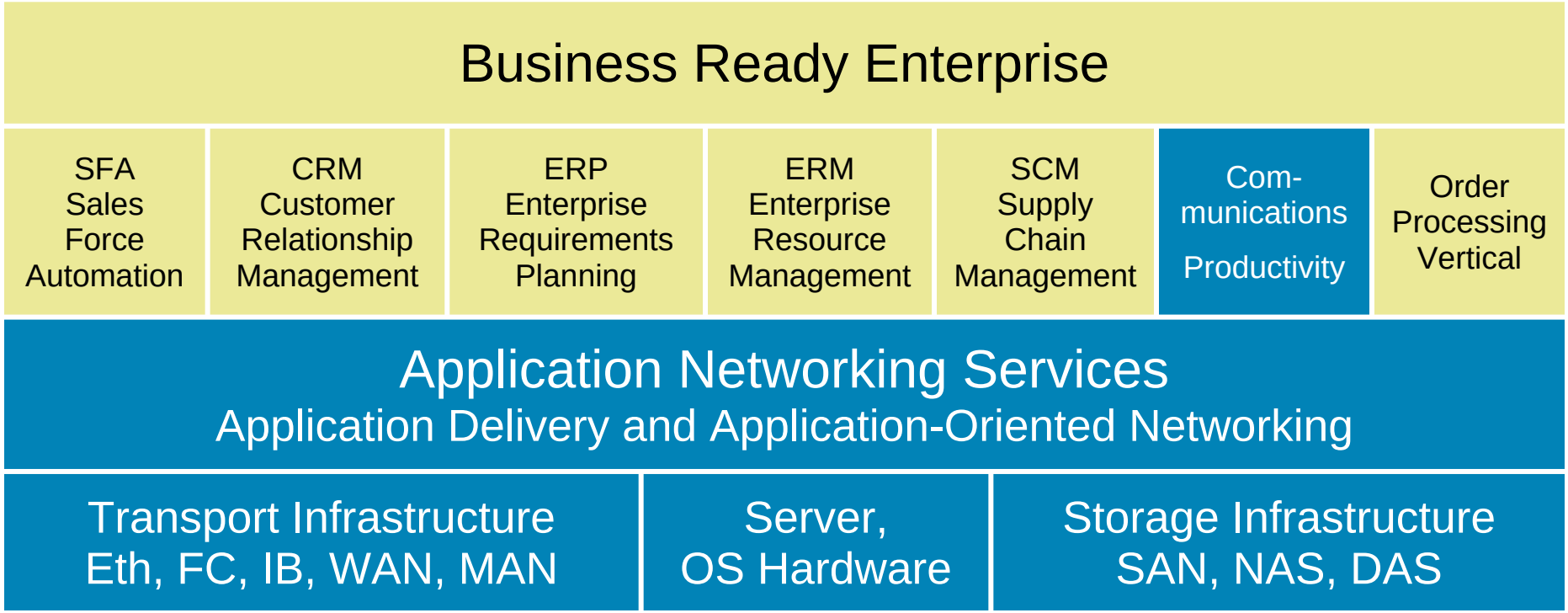
Fabio Ganzaroli

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



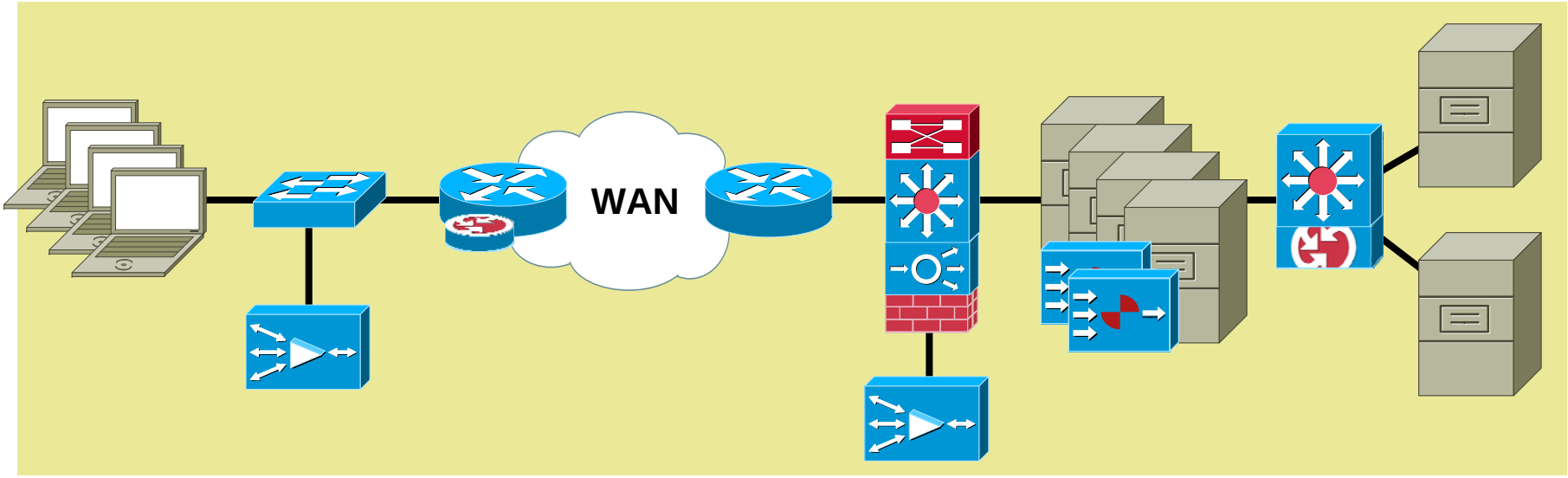
Optimizing Application Performance with Existing Server, Storage, and Network Infrastructure

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

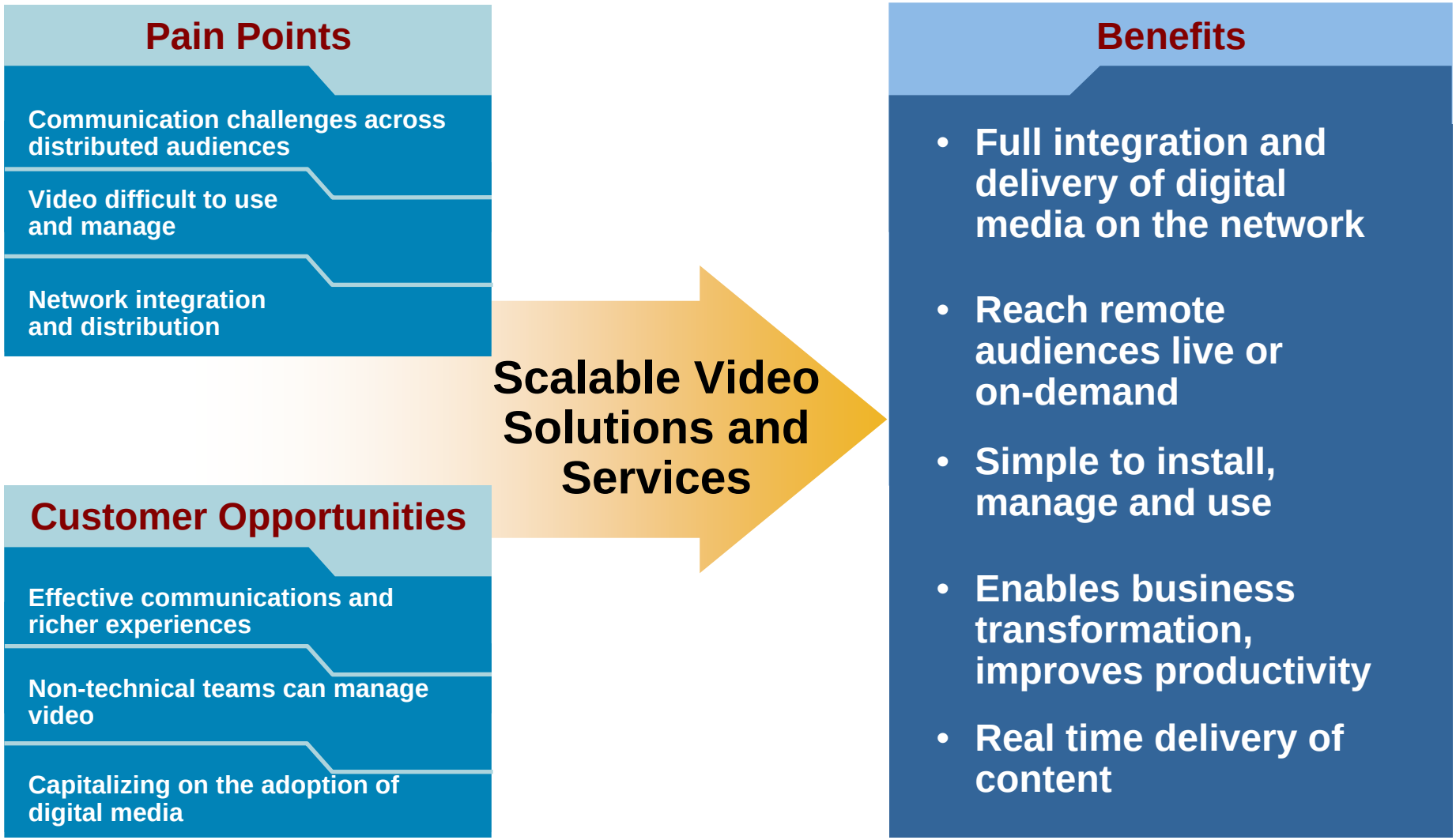


Application Acceleration
- Latency mitigation
- Application data cache
- Meta data cache
- Local services

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

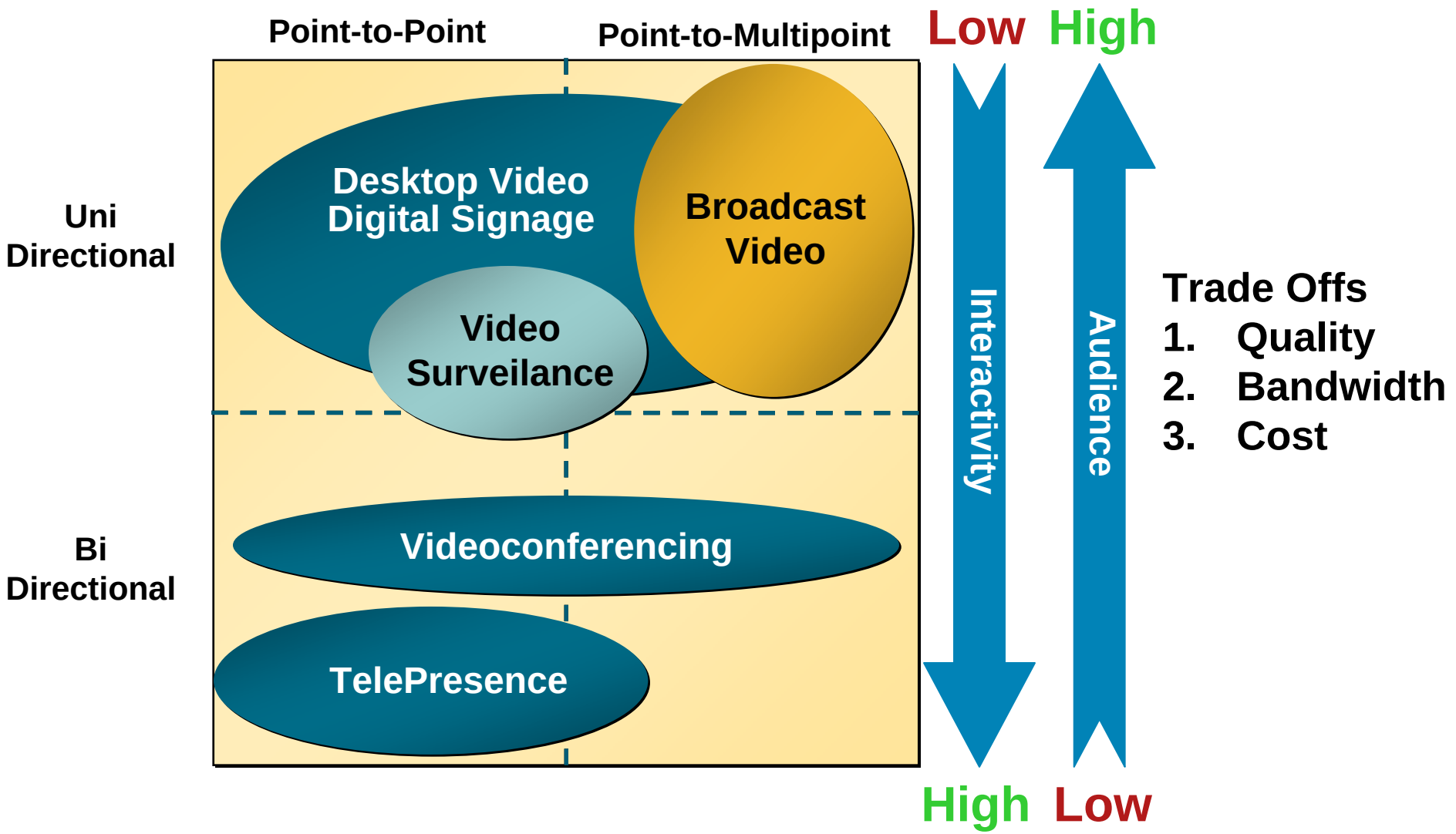


Agenda

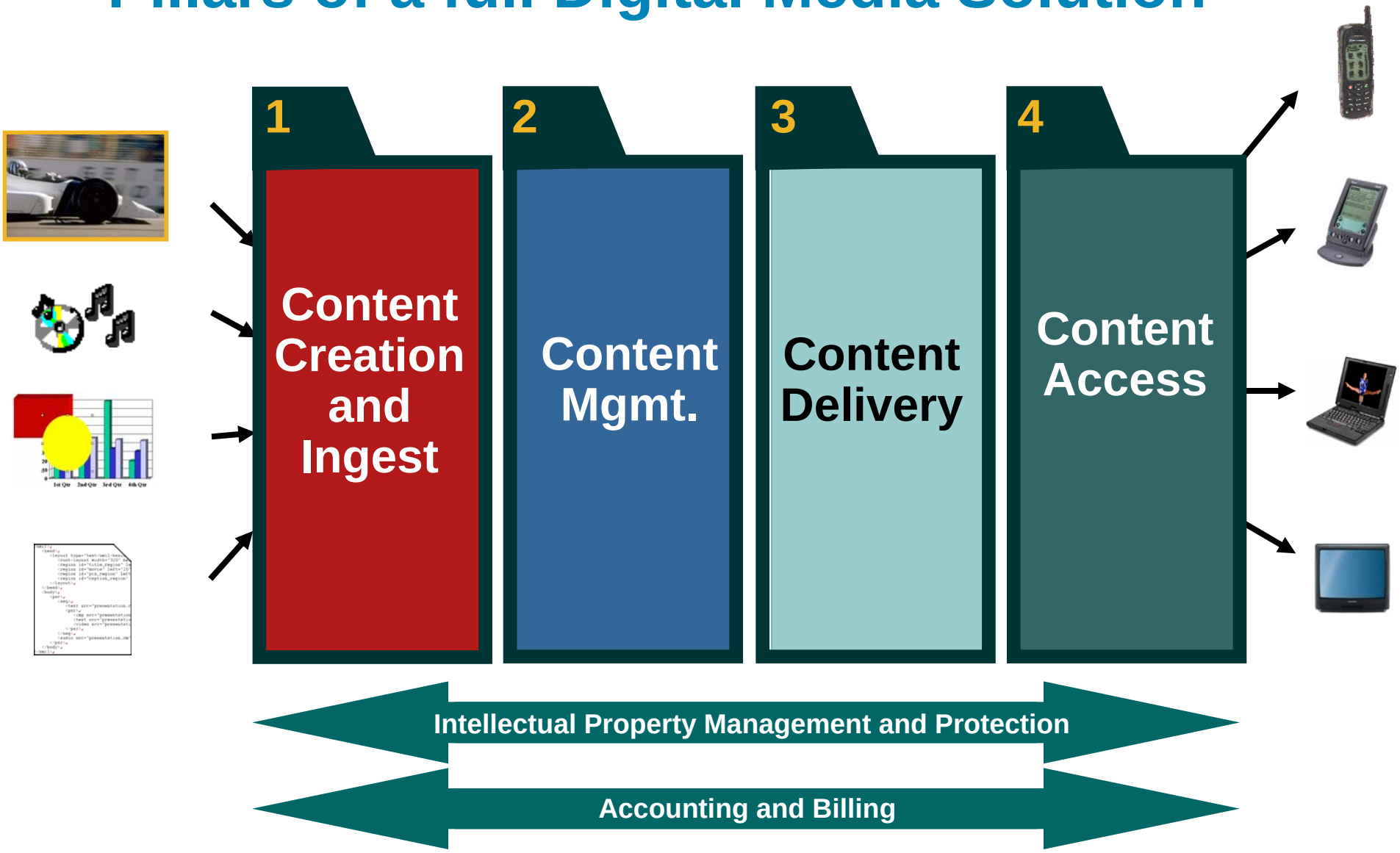
- Overview
- Basic Concepts
- Planning
- Video Architectures
- Video Pre-Positioning
- Deploying Video
- Video and Digital Media Services

Overview

There are different Video Applications and different Delivery Models

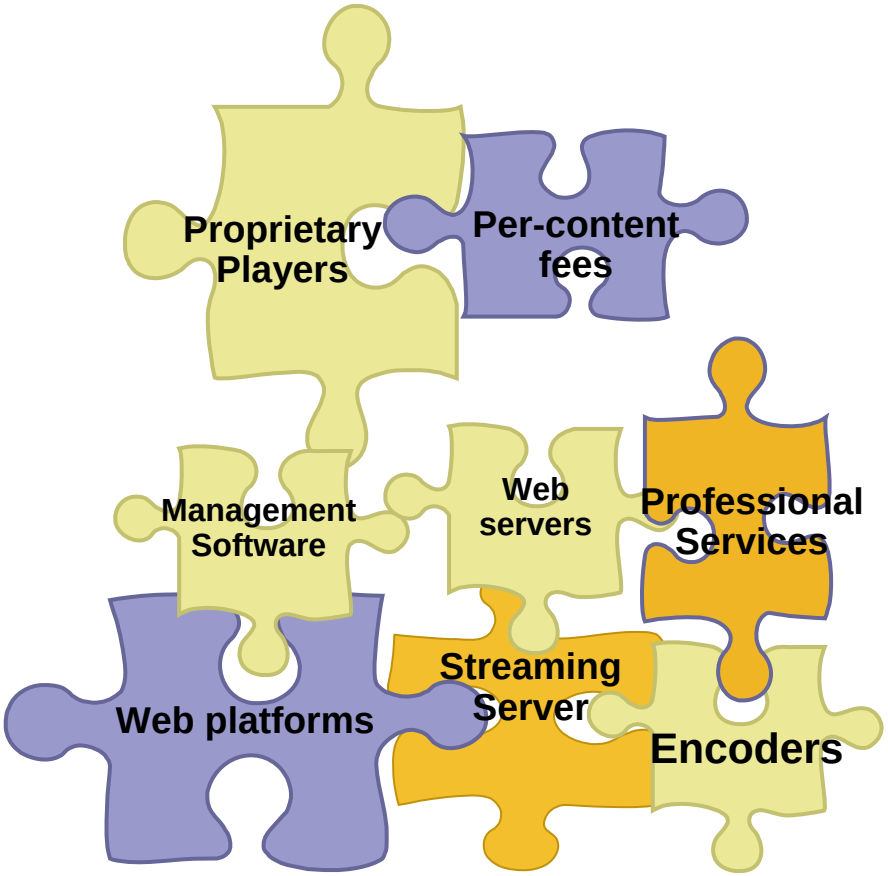


Pillars of a full Digital Media Solution

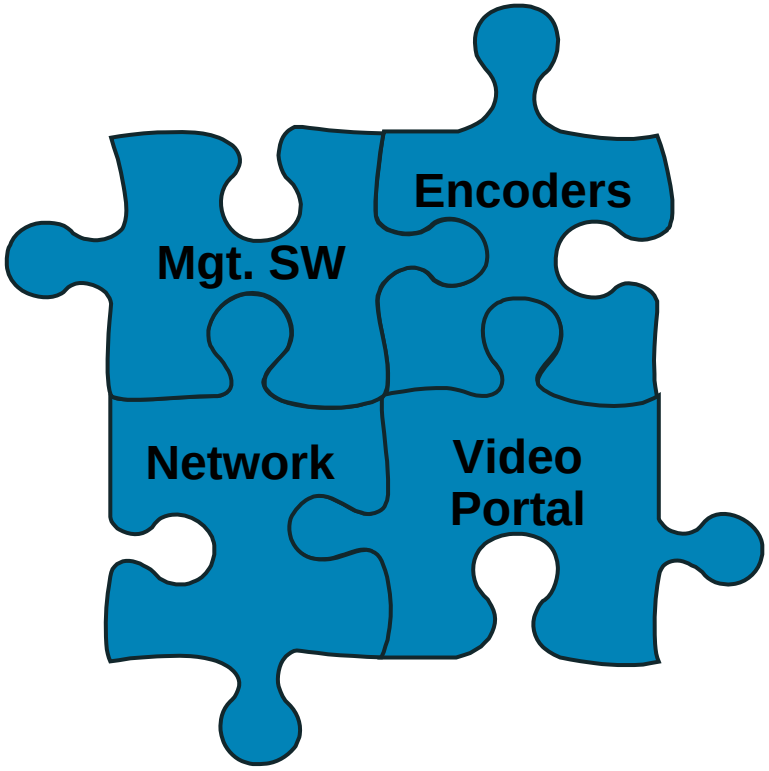


The reality on the Value Chain, and what we want

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

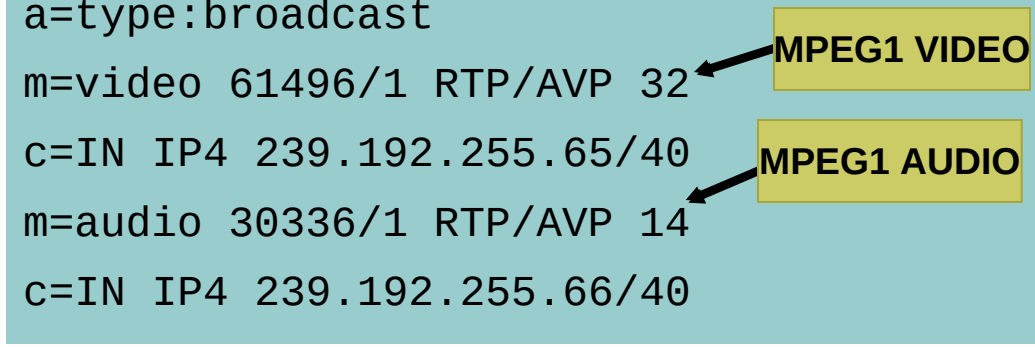
Video Protocols

- 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
```



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)

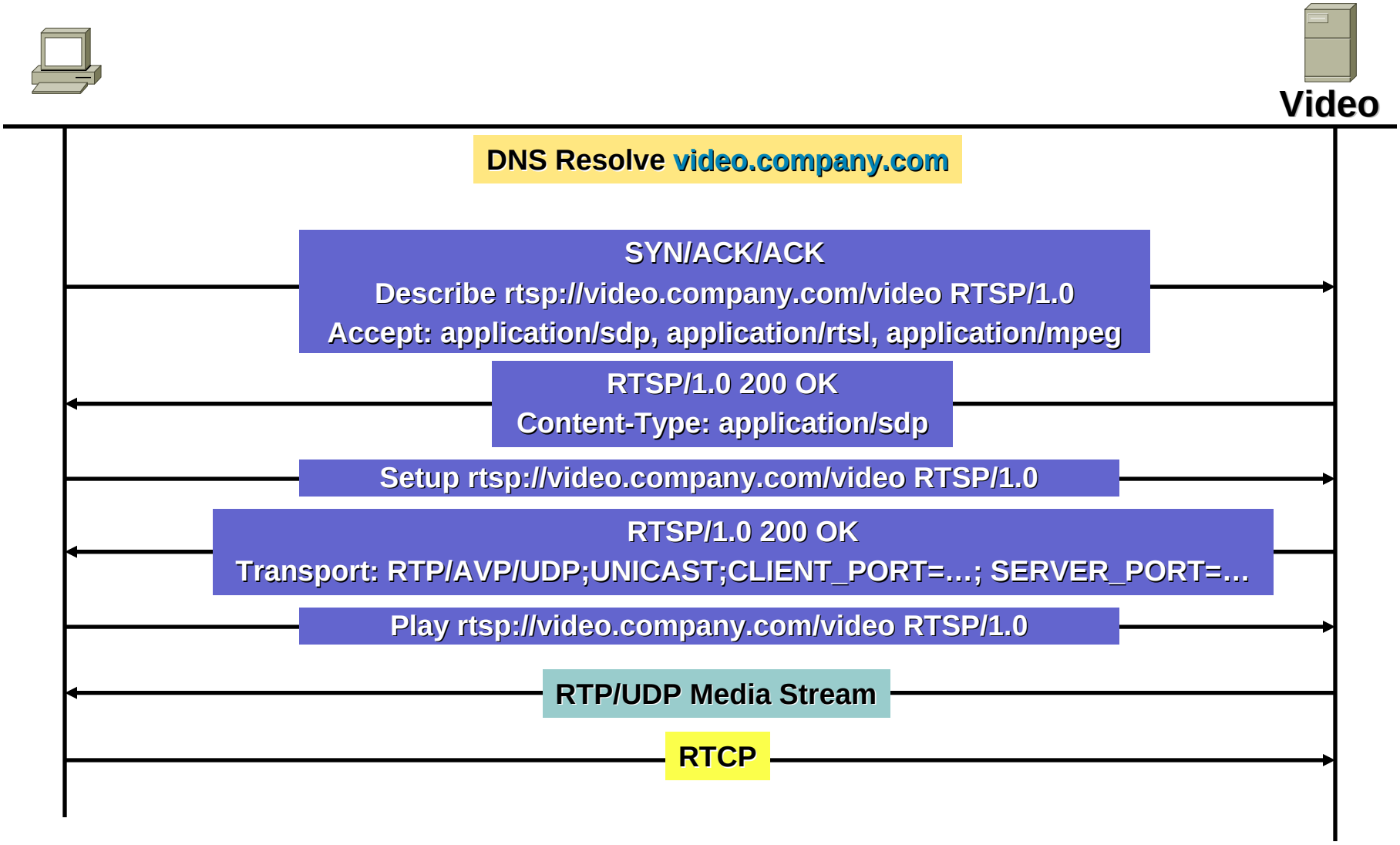
Video
RTSP

- 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

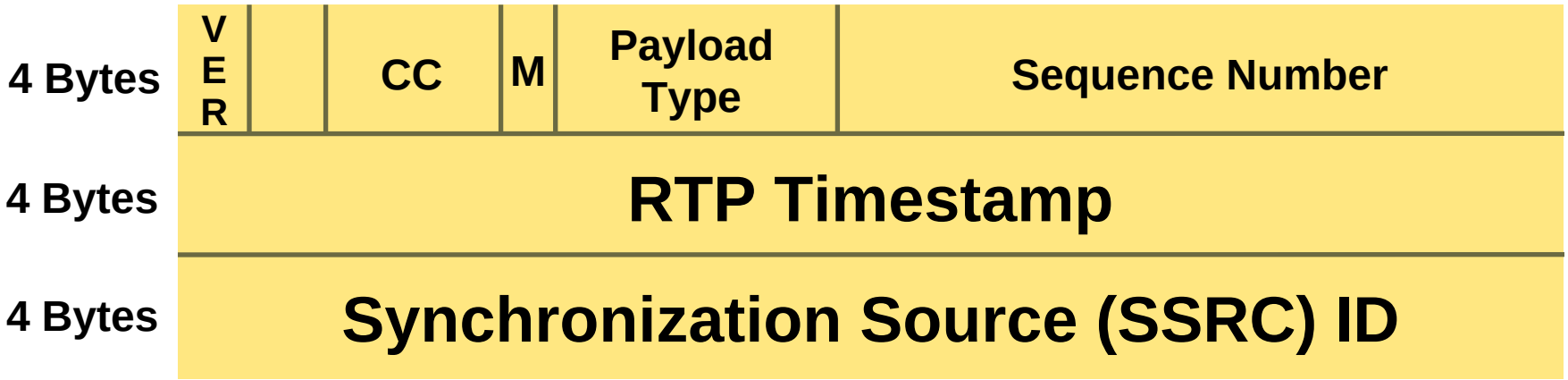
- DESCRIBE—retrieves the description
- SETUP—start an RTSP session
- PLAY—starts stream transmission
- PAUSE—temporarily halts a stream
- RECORD—saves stream transmission
- TEARDOWN—session ceases to exist
- OPTIONS—ANNOUNCE, GET_PARAMETER, REDIRECT, SET_PARAMETER

Video
RTSP High-Level Flow Diagram

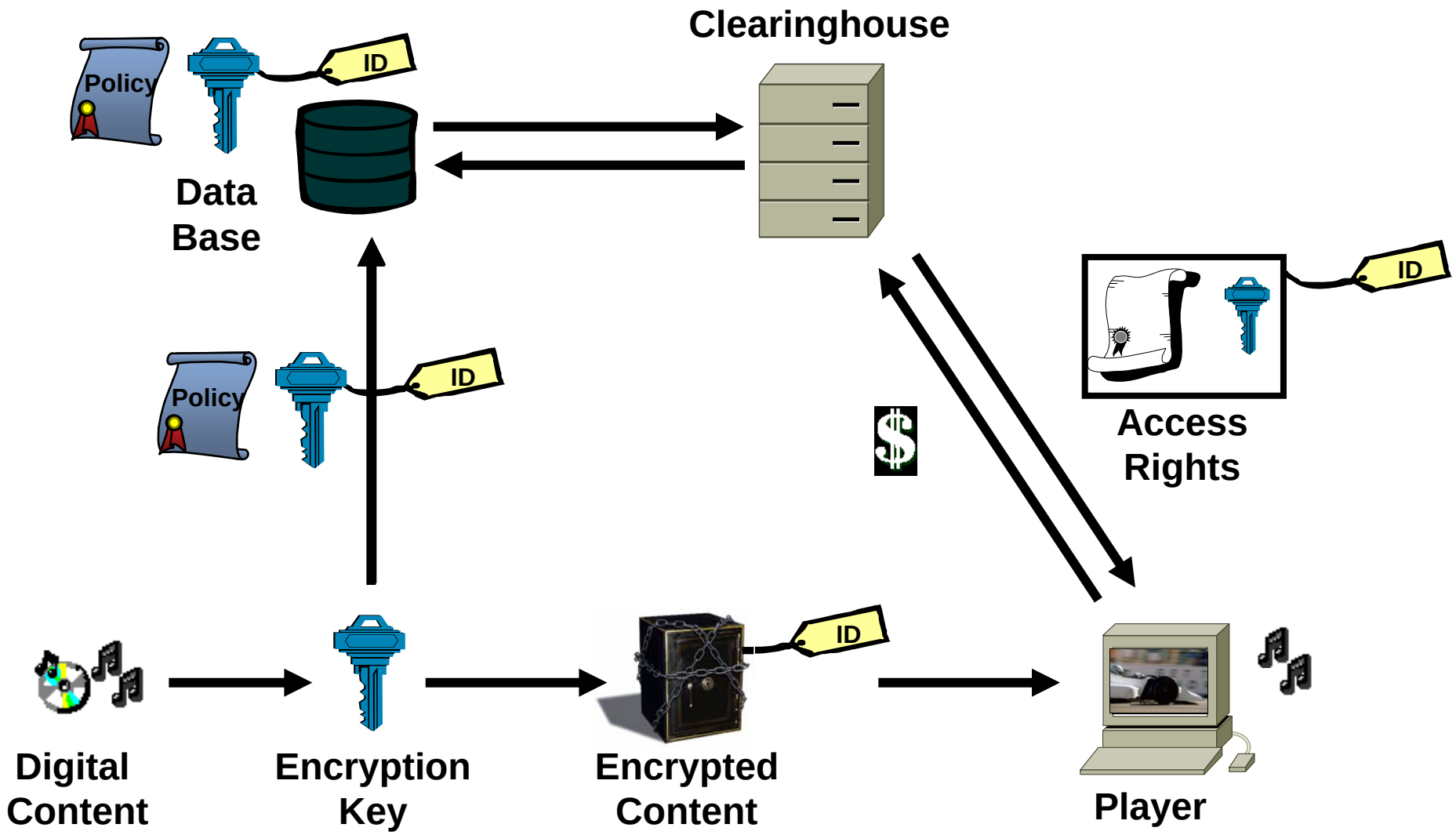


Video
RTP

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

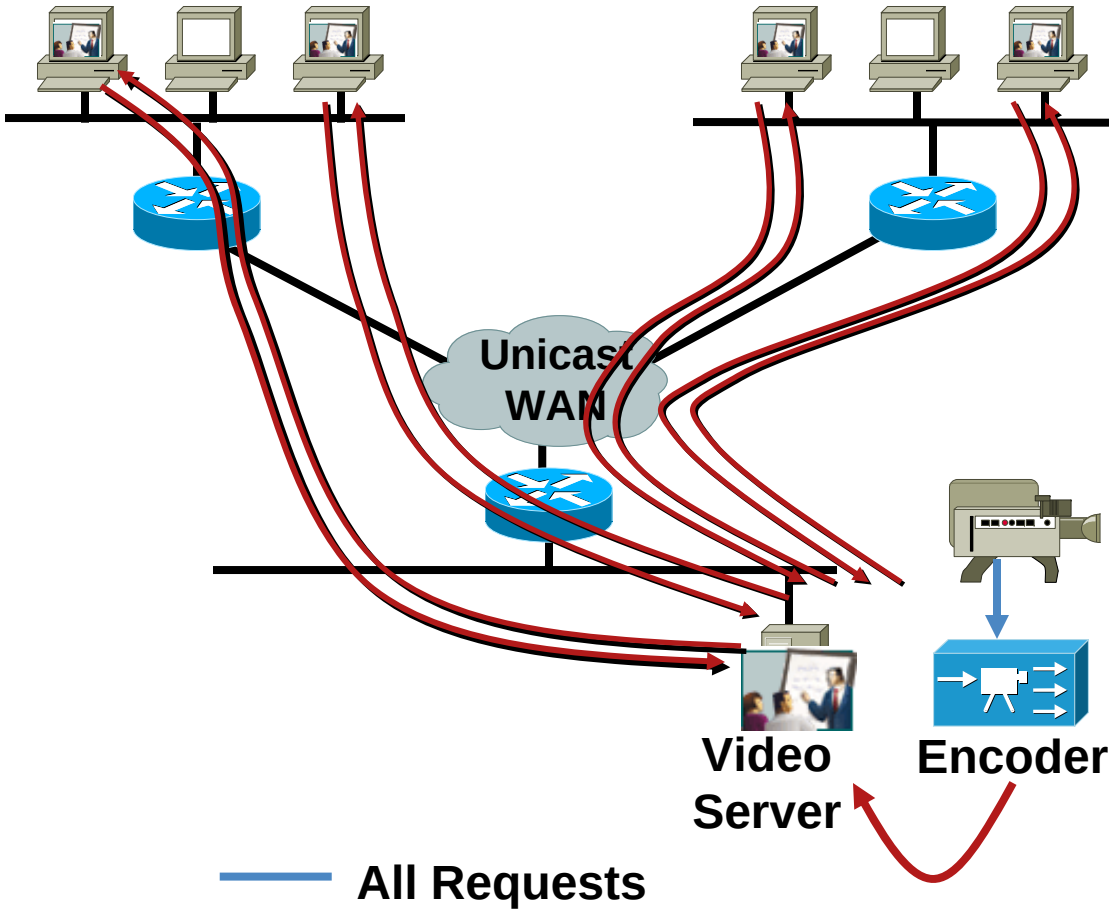


Intellectual Property Protection
Digital Right Management



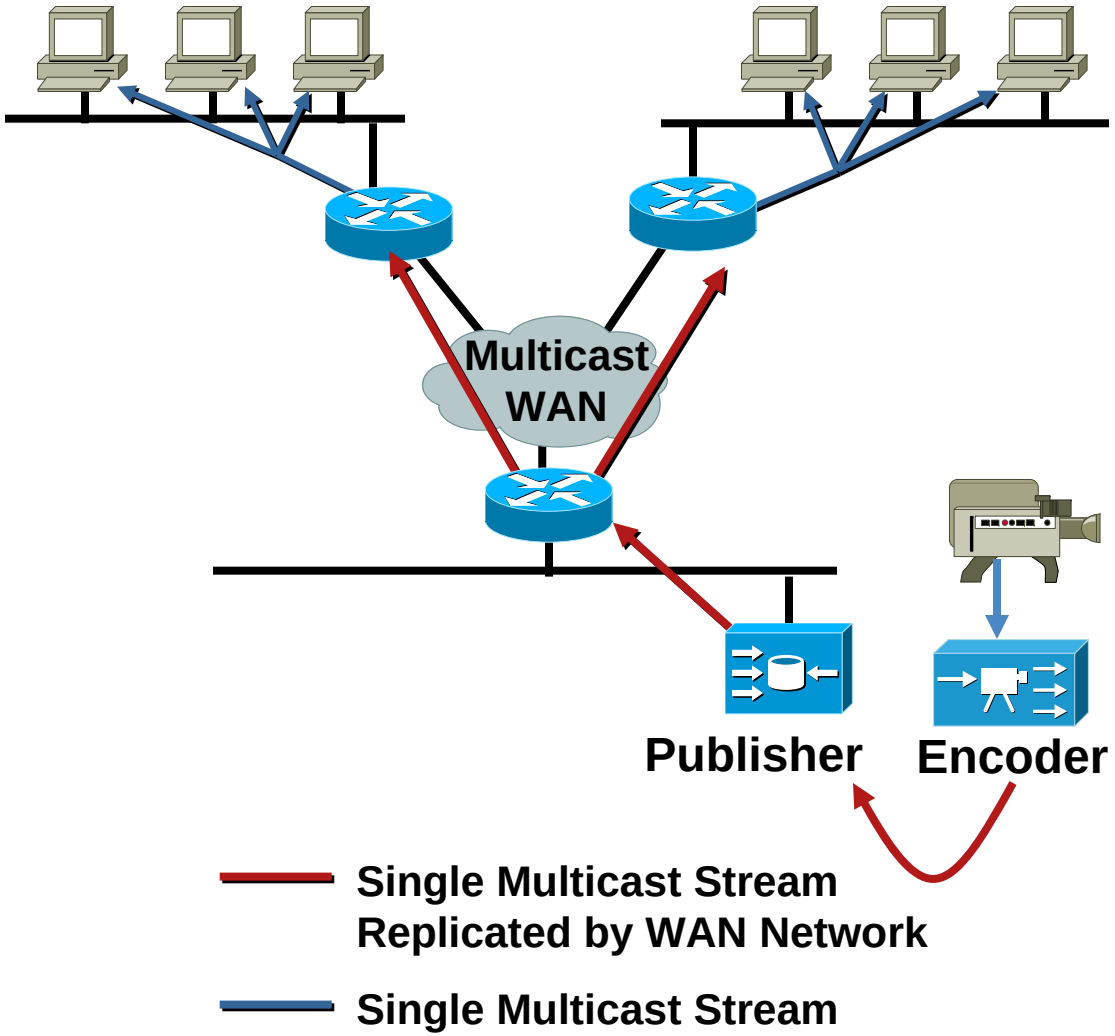
Live Video on Unicast Network

- 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

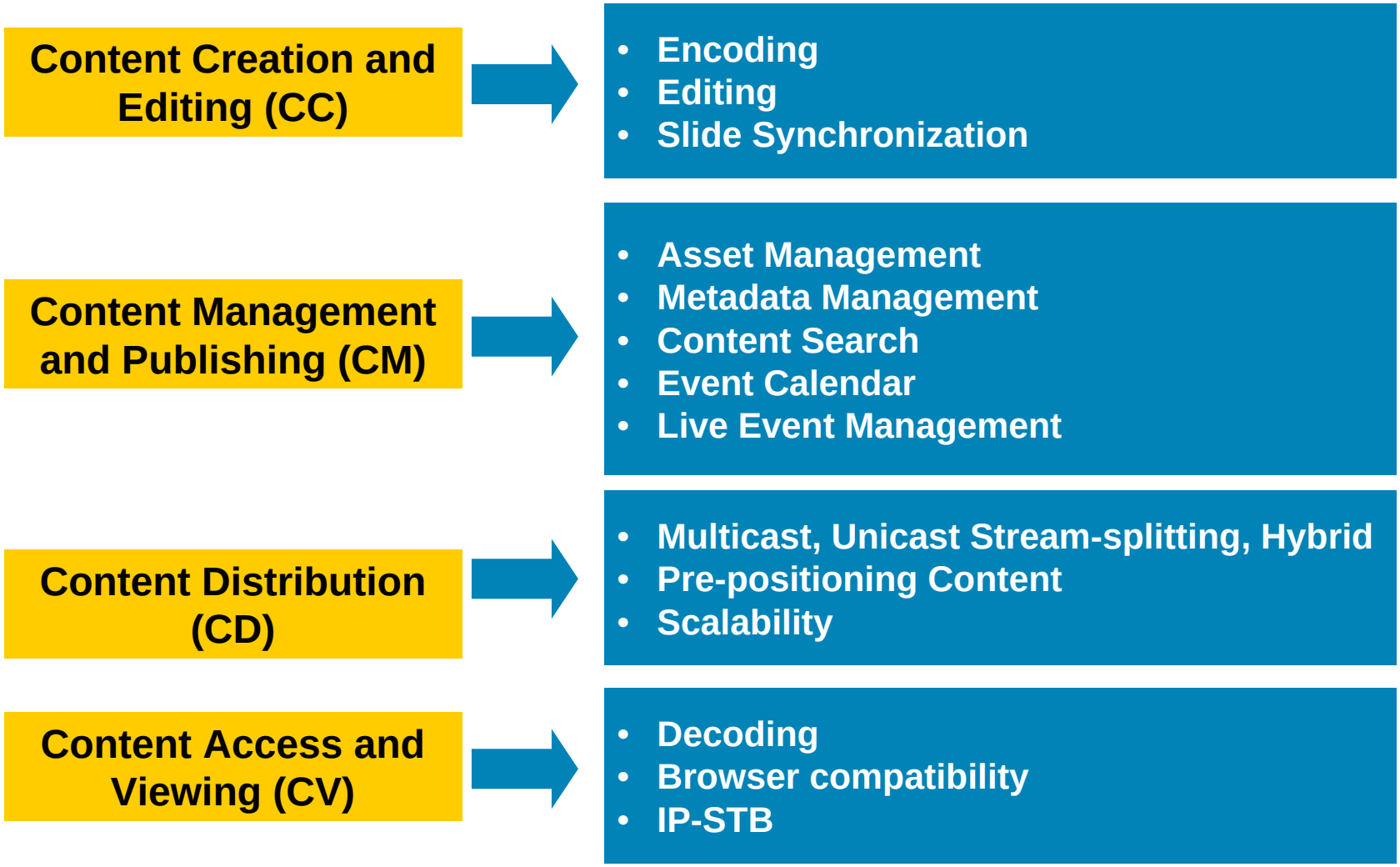
- Multicast enabled LAN and WAN
- Requires event planning and administration



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

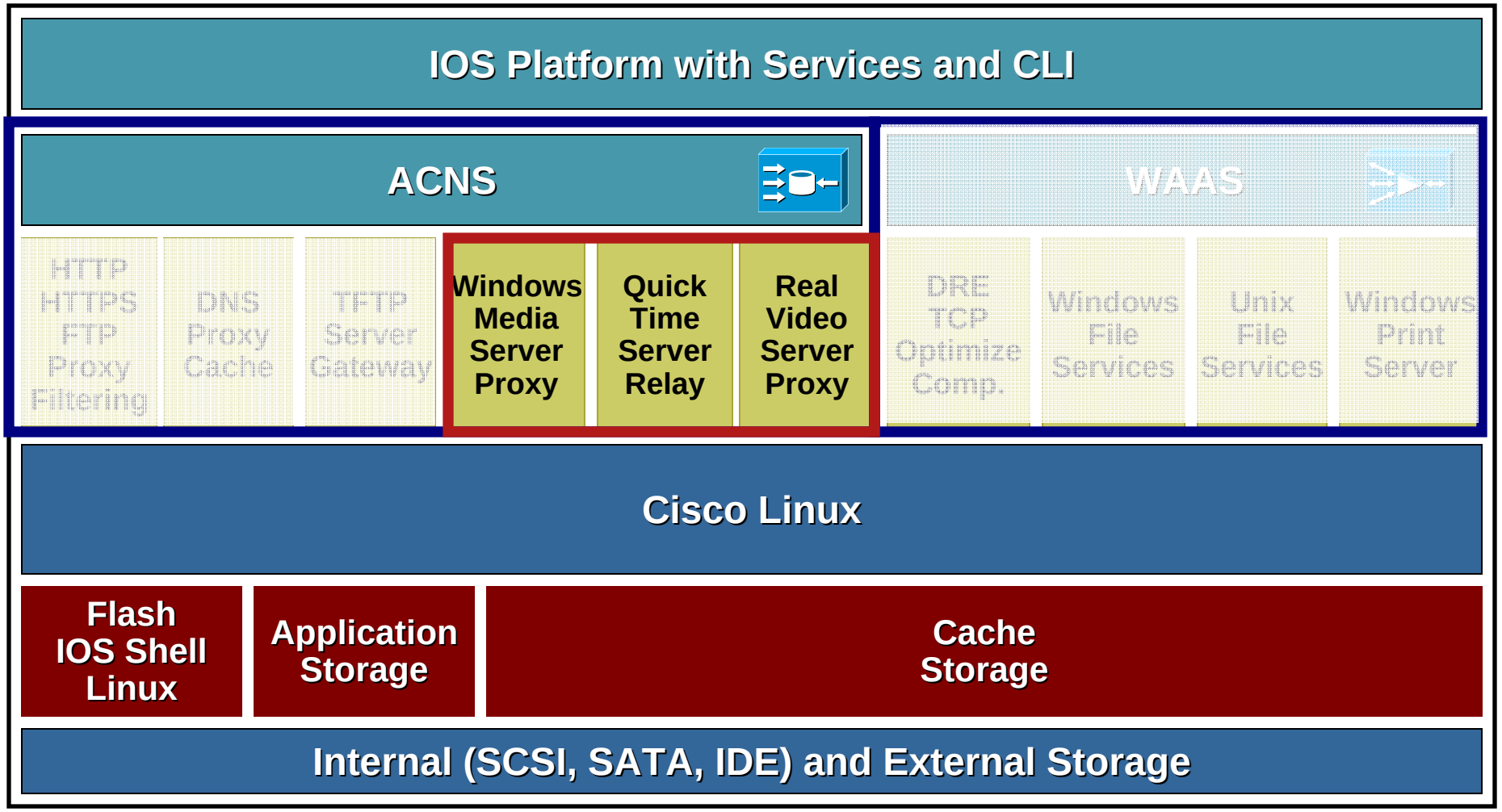
Planning
Streaming Video Event Planning

- 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

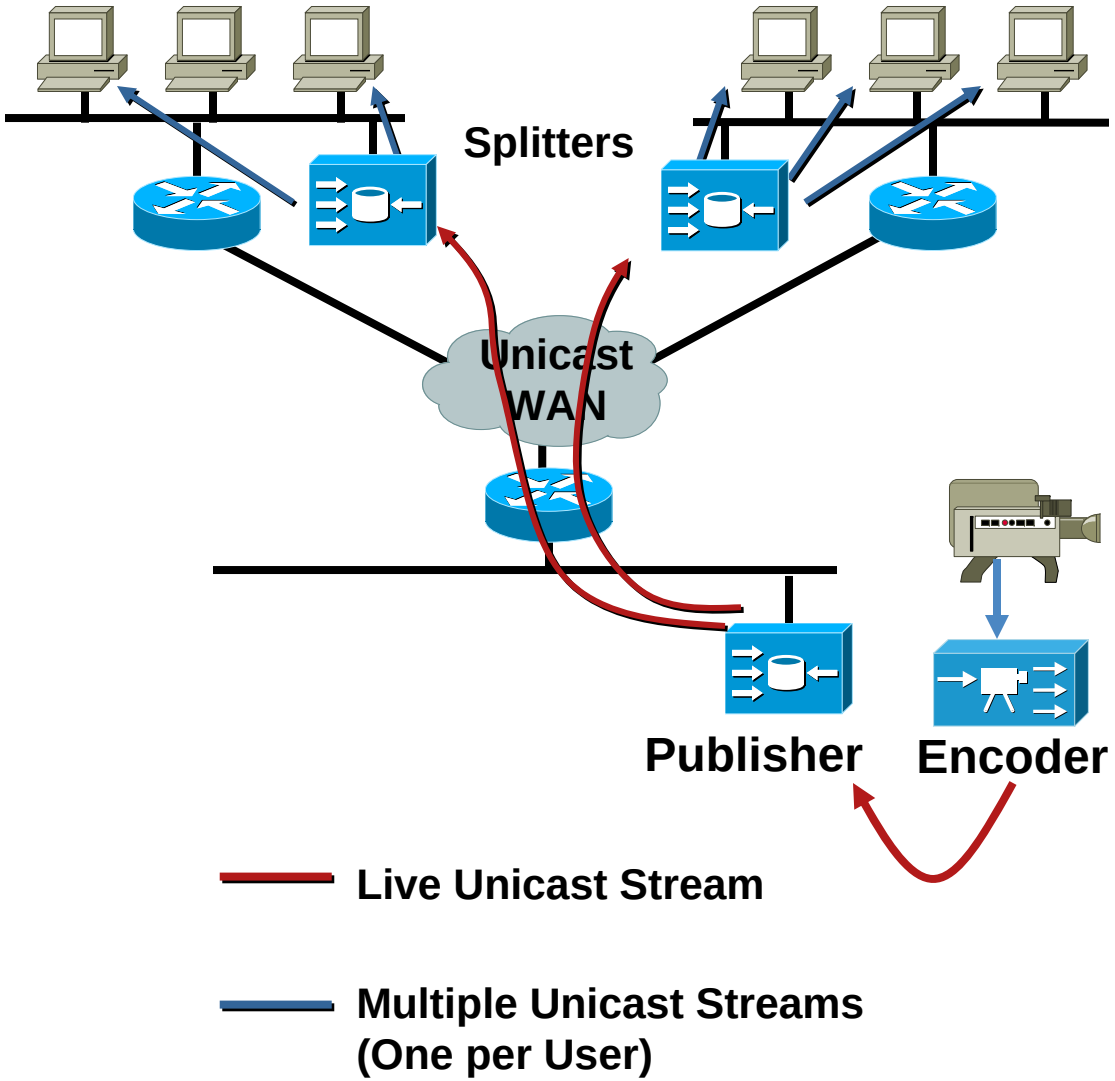
Wide Area Application Engine (WAE)

Application and Content Networking Software (ACNS)



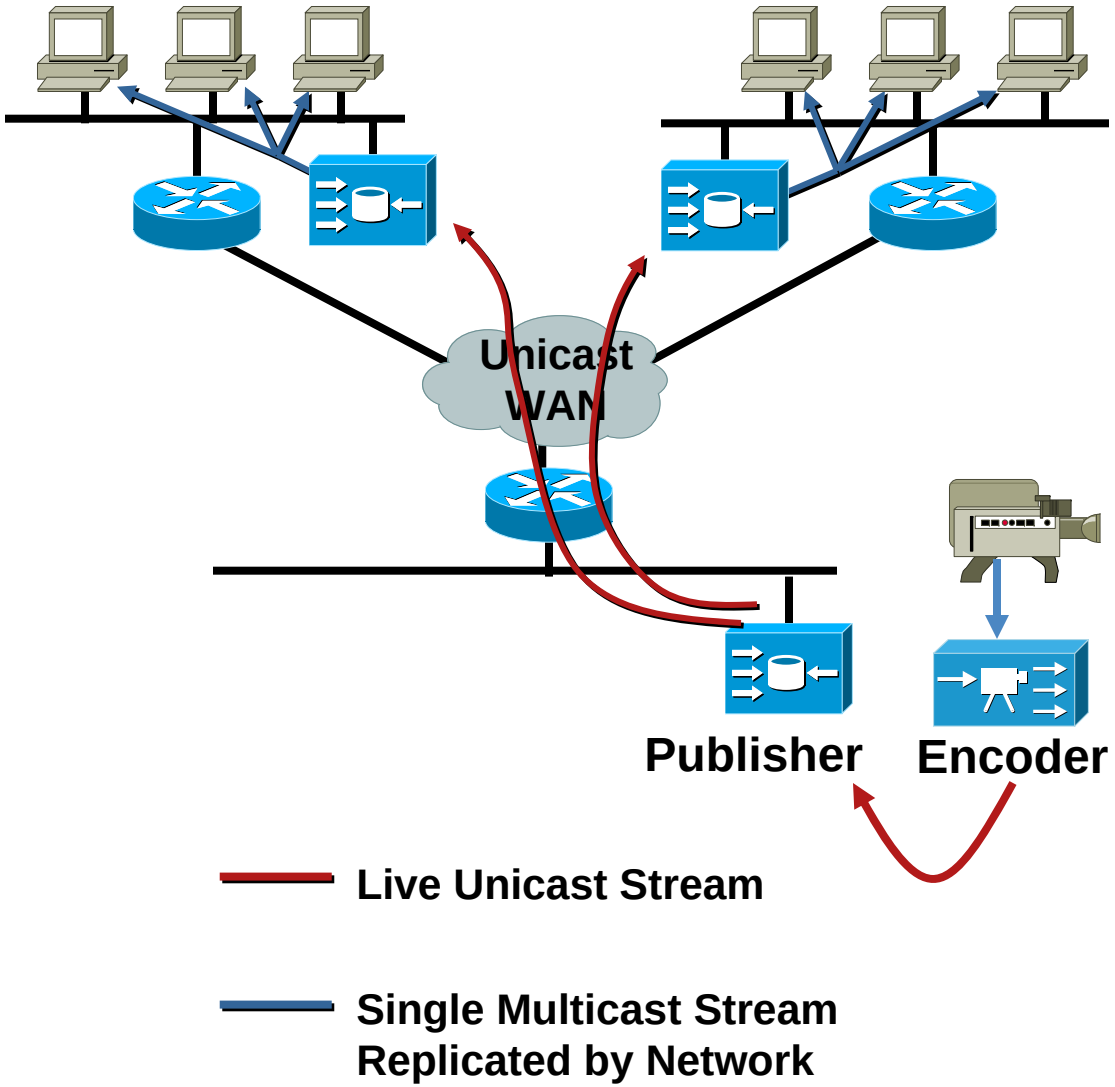
Video Architecture
Live Unicast Stream Splitting

- 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

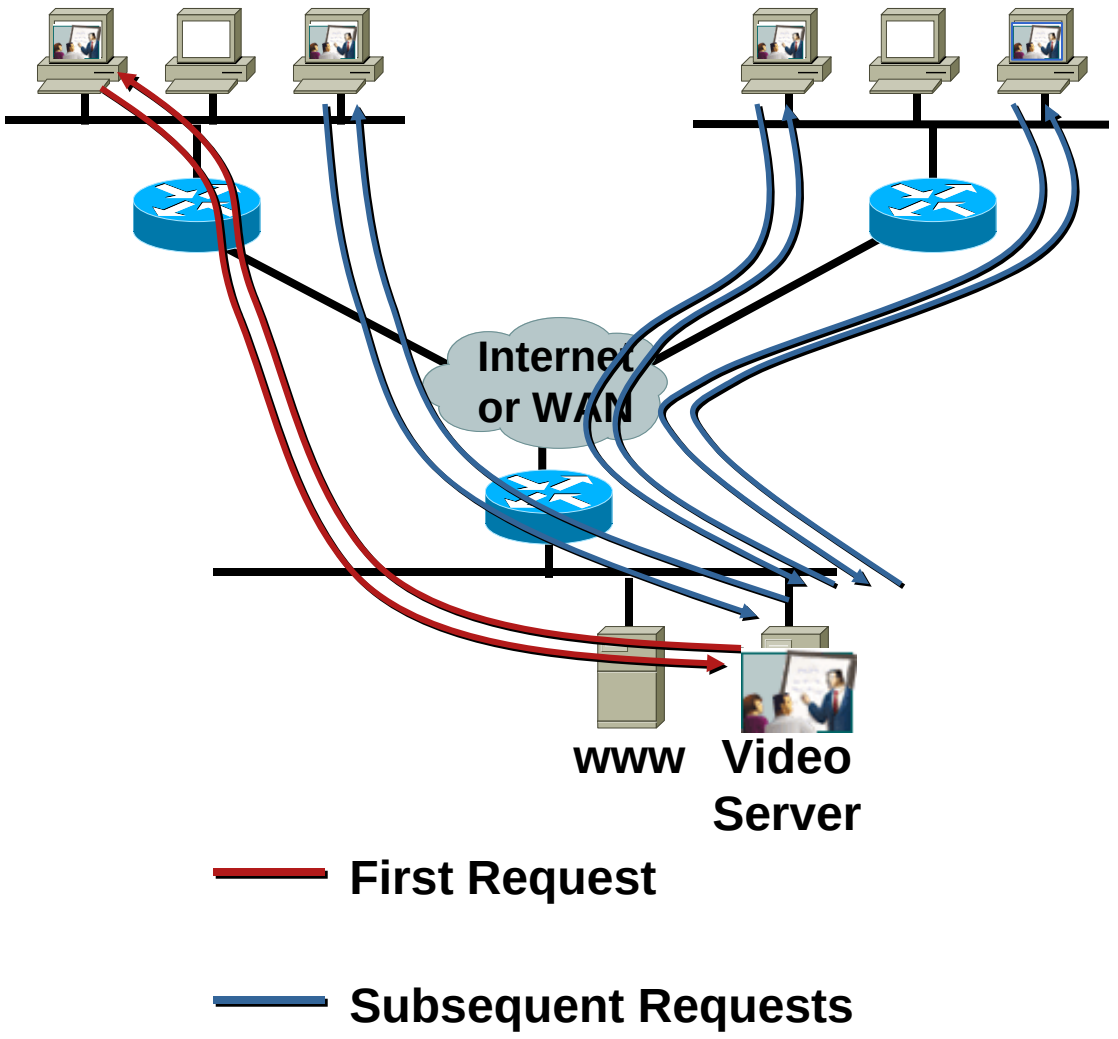


Video Architecture
Live Capacity Planning

- 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)

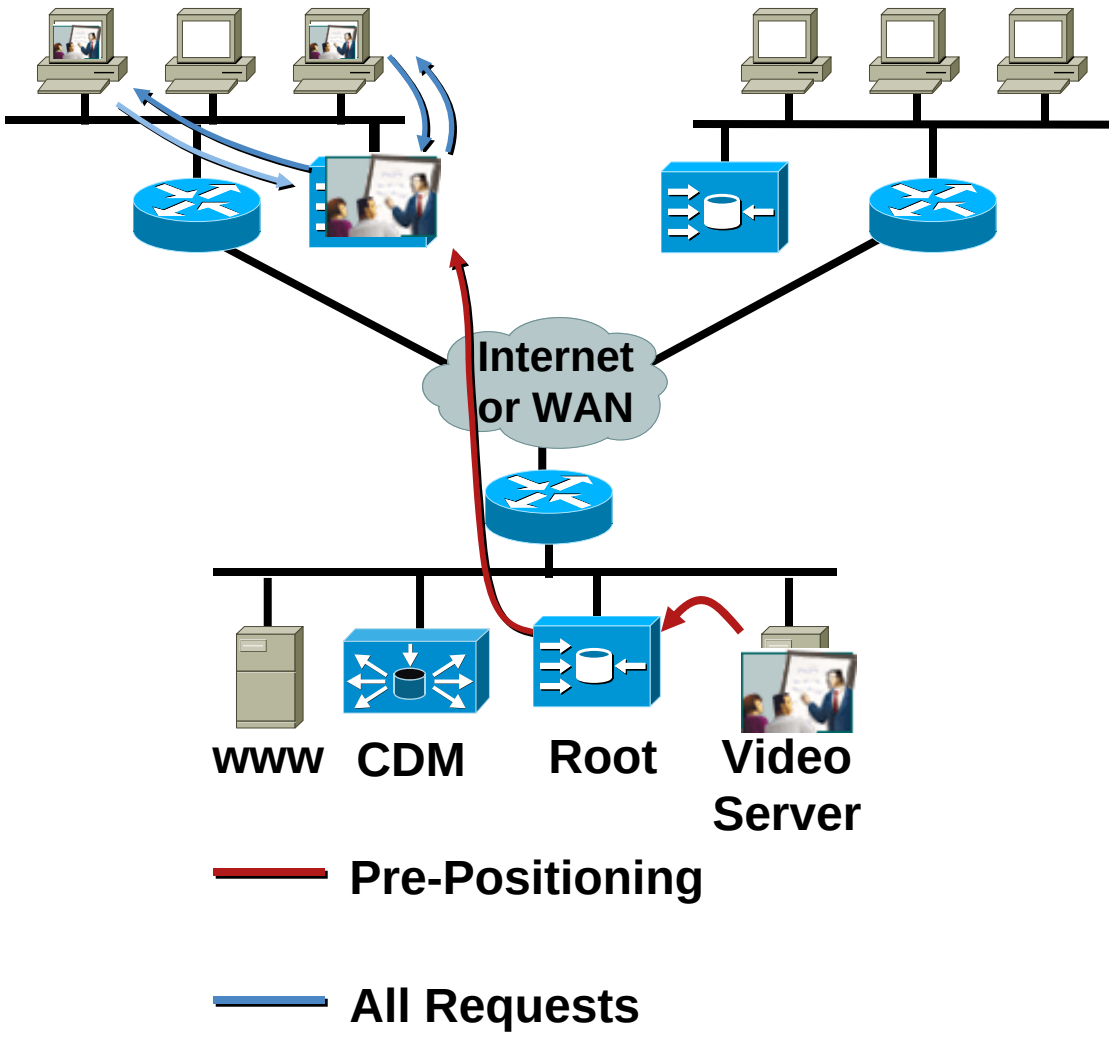
Video Architecture
Video on Demand on a non-optimized Network

- 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

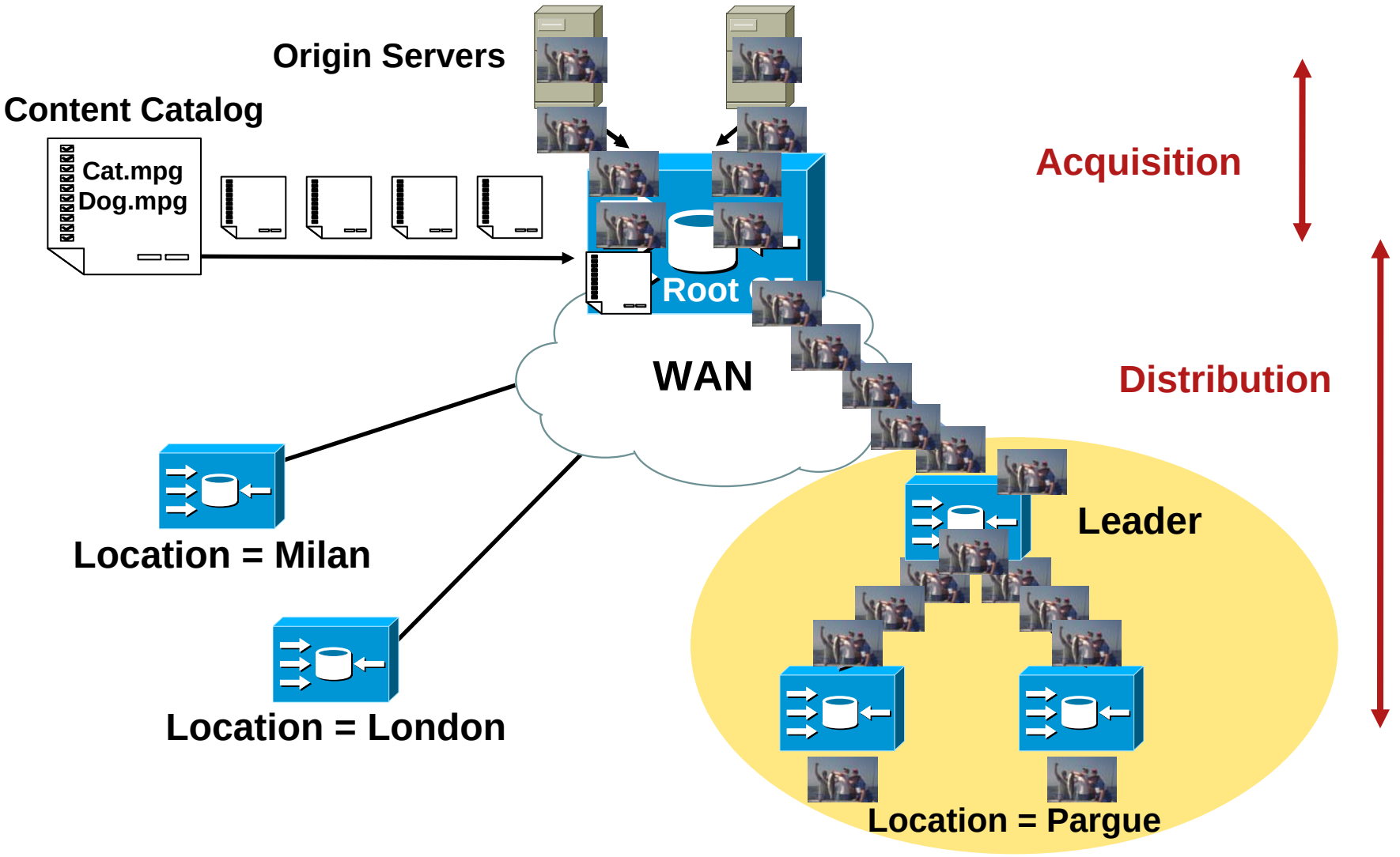


Video Architecture
Video on Demand Pre-Positioned

- 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



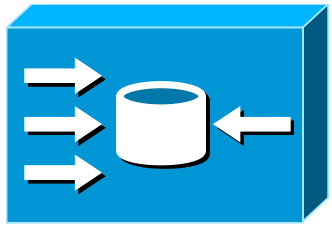
Video Architecture
VoD Capacity Planning

- 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



Windows Media Technologies

real

QuickTime™

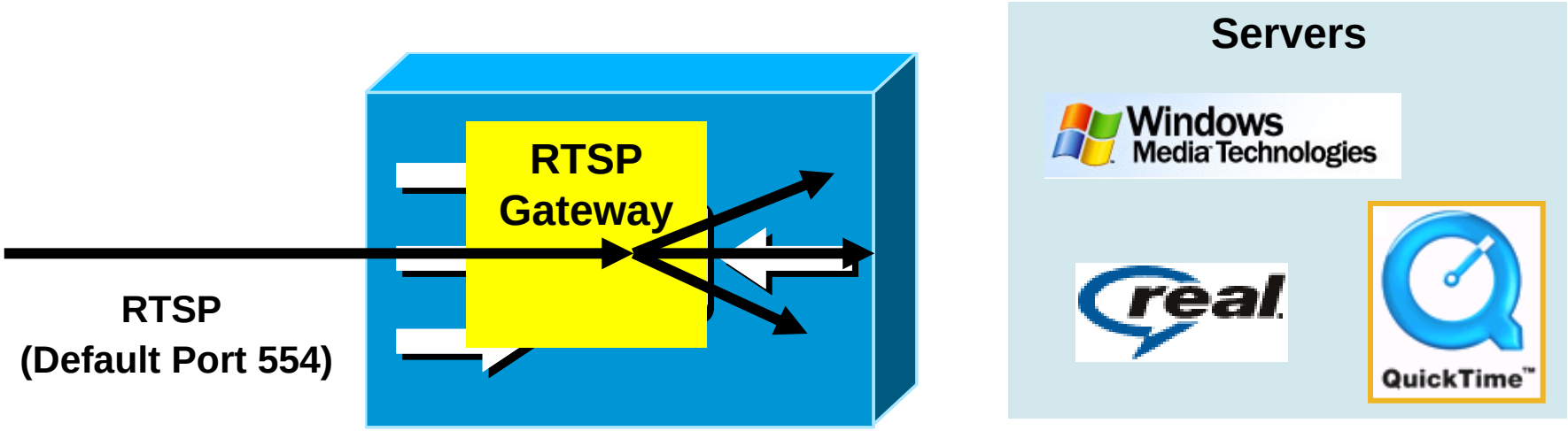
INTERNET STREAMING MEDIA ALLIANCE

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

HTTP

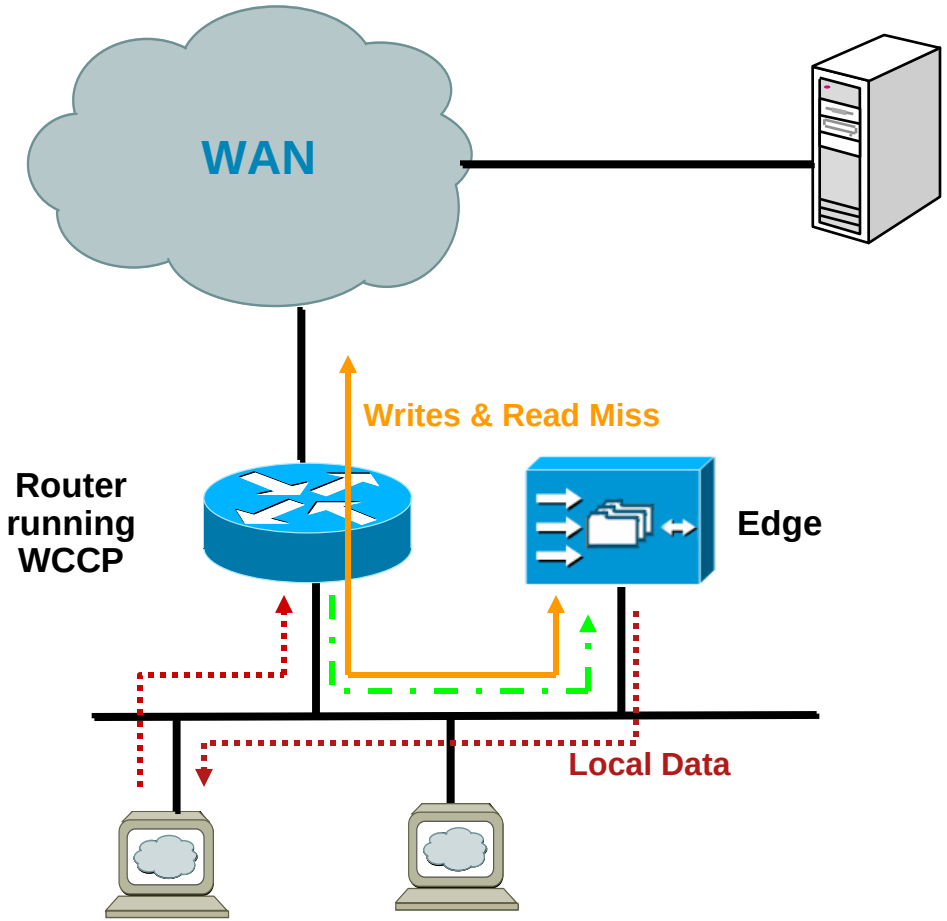
Flash and Progressive Download

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

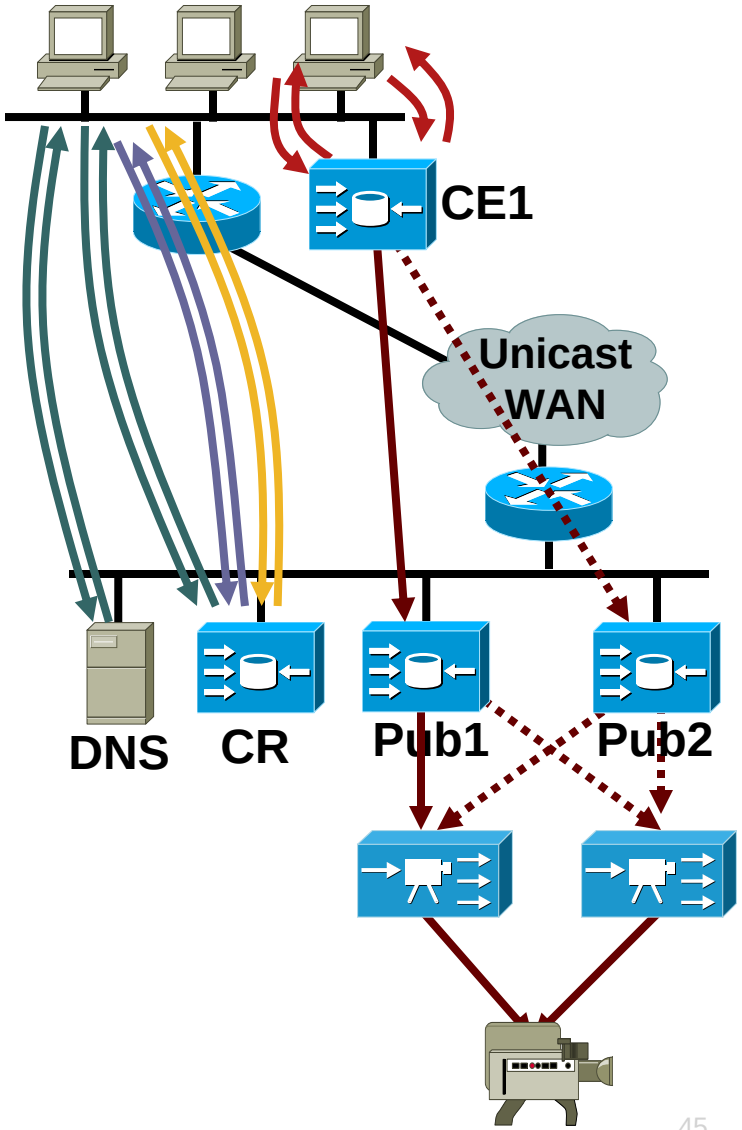
```
ip wccp 80 redirect in/out
ip wccp 81 redirect in/out
ip wccp 82 redirect in/out
ip wccp 83 redirect in/out
```

- 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
```

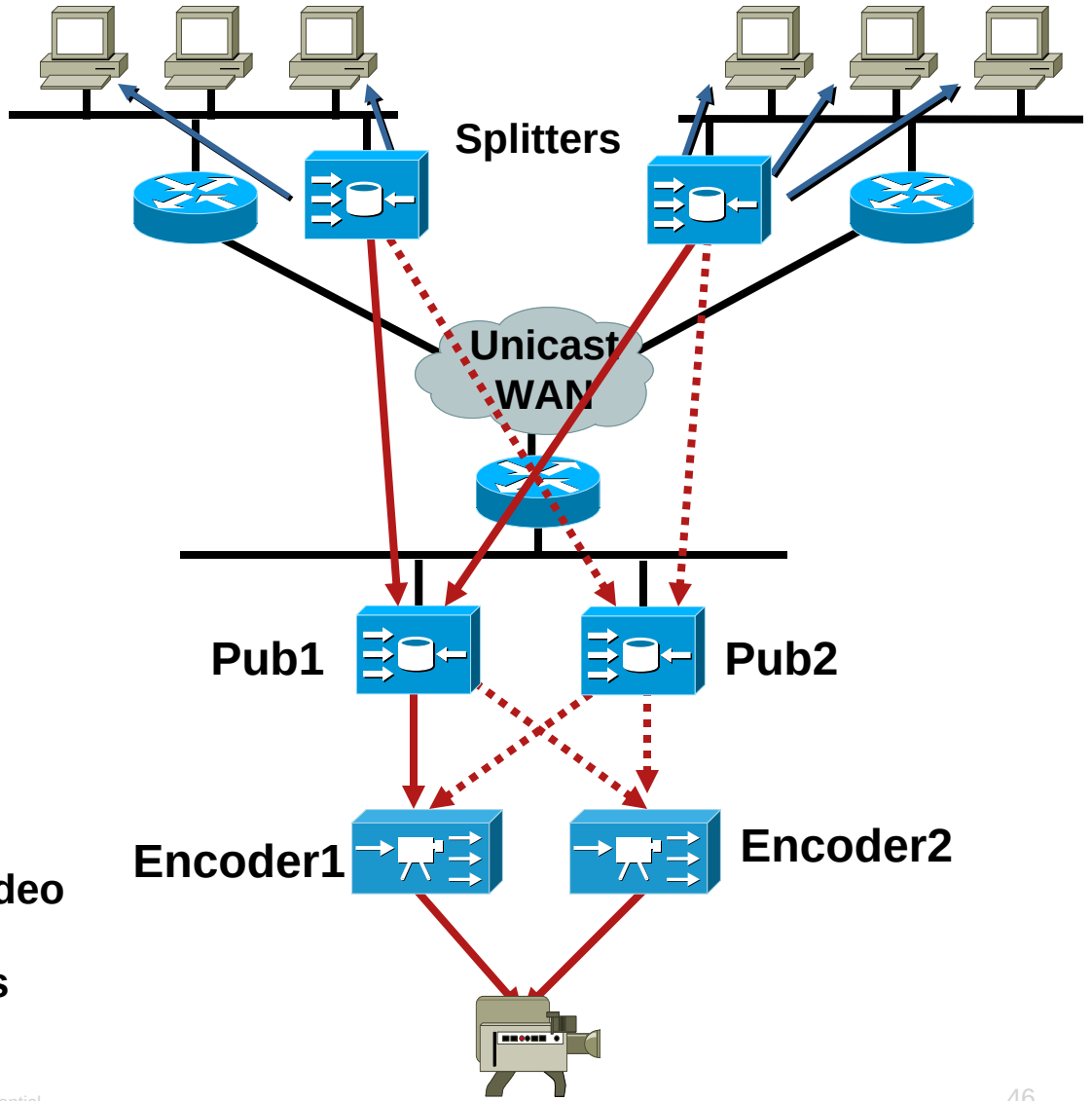
1 - Choose a Redirection Method
Simplified Hybrid Routing

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 based on coverage zone routing
12. Client makes request http://ce1.ce.cdn.company.com/video.asf.asx to ce1
13. CE1 generates a dynamic video.asf.asx file with an MMS/RTSP link in the form of mms://ce1-ip/video.asf
14. 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



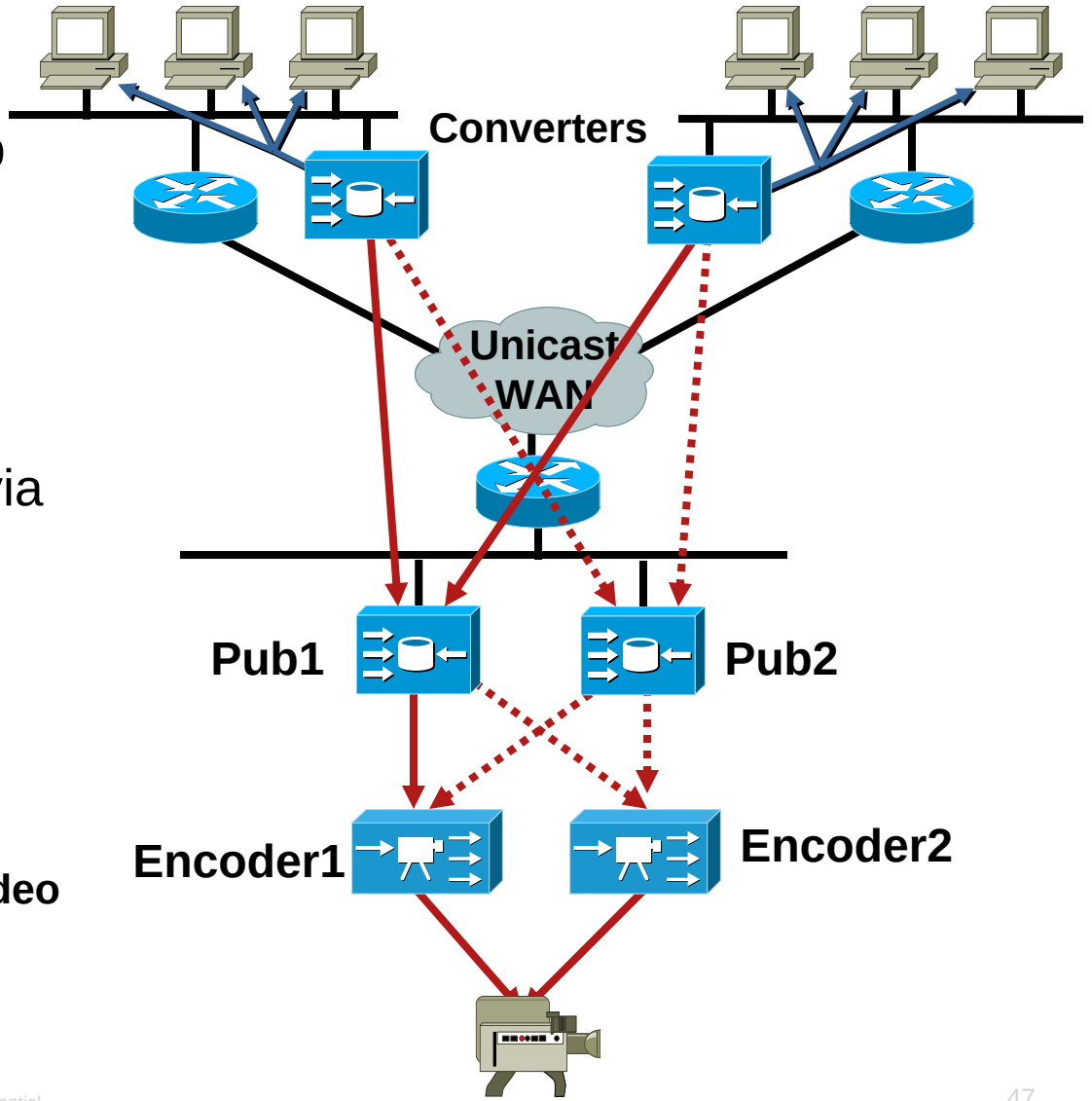
Live Unicast Video

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



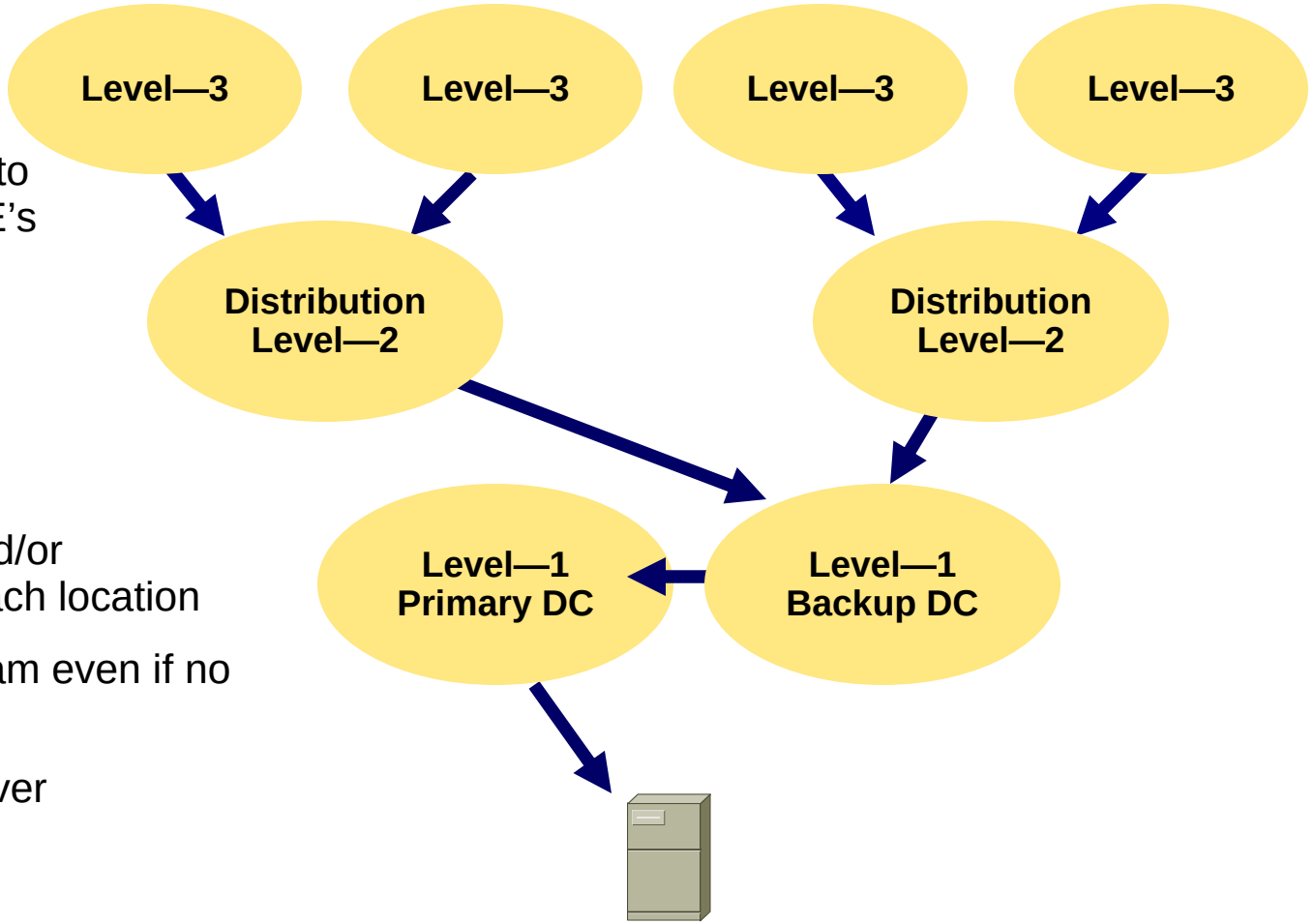
Live Unicast Video

Back-up Live Unicast Video

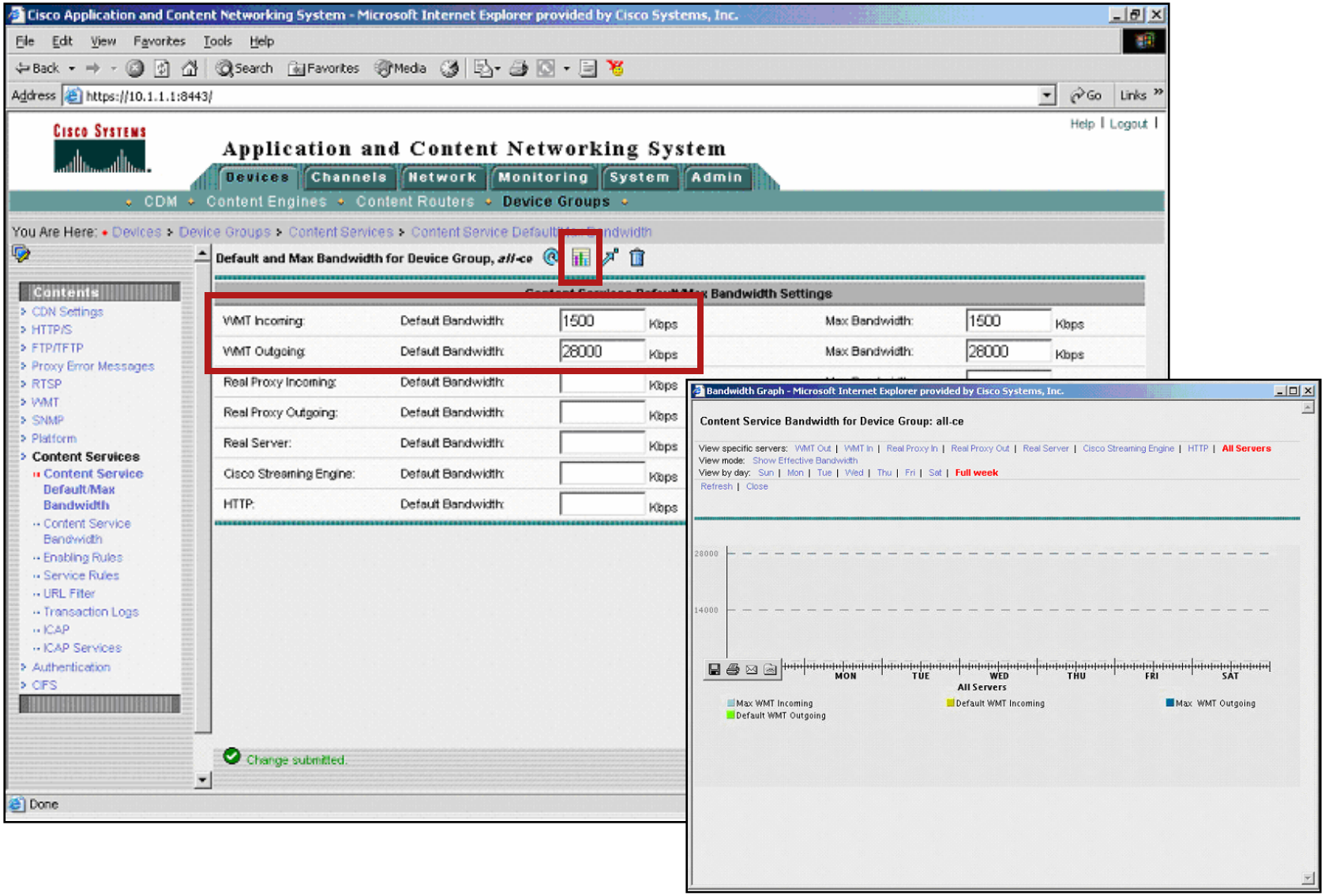
Multicast

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

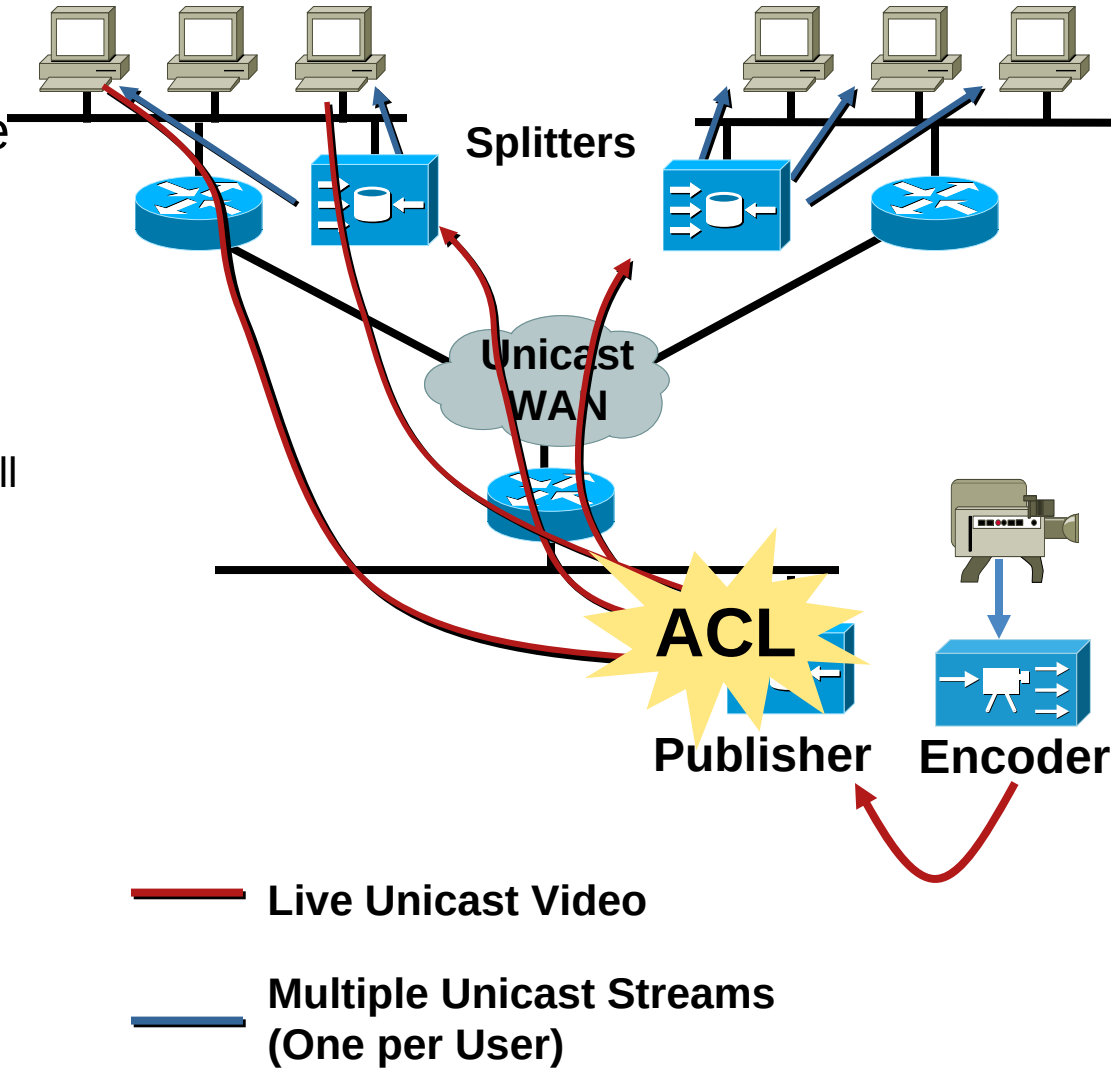


4 - Choose Bandwidth Constraints

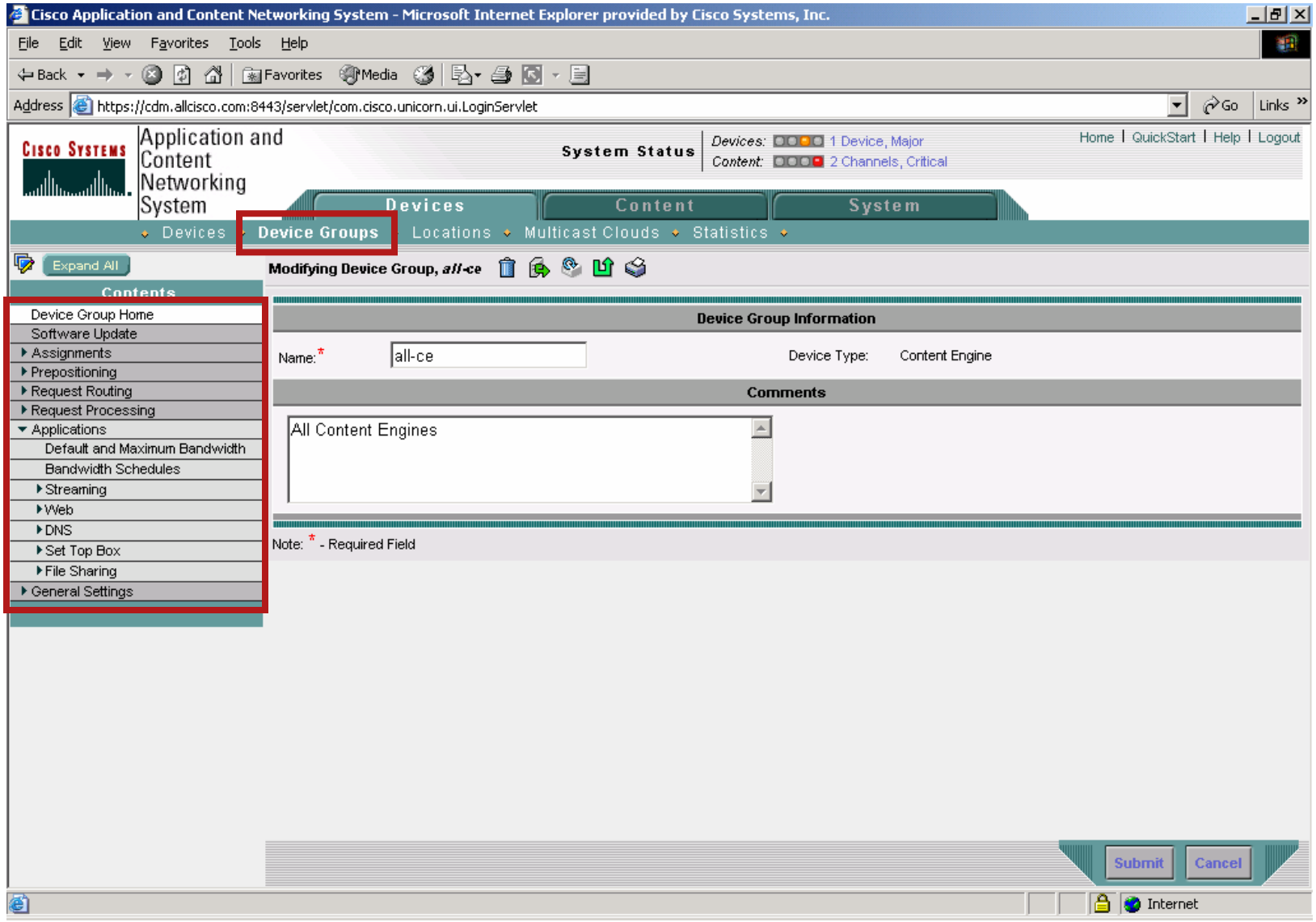


5 - Choose how to protect against failures

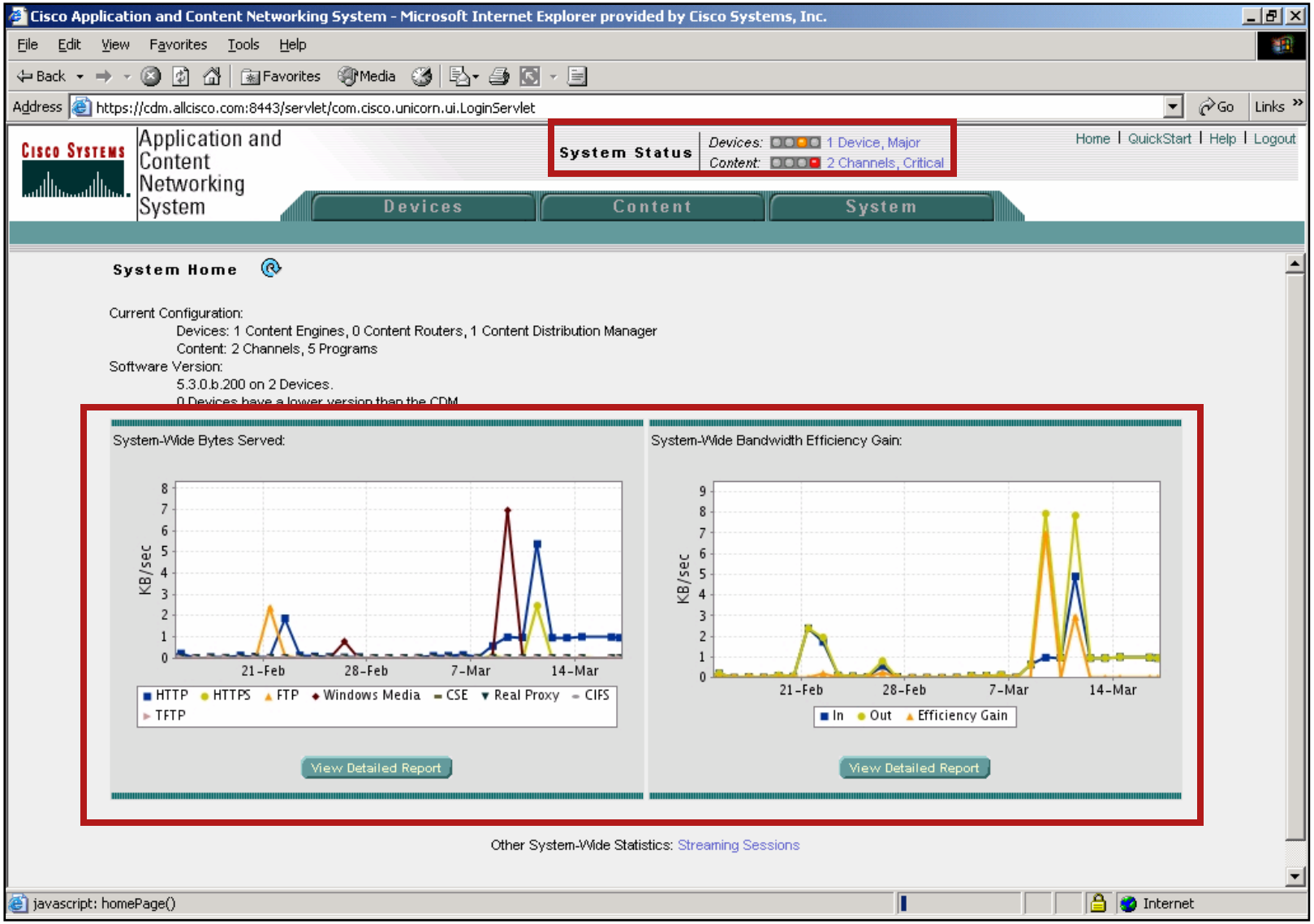
- Upon failure, clients will pull streams over the WAN
- Solutions
  - Branch ACL allowing WAE video requests only
  - Data center ACL allowing all branch WAEs
  - Publisher WAE ACL allowing local clients and branch WAEs only



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

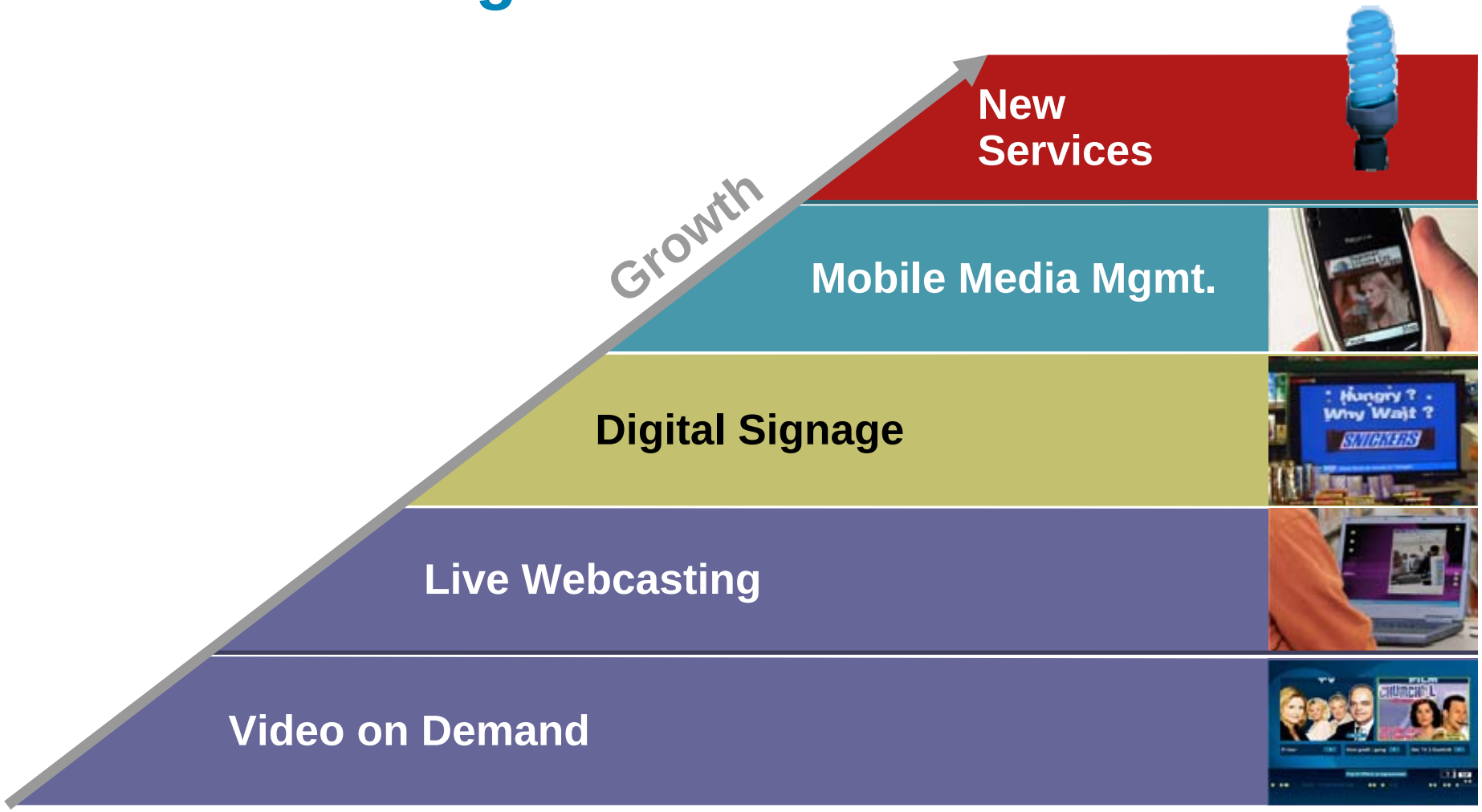


…Monitored and Operated
(example: Global Protocol Statistics and Faults)



Video Services

Video and Digital Media Services



Digital Media Systems

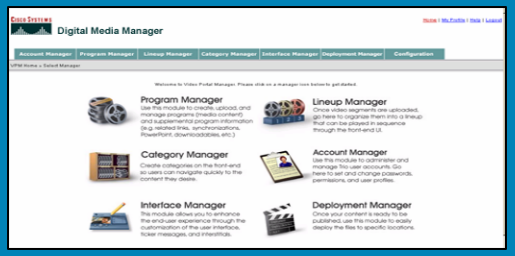
Content Creation

Digital Media Encoder 1000

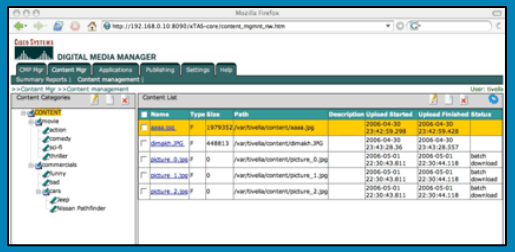
Digital Media Encoder 2000

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

Streaming server

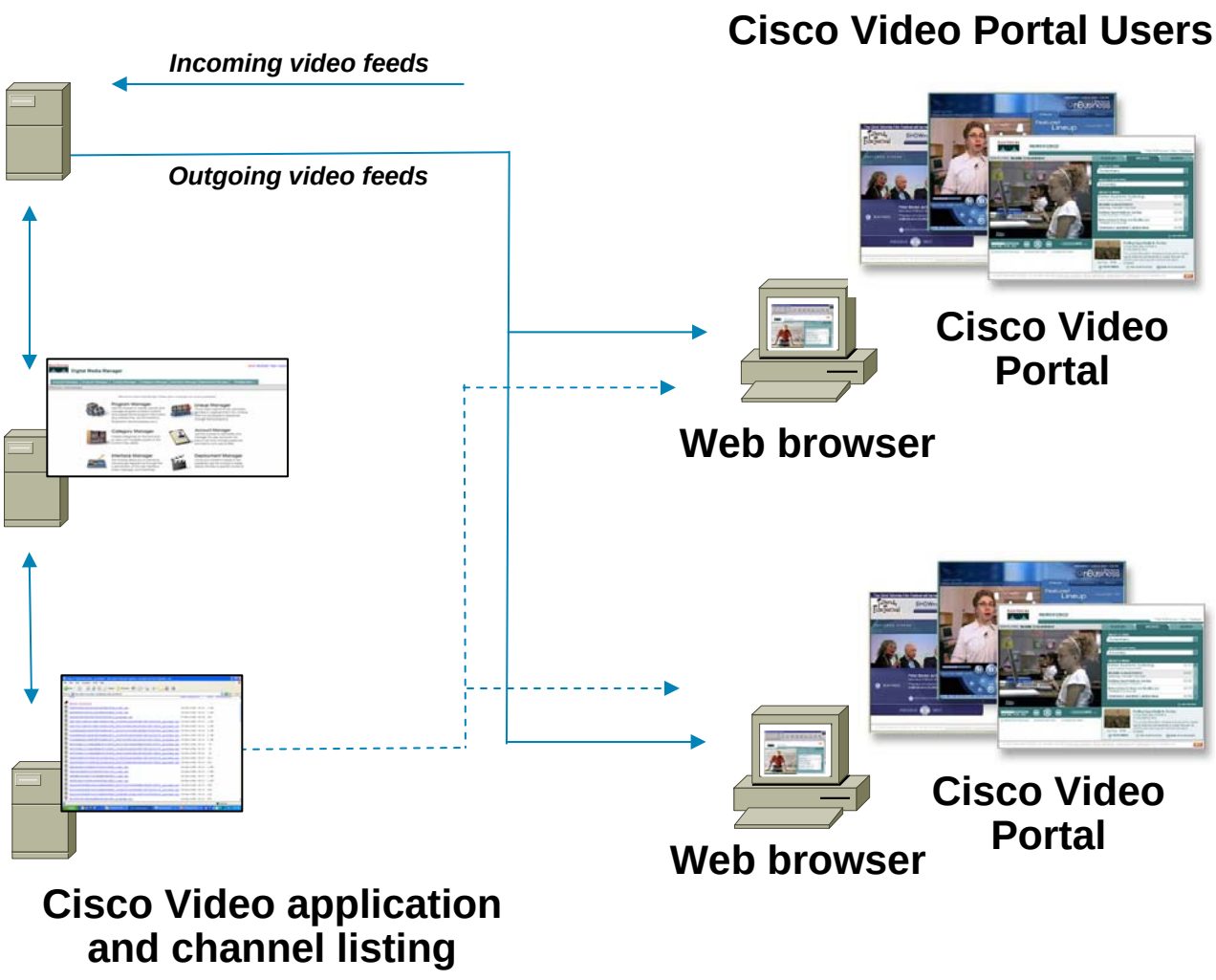
Receive video data and re-publish to Cisco Video Portal clients

Cisco Digital Media Manager

Administration of digital media channels and content publishing, Cisco Video Portal look-and-feel

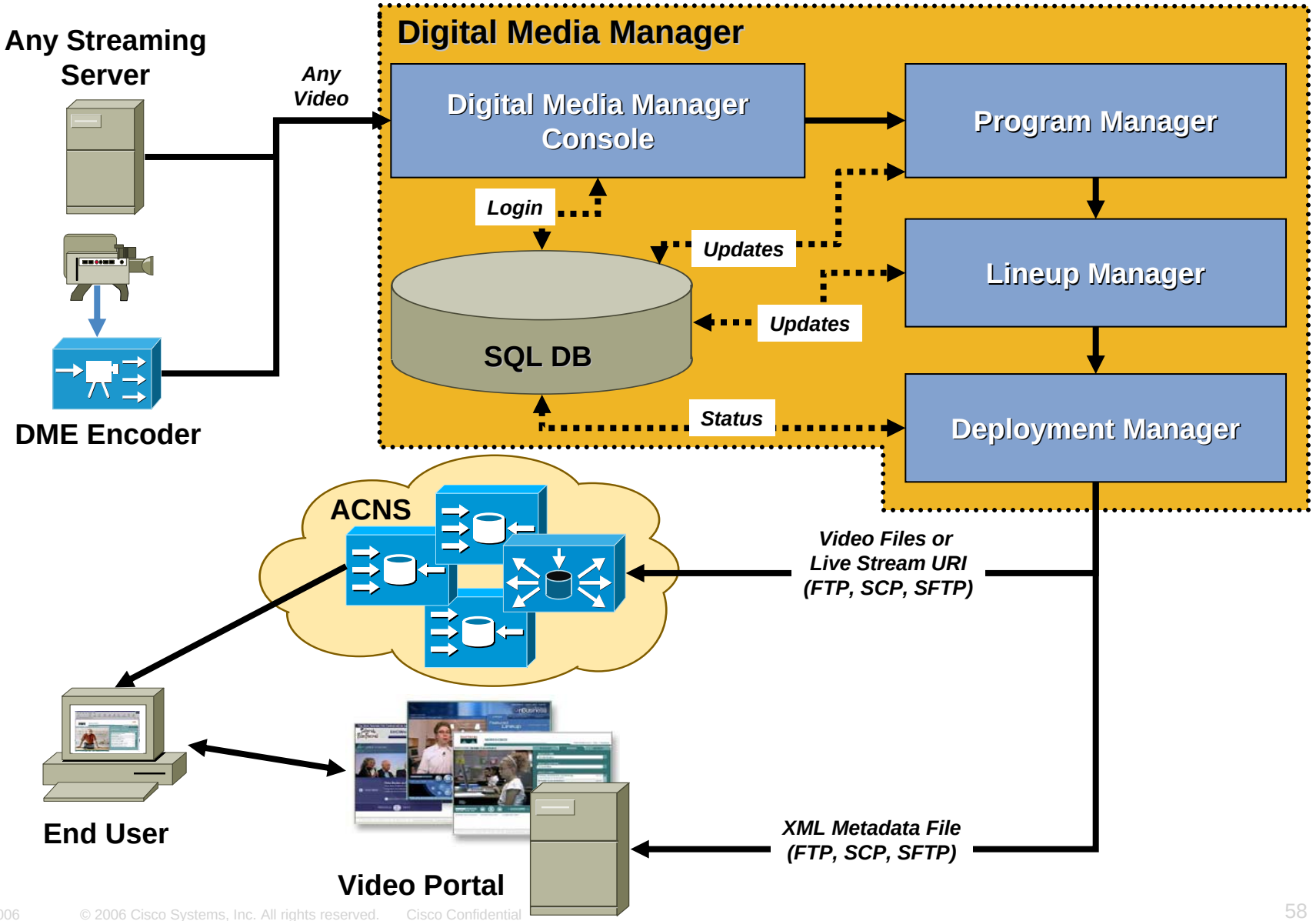
Cisco Video Portal Server

Hosts Flash-based Cisco Video Portal, digital media channel listings and usage reporting tool

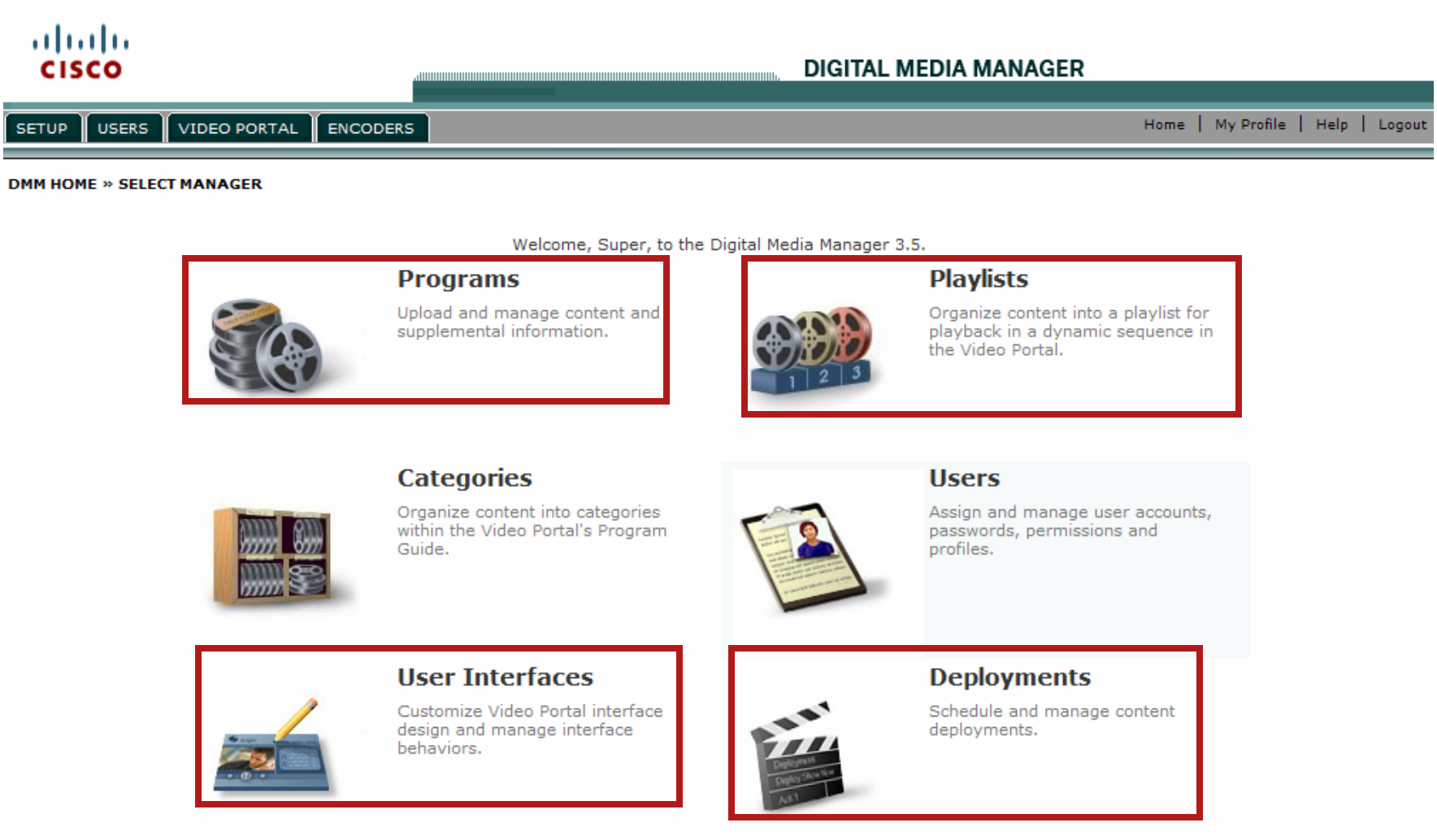


DEMO #2
Desktop Video

There is a strong relations between DMS components



Digital Media Manager



Cisco Video Portal with Video Player

Day in a “user-click” life

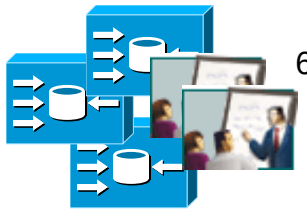
Intranet WebPage

1 – Request from Client

4 – Portal Browsing

3 - **Video Portal Web Application**

7 - Playback

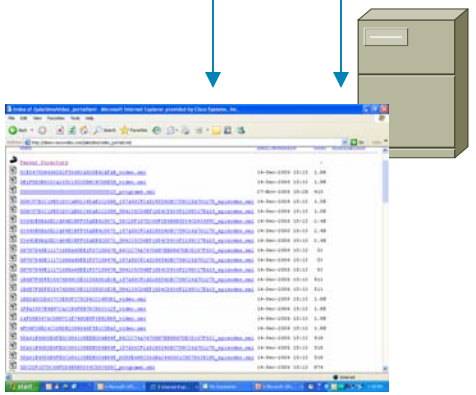


Streaming Servers

6 – Video Request

3 – Serves Main Front End

5 – Serves Portal Browsing Request

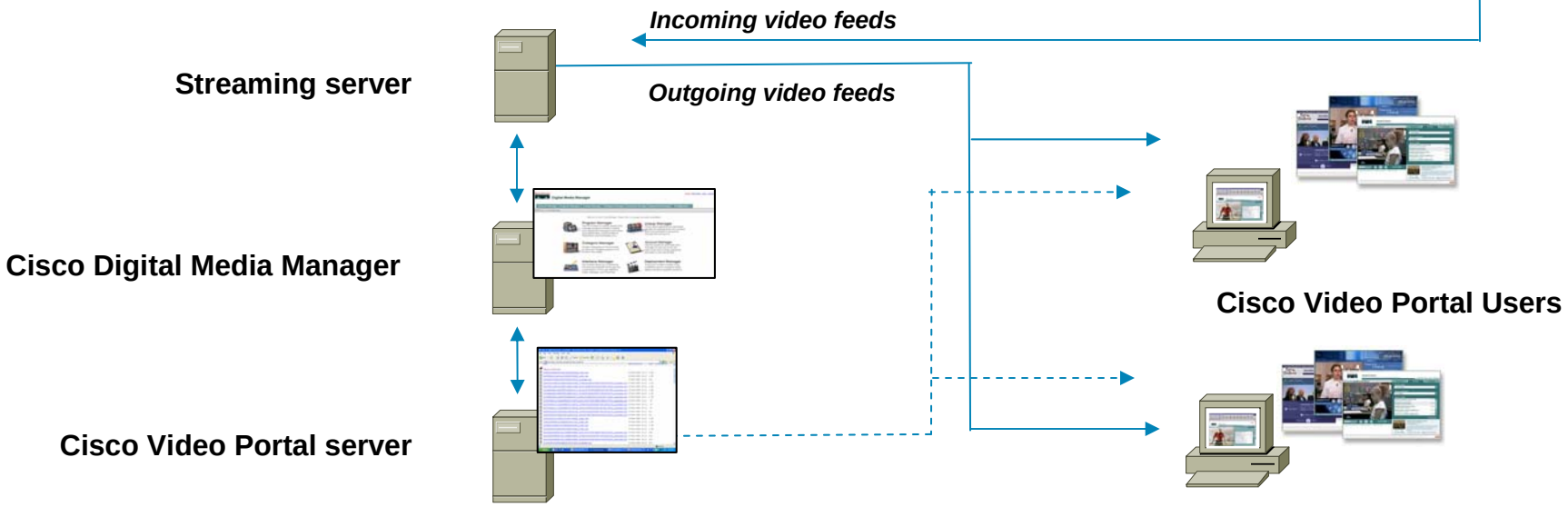


2 - **Video Portal Server check Client Capabilities**

Live Video and Video on Demand

Digital Media Encoding

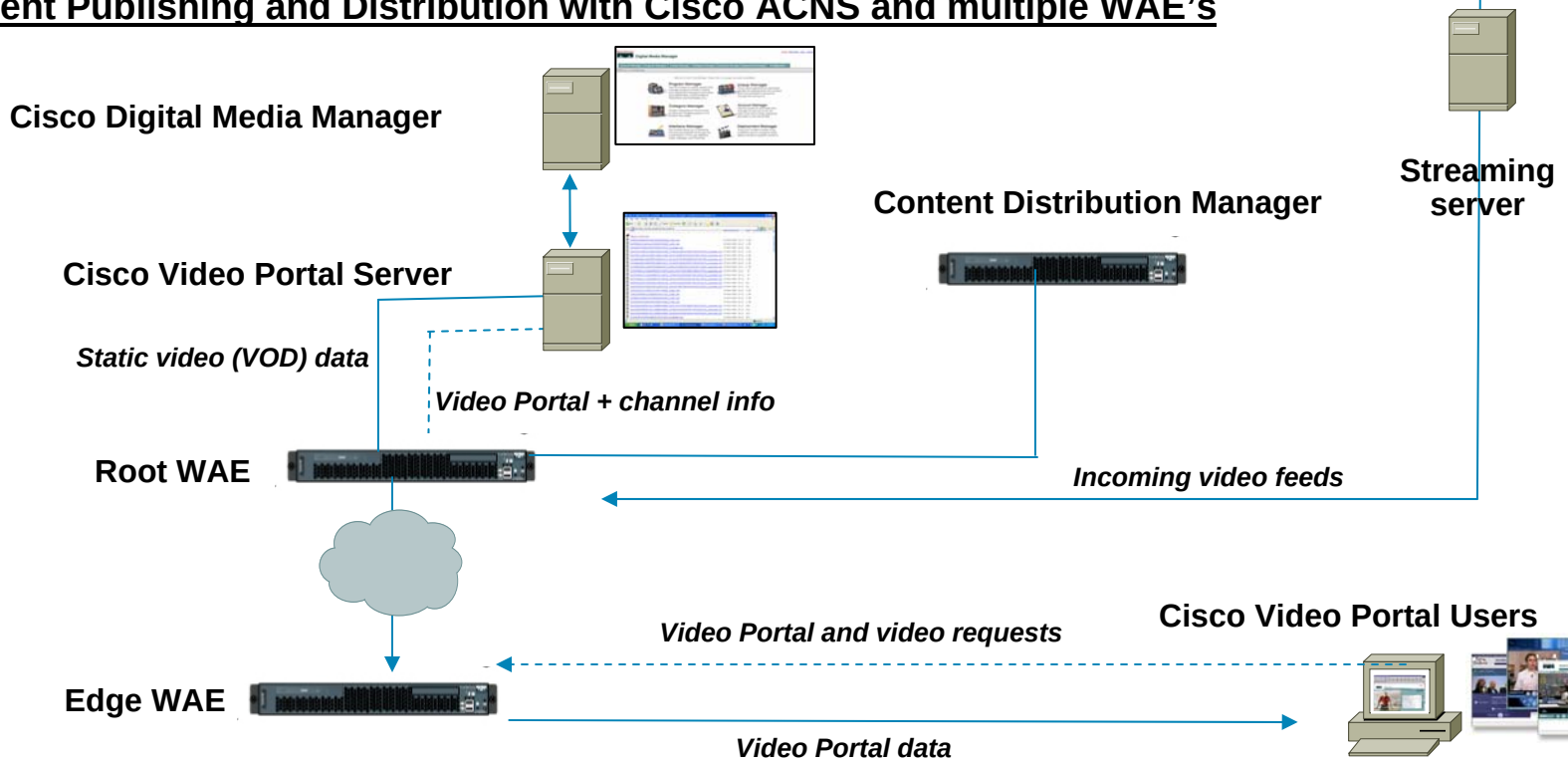
Content Management and Publishing



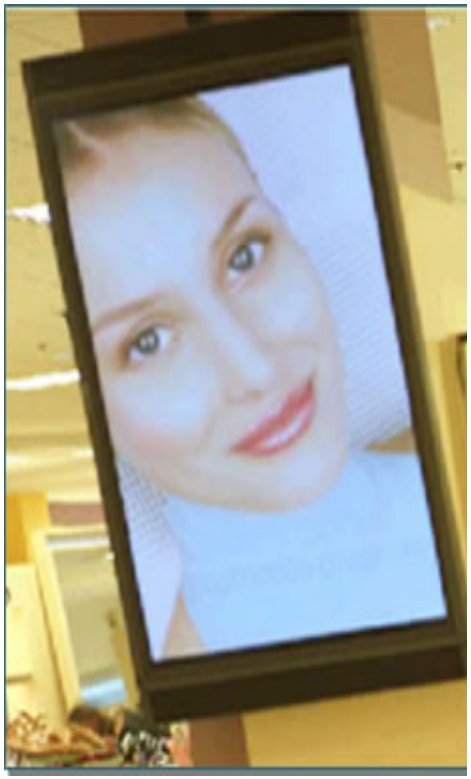
Video Publishing with ACNS

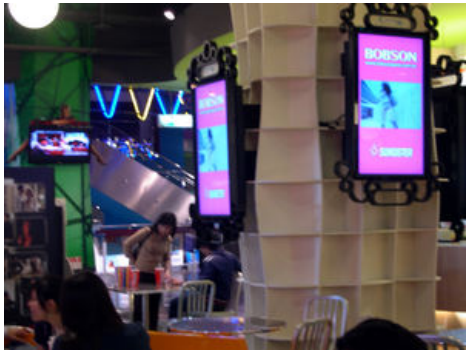
Digital Media Encoding

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



Digital Signage Examples...





Digital Signage
Benefits, Features and Applications

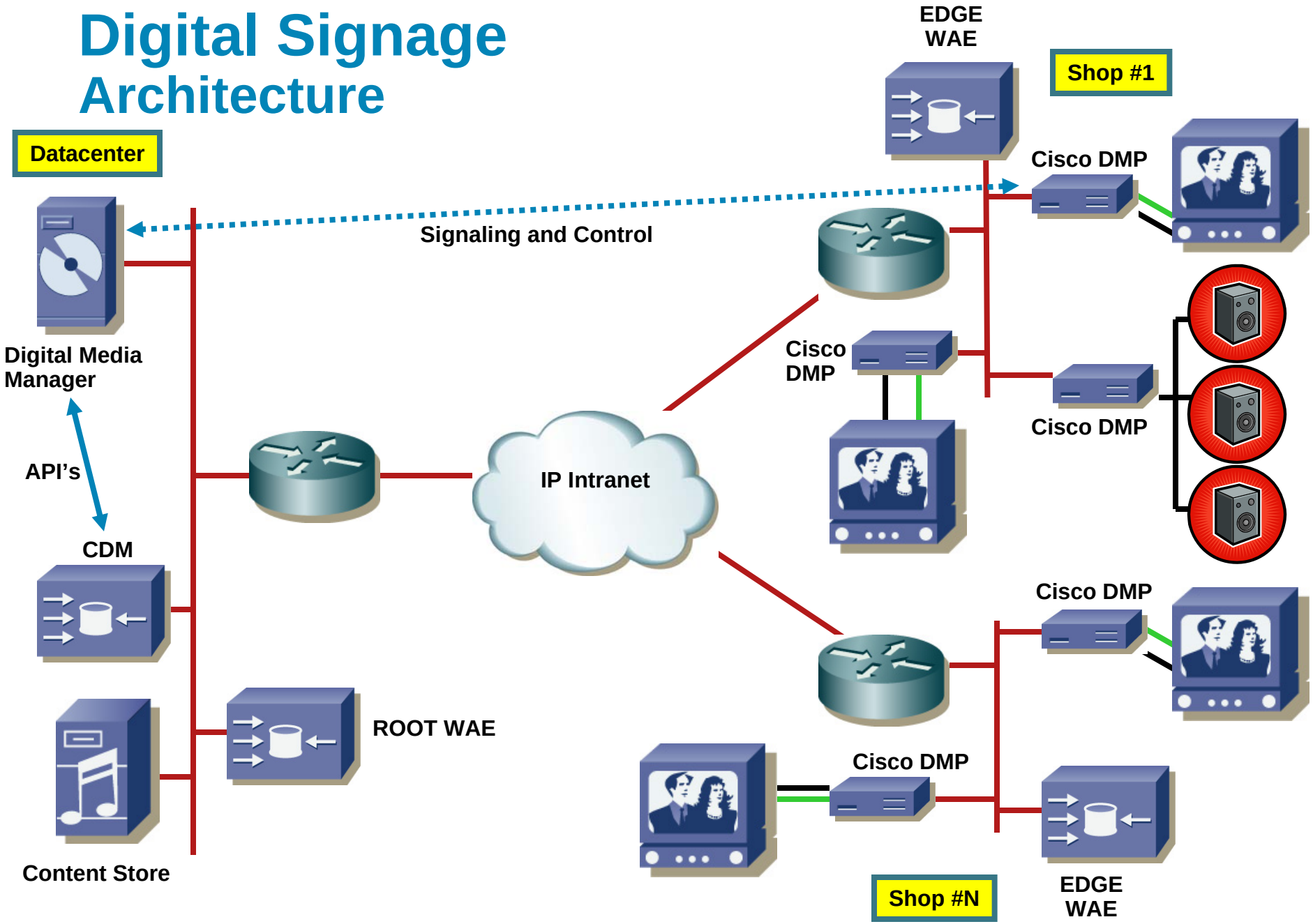
Benefits and Features

- **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**

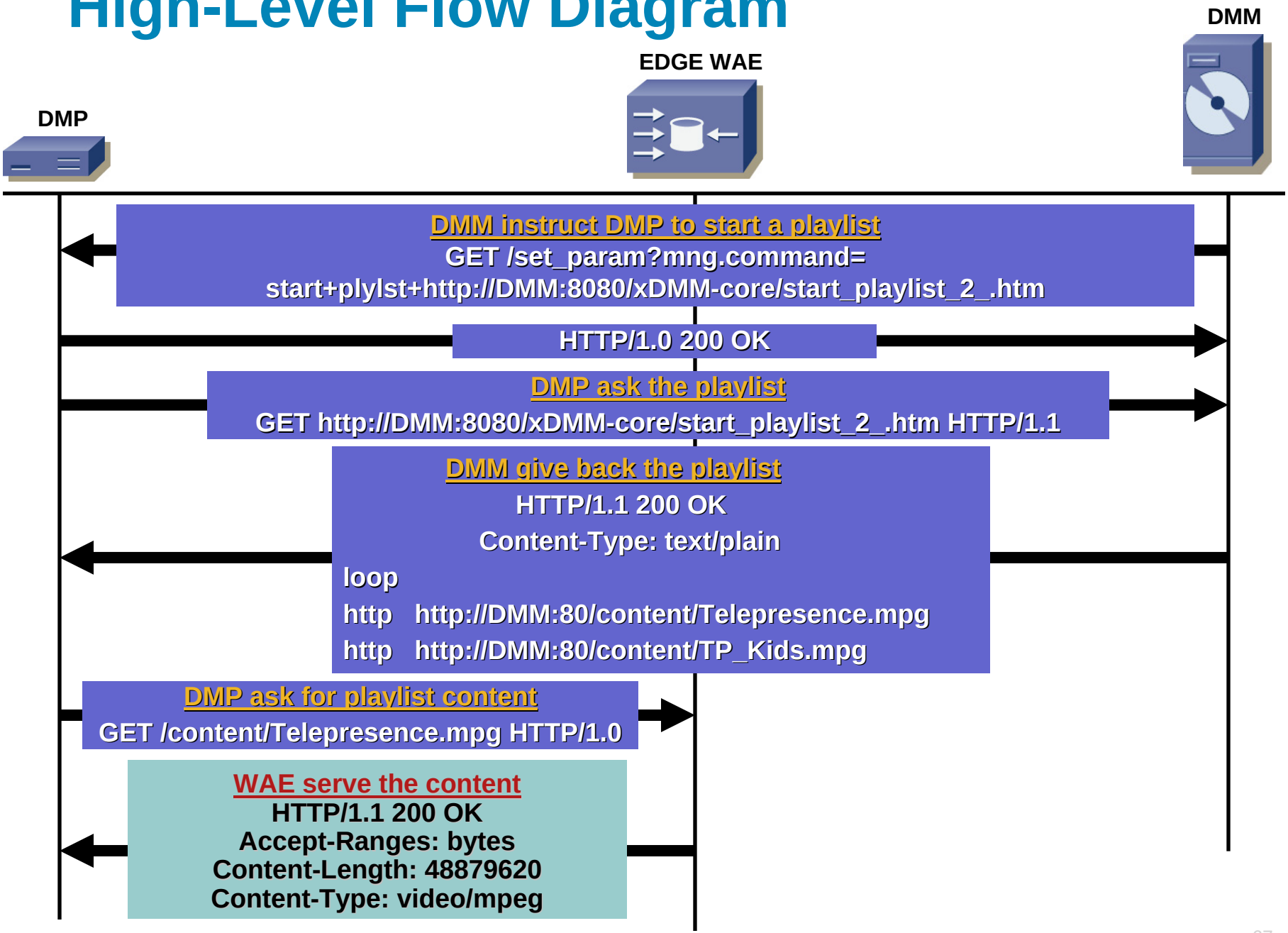
Applications

- **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**

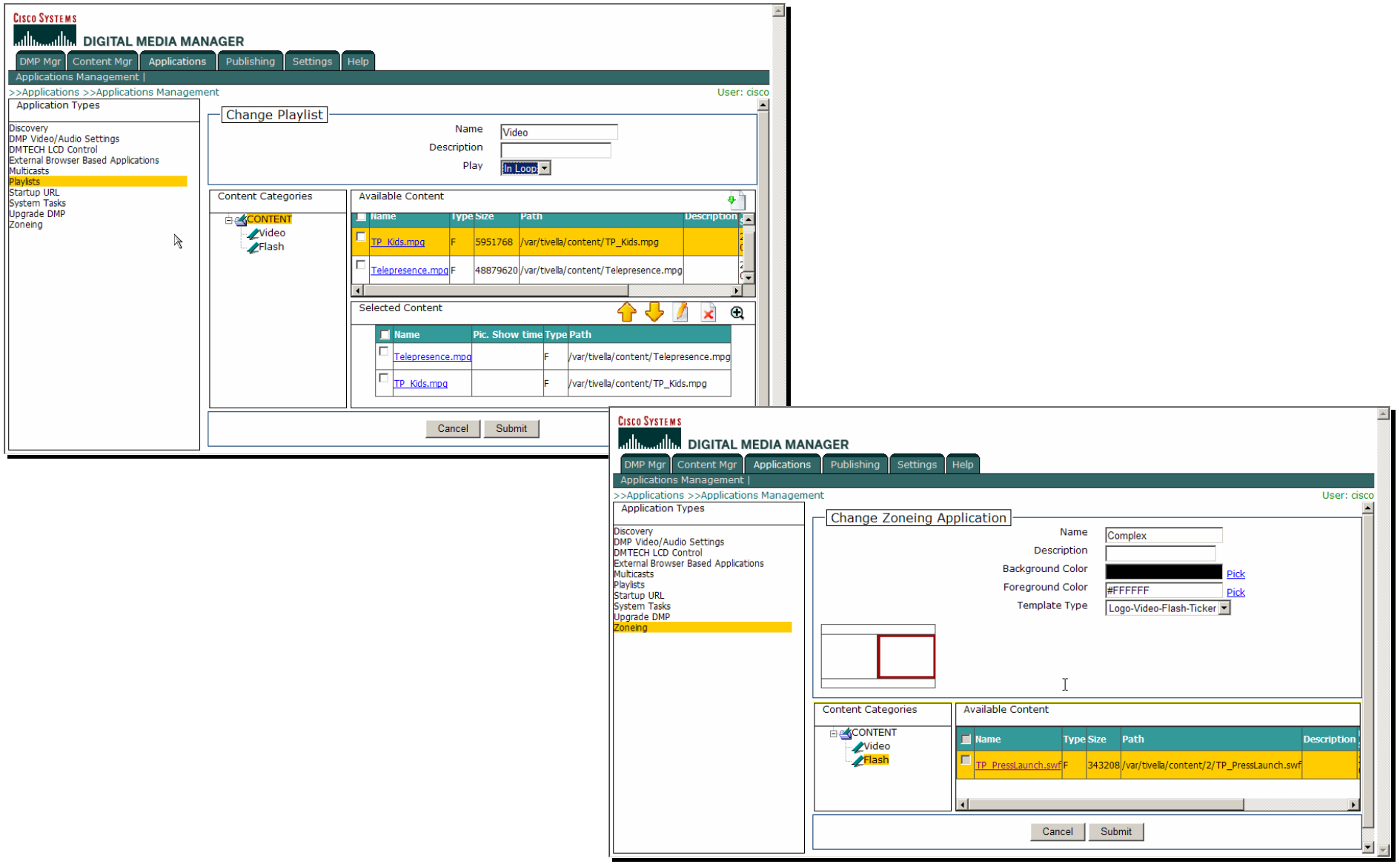
Digital Signage Architecture



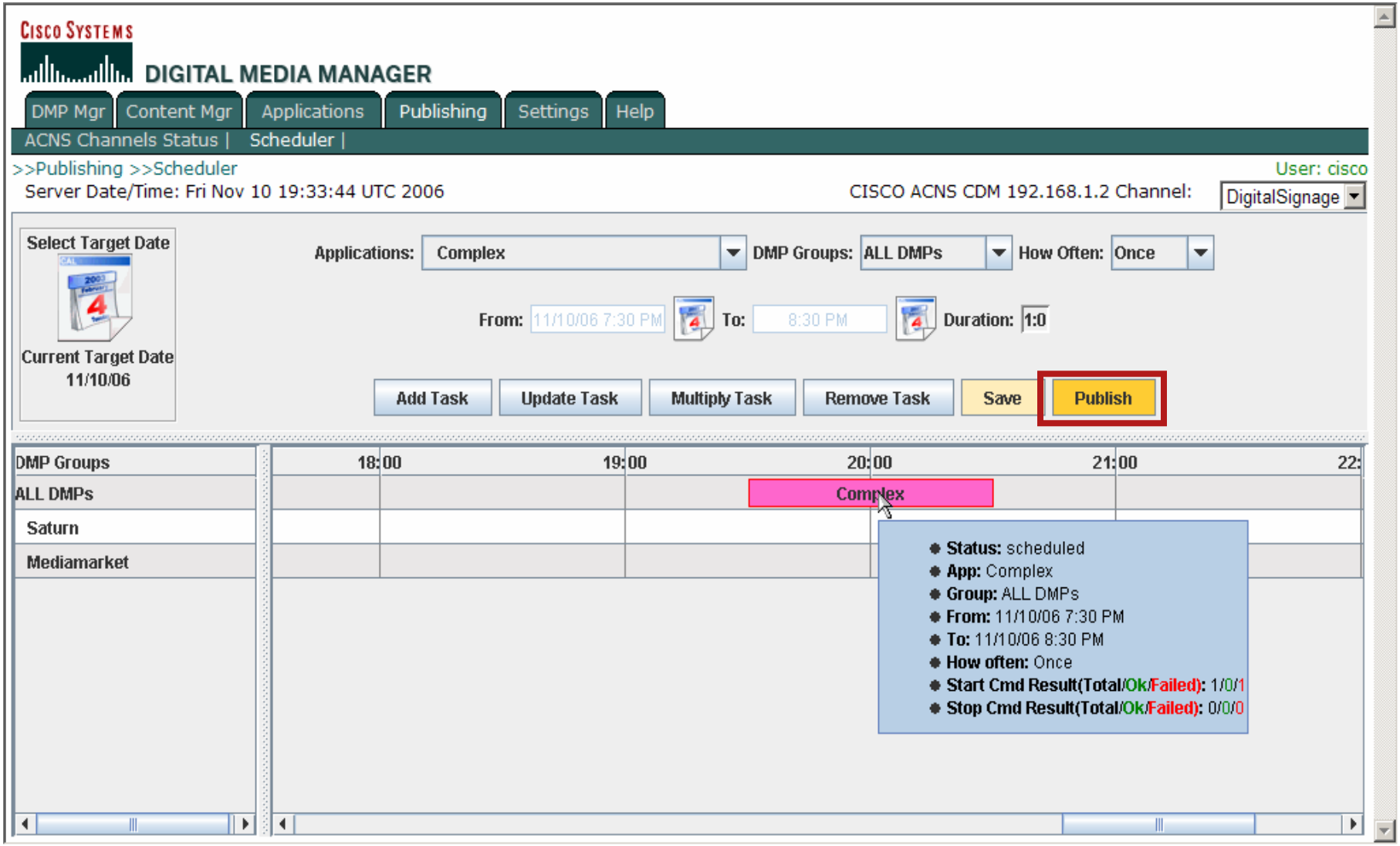
High-Level Flow Diagram



Content Management
Playlist and Zoneing



Scheduling and Publishing



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

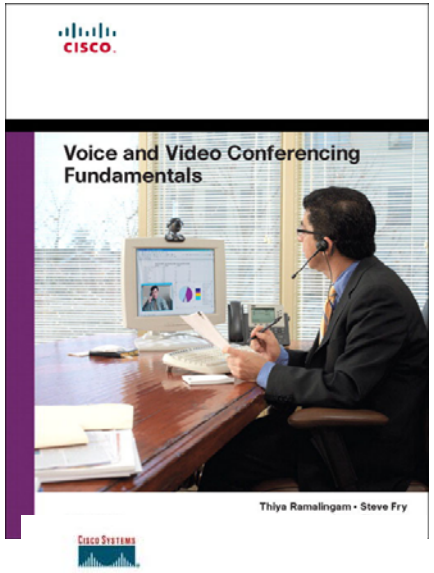
- Floris Grandvarlet
  Consulting Engineer

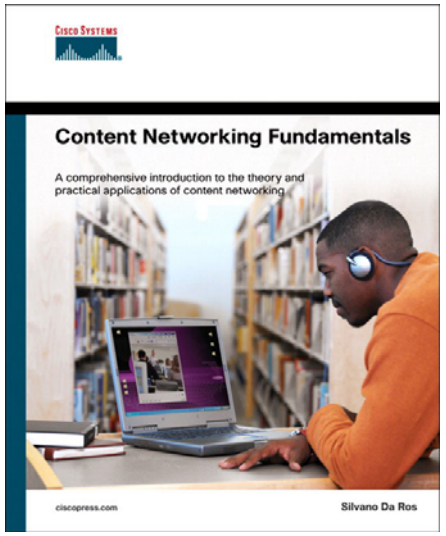
- Horst Dumcke
  Consulting Engineer

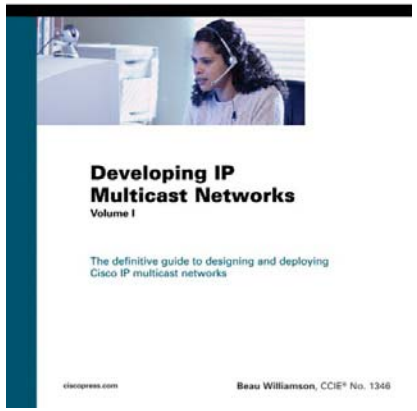
Recommended Reading

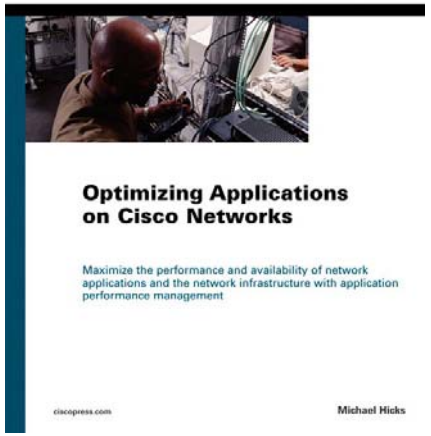
BRKAPP -2006

- 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

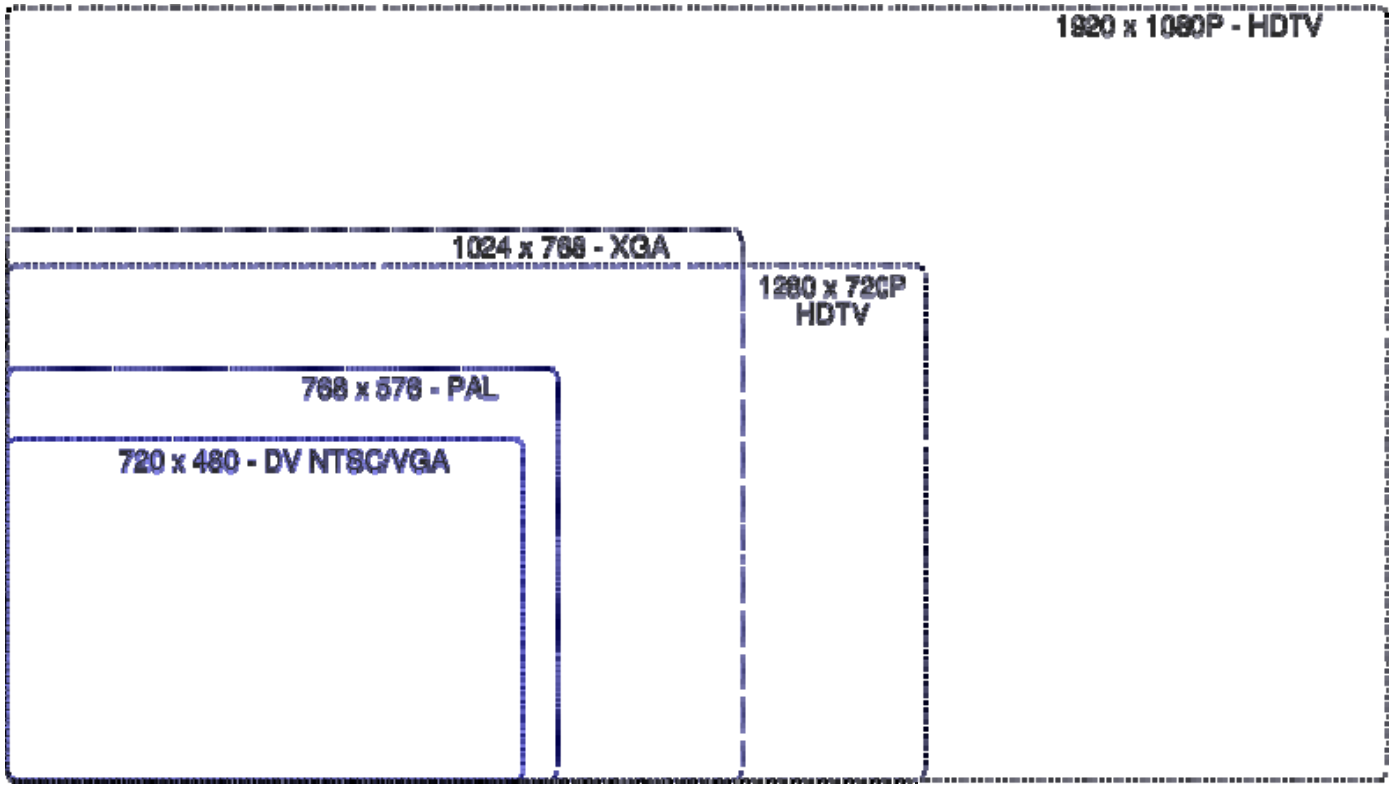
Reference Material

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 12Mpbs	
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