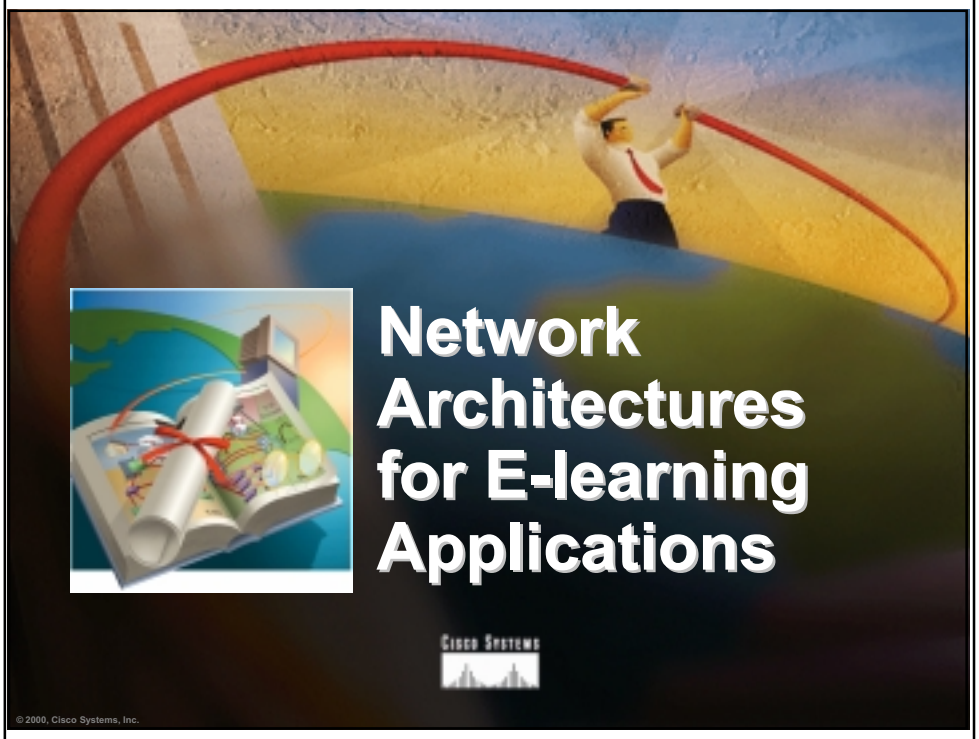


Agenda

- E-learning Challenges/Opportunities
- Cisco's E-learning Solution Architecture
- Cisco CDN Solutions
- Cisco IP/TV Solution
- Customers and Applications

The Problem ...

Last 5 years . . .

Network enabling of relatively simple applications

Next 5 years . . .

Enabling more demanding networked applications
e-Learning, e-Commerce, e-Communication

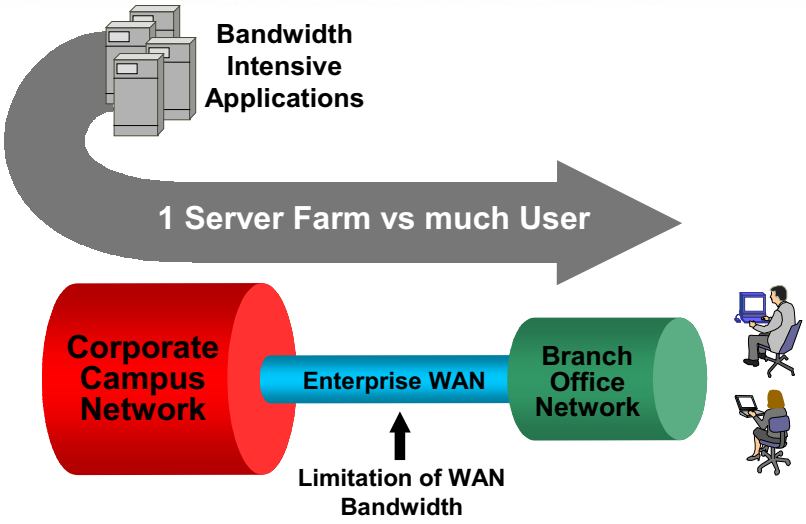
Key strategic applications will require . . .

Higher Bandwidth

Higher Reliability

Better response times

Key Challenge to Scale
for Internal Enterprise Applications



Applications

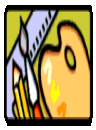
Education

- University
- Community College
- K-12

Fortune 1000

- Finance
- Retail
- High Tech
- Healthcare

Professional Services



- Advertising
- Media Production
- Content Providers

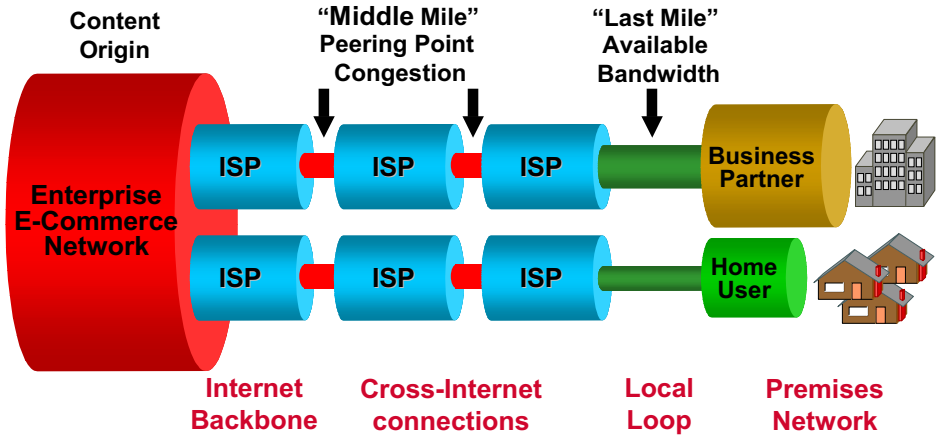
Government

- State, Local, Federal

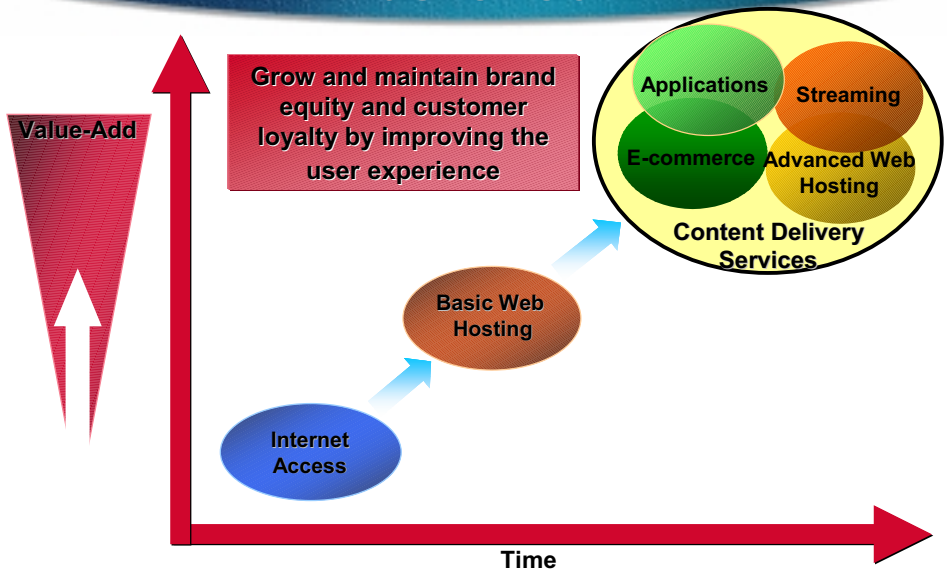
Live and On-demand Distance Learning, e-Learning, Corporate Communications, Partner/Supplier Training/Communications, Retail, Kiosks, Documentation Delivery, VoD, MoD

Key Challenge to Scale
for External Enterprise Applications

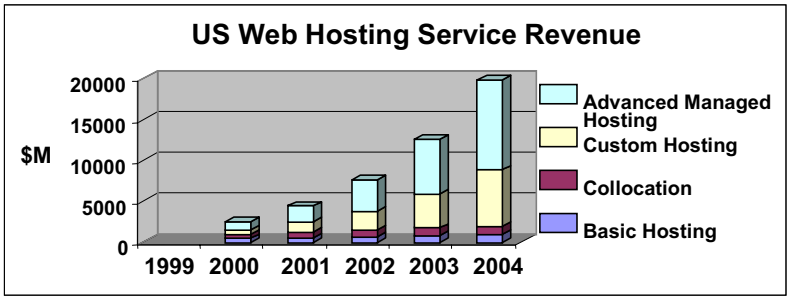
E-Commerce applications limited by congestion points within the Internet



Value-Add Content Delivery Services
The SP's Vision



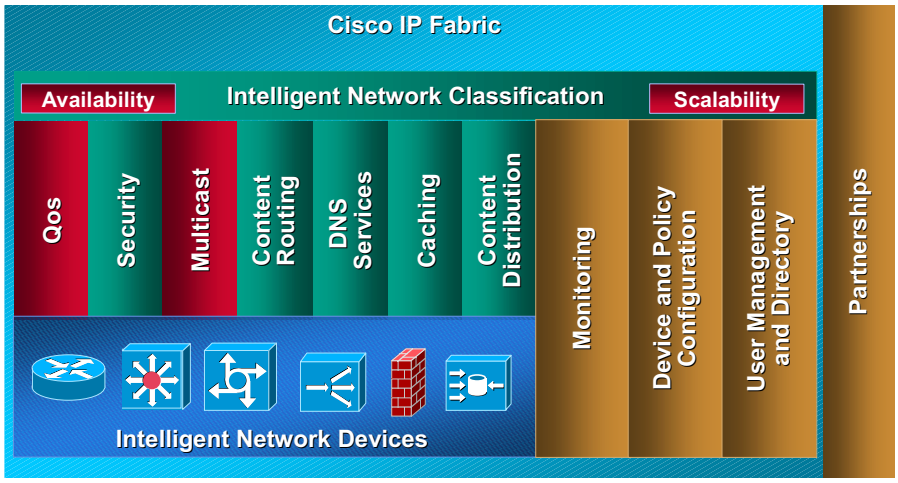
Streaming Media - Impact to Hosting Service Revenue



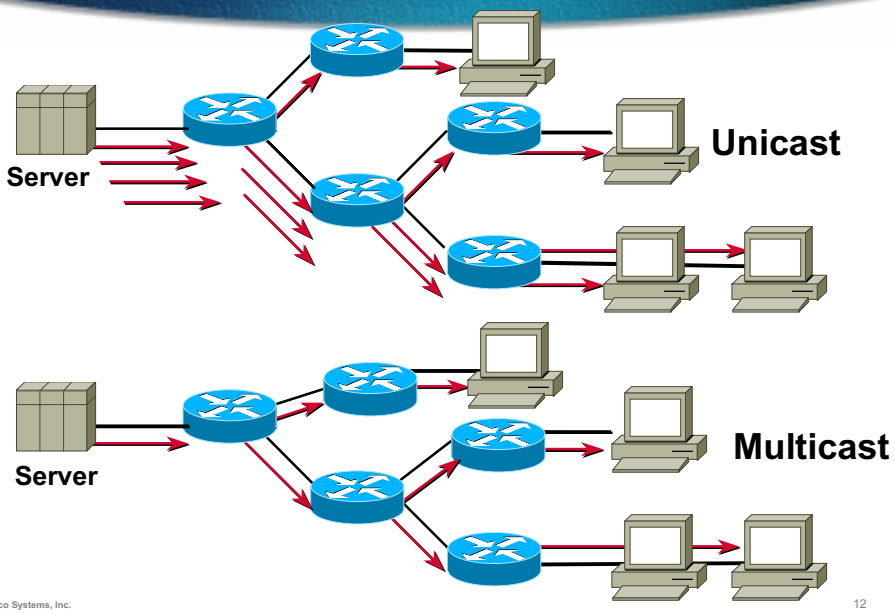
- Streaming Media will be a value-added service for ISPs and will contribute at least 50% of Web Hosting Service Revenue, especially in advanced managed hosting (assuming same SM ratio as content delivery service revenue)

Cisco's E-learning Solution Architecture

Cisco E-Learning Solutions Architecture

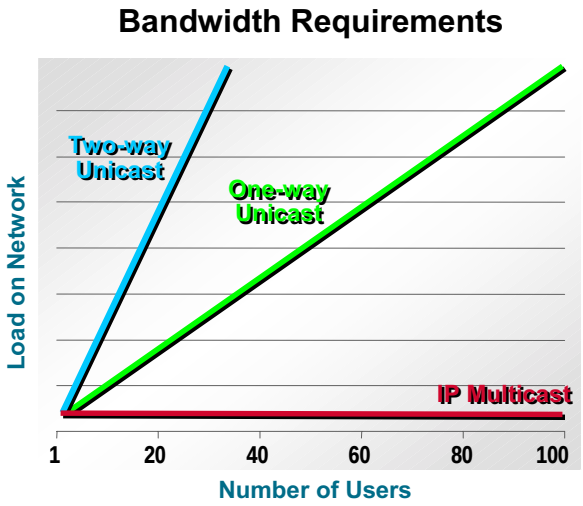


Unicast vs. Multicast



Network Bandwidth Planning

- Videoconferencing
  - Two-way Unicast
- Video-on-Demand
  - One-way Unicast
- Broadcast
  - IP Multicast



Benefits of IP Multicast

- **Increases productivity**

  Opens new ways to work through collaboration and conferencing, saving valuable travel time and money. Multicasting also enables the simultaneous delivery of information to many receivers, especially beneficial for delivering news and financial information

- **Supports distributed applications**

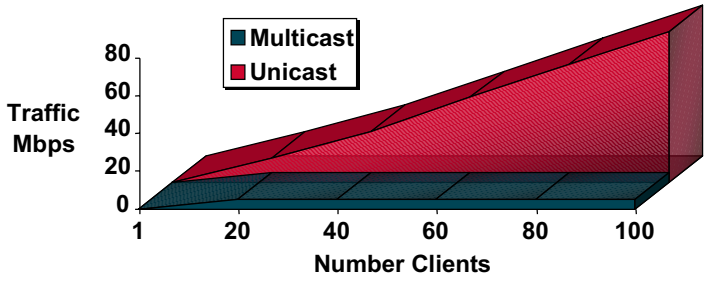
  Enables next generation multimedia applications such as distance learning and videoconferencing on the network in a scalable, reliable and efficient manner

- **Increased application availability**

  Alleviates network congestion caused by existing applications that are inefficiently transmitting to groups of recipients, thus allowing more recipients simultaneous access to the application

Benefits of IP Multicast

Example: Video Streaming
All Clients Viewing the Same 800 kbps Video



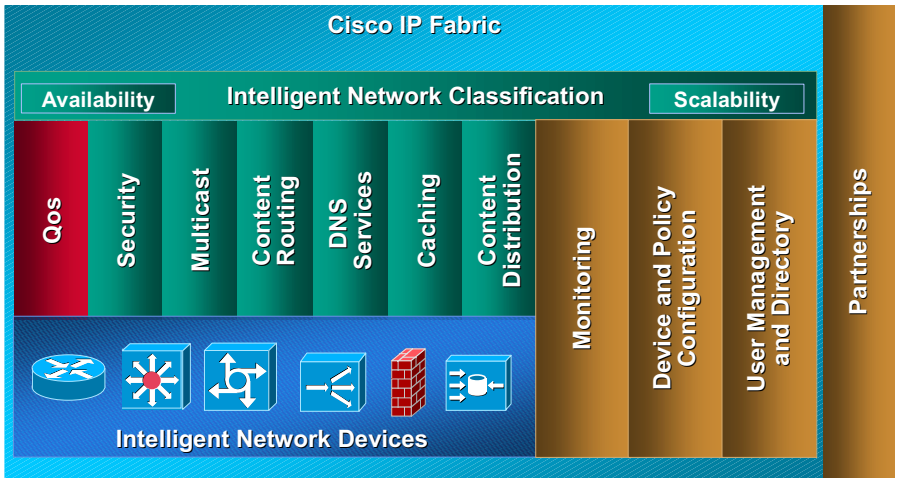
- **Eases scalability**

  Scales well as the number of participants and collaborations expand and greatly reduces the load on the sending server

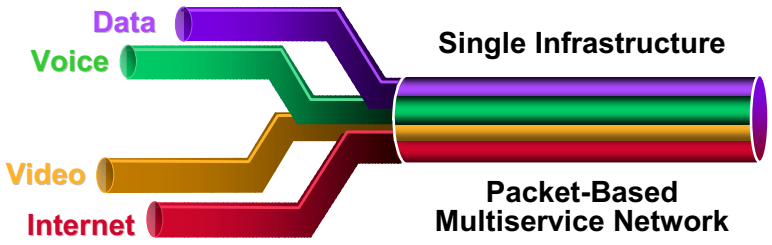
Multicast Applications

One-to-Many	Many-to-One	Many-to-Many
Database Updates	Resource Discovery	*Multimedia Conferencing*
Live Concerts	Data Collection	Synchronized Resources
Broadcasts	*Auctions*	Concurrent Processing
News Feeds	Polling	Collaboration
Push Media	Moderated Applications	*Distance Learning*
Caching		Chat Groups
Announcements		Distributed Simulations
Monitoring		*Multi-Player Gaming*
Lectures		Interactive Music Sessions

Cisco E-Learning Solutions Framework



Trend - Integrated Multiservice Network



- Integration of data, voice, and video services into a single packet-based infrastructure using IP
- Both in enterprise and public service provider networks infrastructure

QoS - What Is It ?

- A traditional network is best-effort
- All traffic gets the same service, i.e., the forwarding behavior by a network device is FIFO
- QoS prioritizes traffic into different service levels and provides preferential forwarding treatment to some traffic at the expense of lower priority traffic
- QoS = Preferential treatment

Not All Traffic Is Created Equal

	Voice	Video	Data (Best-Effort)	Mission-Critical Data
Bandwidth	Low to Moderate	Moderate to High	Moderate to High	Low to Moderate
Random Drop Sensitivity	Low	Low	High	Moderate to High
Delay Sensitivity	High	High	Low	Moderate to High
Jitter Sensitivity	High	High	Low	Low to Moderate

QoS - Why Is It Needed?

- Integrated networks carry different traffic types from a variety of business-enabling applications
- Business drivers and policies dictate preferential treatment for some type of traffic over other(s)
- Convergence of voice and data networks force us to consider servicing two different types of traffic on a single wire

Resources in CCO

www.cisco.com/go/ipmulticast

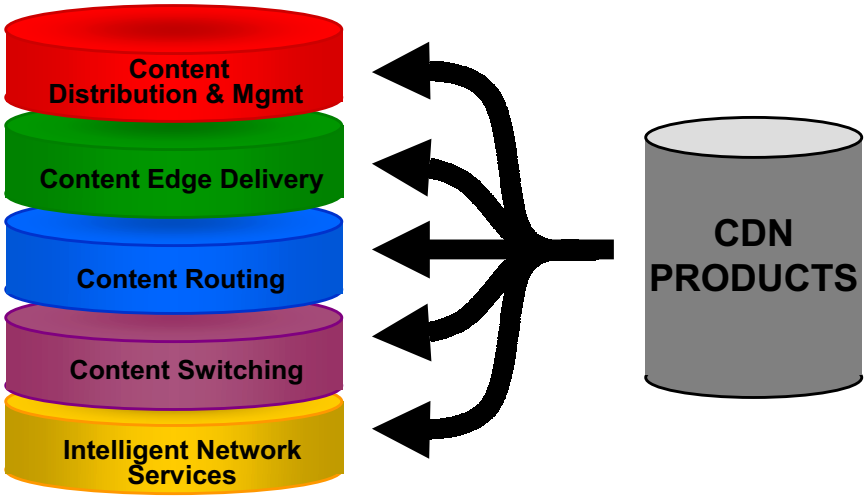
www.cisco.com/go/qos

- overview, sample configs, tech docs, and more

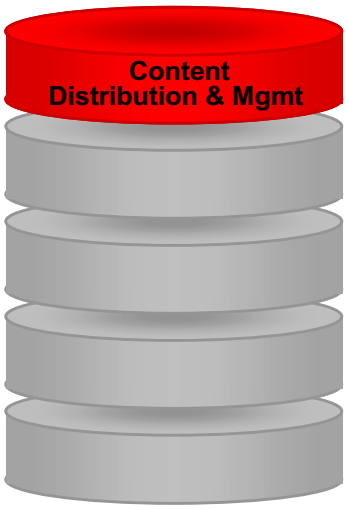
CDN Criteria

- **Flexibility:**
  - All formats: streaming media, graphics, PowerPoint, documents, more
  - All e-business applications
- **Ease of use + administration:**
  - Fully Web integrated
  - Zero-administration remote devices
- **Scalability:**
  - Efficiently distributes content to one or thousands of sites
- **Low cost of ownership:**
  - Maximize use of available WAN bandwidth
  - Minimize administration costs

5 Key Service Elements of Content Delivery Networks

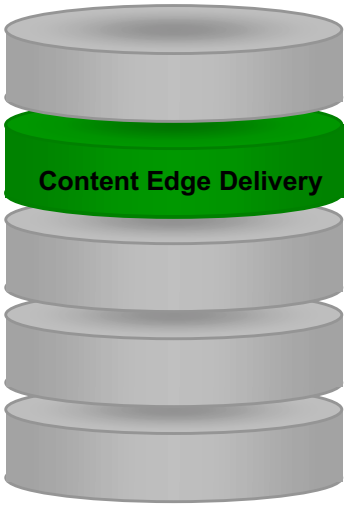


5 Key Service Elements
Content Distribution & Mgmt



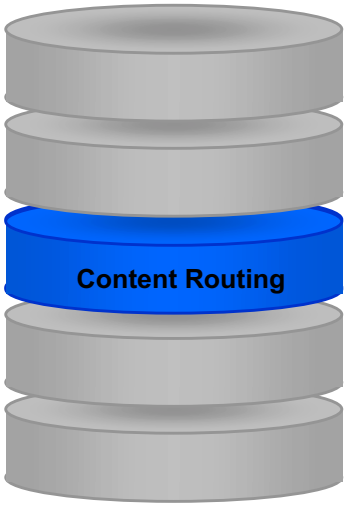
- Global centralized provisioning for content distribution
- Import, encode and automatically distribute content to network edge
- Bandwidth and configuration management for delivery nodes at network edges

5 Key Service Elements
Content Edge Delivery



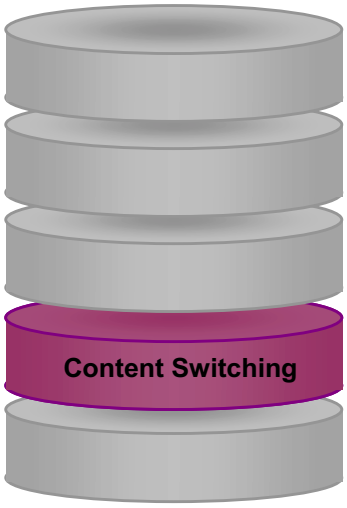
- Import content and maintain copies at edge of network
- Seamlessly deliver content of any type from network edge to desktops or kiosks
- Provide content serving, streaming, and transparent caching all in one
- "Appliance" technology

5 Key Service Elements
Content Routing



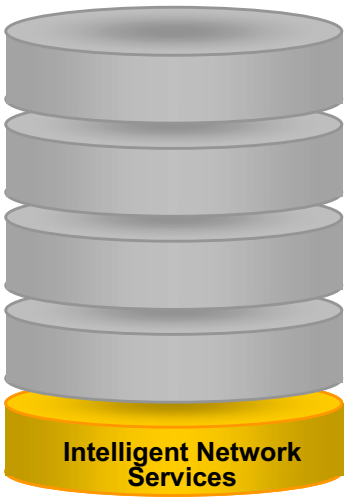
- Reliably route user requests for content to the best site across a CDN
- Metrics include: presence of content, geographic proximity, network conditions, POP load, Content Engine load measure of performance and usage
- Adaptive routing around failures/congestion

5 Key Service Elements
Content Switching



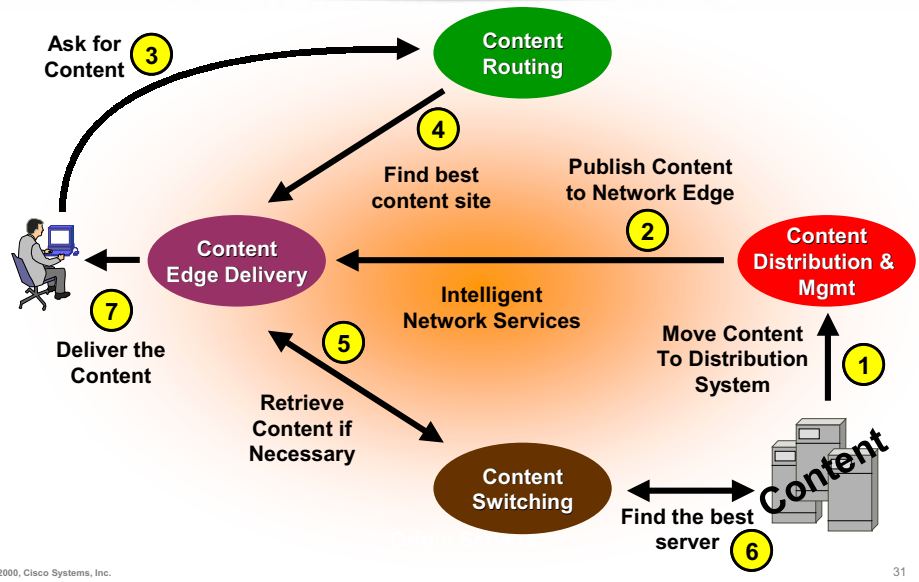
- Intelligently switch traffic across origin servers for load balancing
- Layer 5-7 services for intelligent load distribution
- Content verification services to ensure content validity, availability and load on server
- 'Flash Crowd' support for dynamic provisioning of content

5 Key Elements
Intelligent Network Services

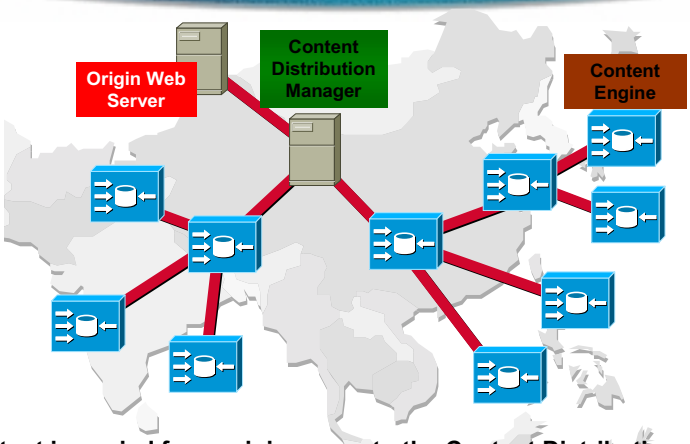


- Intelligence within the Cisco IP infrastructure
- Required to build reliable and scalable Cisco CDNs
- A solid layer 2/3 core Cisco infrastructure is a key requirement
- Examples of Cisco's intelligent network services include QoS, VPNs, Security, and Multicast

Functional Overview of a CDN



Content Distribution



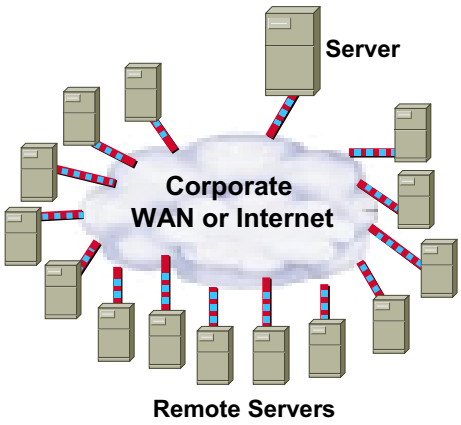
- Content is copied from origin server to the Content Distribution Manager and replicated to Content Engine
- Bandwidth used during content distribution can be limited
- Distribution can be scheduled during non-peak hours of the day

Non-Cisco Content Distribution Replication

- 1 hour of video at 1.5 Mb/s
- All devices have T1 connections

Time to replicate = (1 hr x 1.5 Mb/s x 14 devices)/T1 = 14 hours

- Origin Server link is taxed every time



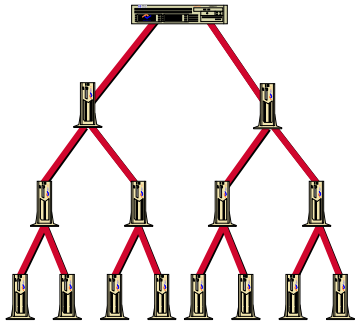
Cisco Content Distribution Replication (SODA Mesh)

- 1 hour of video at 1.5 Mbps
- All devices have T1 connections

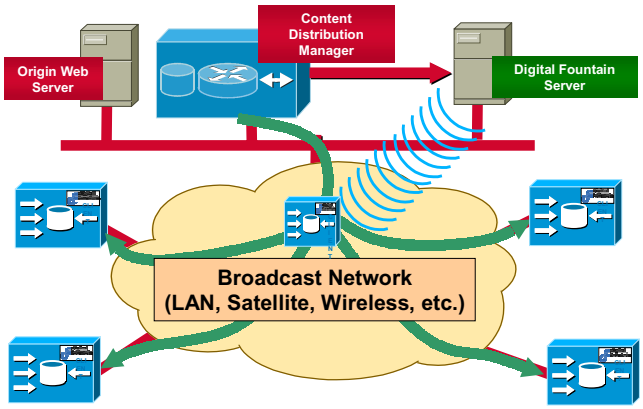
  Appliance-to-appliance replication occurs immediately after start of file receipt (not after replication is complete)

  Time to replicate = (1 hr x 1.5 Mb/s x 14 devices)/750 kbps*14 = 2 hours

- CDM link taxed less

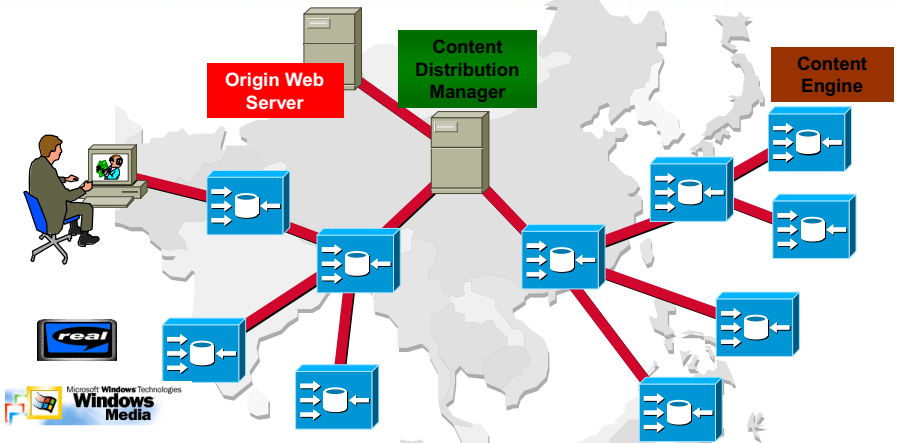


Cisco/Digital Fountain Integration



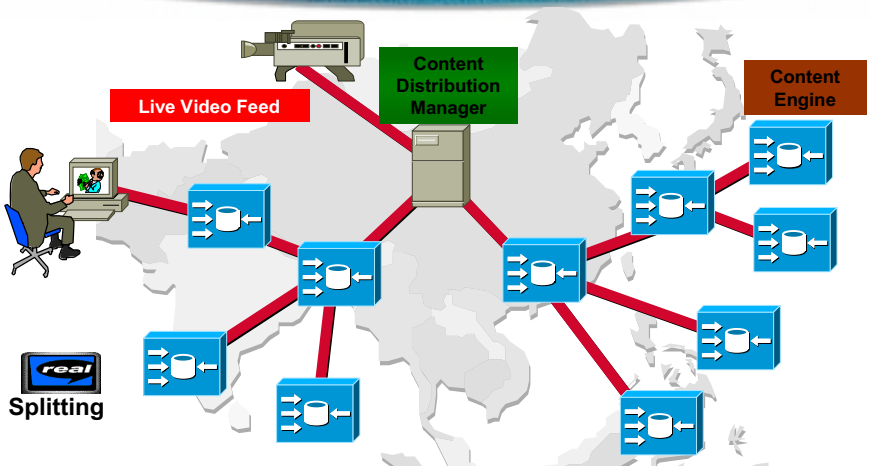
- Create "multicast" channel in the CDM
- Push Content from the CDM to the DF Server
- CDM notifies CEs of the multicast address
- DF Server and CEs join the multicast group

Streaming on Demand



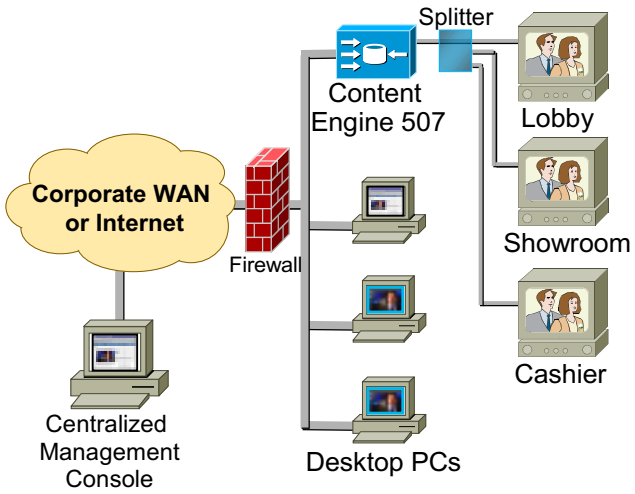
- Video content is distributed to Content Engines
- Client requests a video stream on web page
- Client is redirected to a special URL on the closest Content Engine
- Content Engine streams video from file on Content Engine

Live Streaming



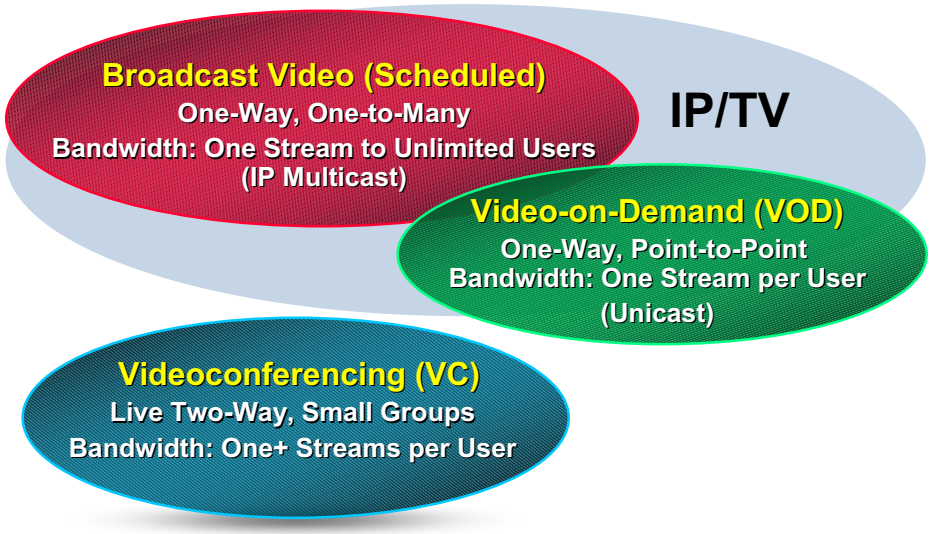
- Client requests a live video stream on web page
- Client is redirected to a special URL on the closest Content Engine
- Content Engine requests a live stream from the origin server

The MPEG Decoder
(The Retail Slam Dunk)



Cisco IP/TV Solution

3 Models of Network Video:



Shipping Cisco IP/TV 3400 Servers (4RU)

- Cisco IP/TV 3411 Control Server
- Cisco IP/TV 3422/3423 Broadcast Server
- Cisco IP/TV 3431 Archive Server
- Cisco IP/TV 3415 Starter System

Cisco IP/TV 3411 Control Server

- Centrally manages entire IP/TV system
- Provides bandwidth, server, and content management services
- Sends instructions to distributed broadcast and archive servers
- Communicates program information to Cisco IP/TV viewers

Easy to Use Web-based Administration Tool

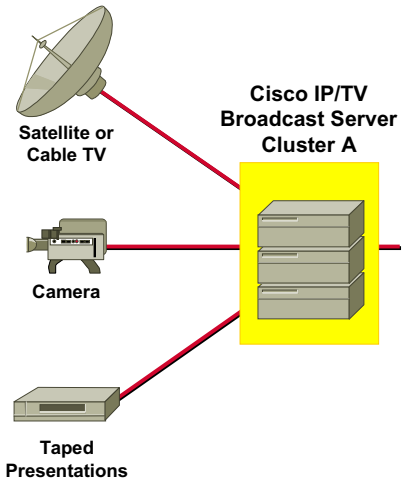
Cisco IP/TV 3411 Control Server

- Allows administrators to easily schedule on-demand and broadcast programs
- Lets managers quickly set up times and dates for initial and repeat showings
- Manages FTP video file distribution between IP/TV Servers
- Offers security features to control access

On-Demand and Scheduled Program Listings

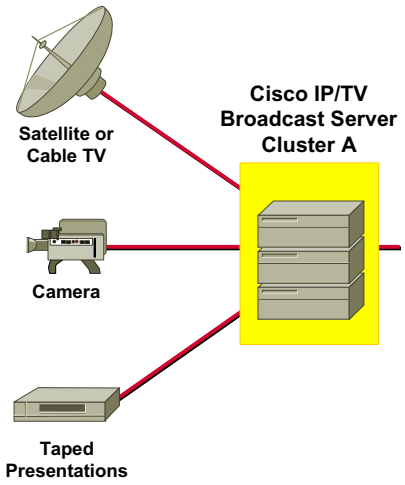
Cisco IP/TV 3422 and 3423 Broadcast Servers

- Capture and broadcast real-time and prerecorded content
- Ideal for live and scheduled broadcasts using IP multicasting
- Receive content from a variety of sources including cameras, satellite and cable feeds, DVDs, and ASF, AVI, and MPEG digital files
- Can record live broadcasts to disk for VOD or can be imported into CDM

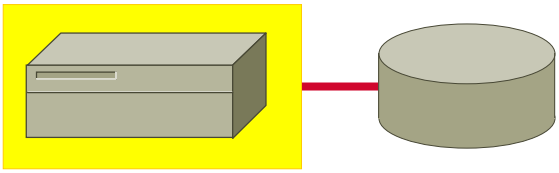


Cisco IP/TV 3422 and 3423 Broadcast Servers (Cont)

- 3422 – Has one live capture card that enables Lower Bitrate MPEG-4 or H.261
- 3423 – Has two live capture cards that enable MPEG-4 or H.261 and High Quality MPEG-1 or MPEG-2
- Broadcast Servers Live Video input:
  S-video or Composite Video
  Stereo Audio inputs



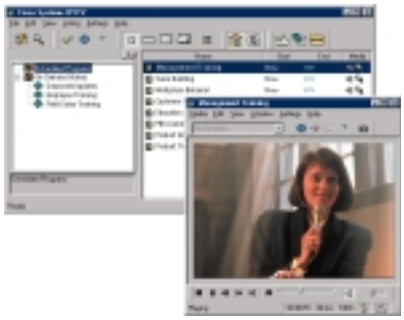
Cisco IP/TV 3431 Archive Server



- Higher-performance platform for Video-on-demand only (No live capture card)
- Supports wide range of video formats including ASF/WMV, AVI, and MPEG
- Offers 120 hours of storage capacity at 1 Mbps (2 times the storage of Broadcast Server)
- Serves 50 high-quality 1-Mbps VoD streams concurrently

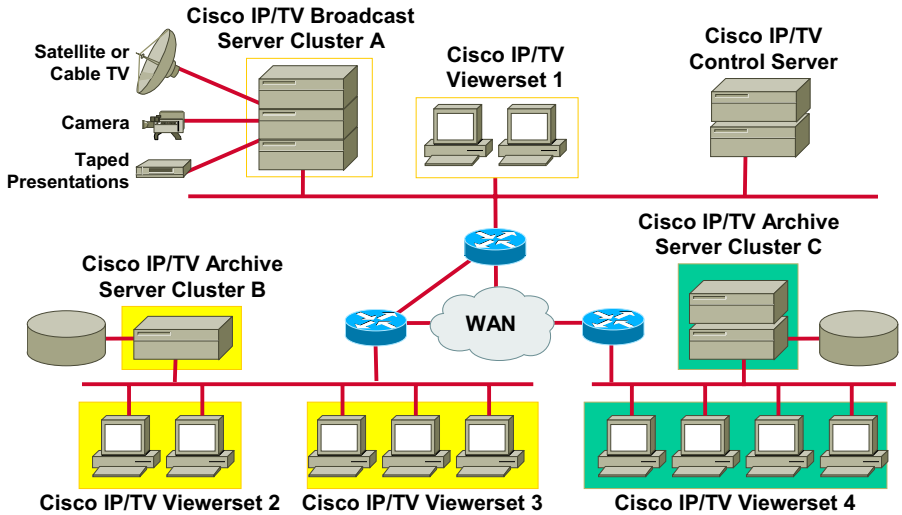
Cisco IP/TV Viewer

- IP/TV client-side software (Win95/98/NT/2000 support)
- Easy-to-use, intuitive interface
- Separate viewing window appears with TV-like controls
- Presents program listing with search capabilities – Allows administrators to easily share program availability to users



Viewers Get Point-and-click Program Access and a Separate Viewing Window

Cisco IP/TV Product Family— Video Solutions



Open, IETF Transport Standards

- IP Multicast broadcasts video
- RTP carries the data (RFC 1889)
- RTCP carries control info among all session members
- RTSP enables client/server control-functions as a network remote control for IP/TV servers (RFC 2326)
- SDP to describe media

Streaming Standards

	Storage	Wire Format	Control Protocol	CODEC	Synch
Microsoft	Windows Media Format	ASF	ASF	WMA, WMV	ASF
Real	RM	Real	Real, RTSP	Real Media 8, MPEG-1	SMIL
Apple/ Quicktime	Quicktime	RTP/RTCP	RTSP	MPEG-2,H.261 Sorenson	Quicktime
Cisco IPTV	MPEG, RTP	RTP/RTCP	RTSP	MPEG-1/2, WMV, H.261	Data

RTP vs. HTTP Streaming

- Video transmission is time sensitive
- HTTP (TCP based) is a reliable transport – lost video packets are retransmitted – could cause video to pause
- RTP (UDP based) is better suited for Video Transmission on lossy networks.– RTP packets are timestamped – visual impact is minimized with a network loss

(Graph: Blue line shows FrameRate – Red line shows LossRate)

Internet Streaming Media Alliance

Accelerate the market acceptance of streaming MPEG-4 over IP solutions:

- Increase Streaming Media over Internet usage as broadband access growing rapidly as service costs decline and ease of installation improves
- Enable New class of Internet devices, thin-client appliances, etc. to consume Internet streaming media
- Consolidation into one industry-accepted standard with
plenty of room for vendor specific value adds, etc

Who is behind the Alliance

Sun microsystems

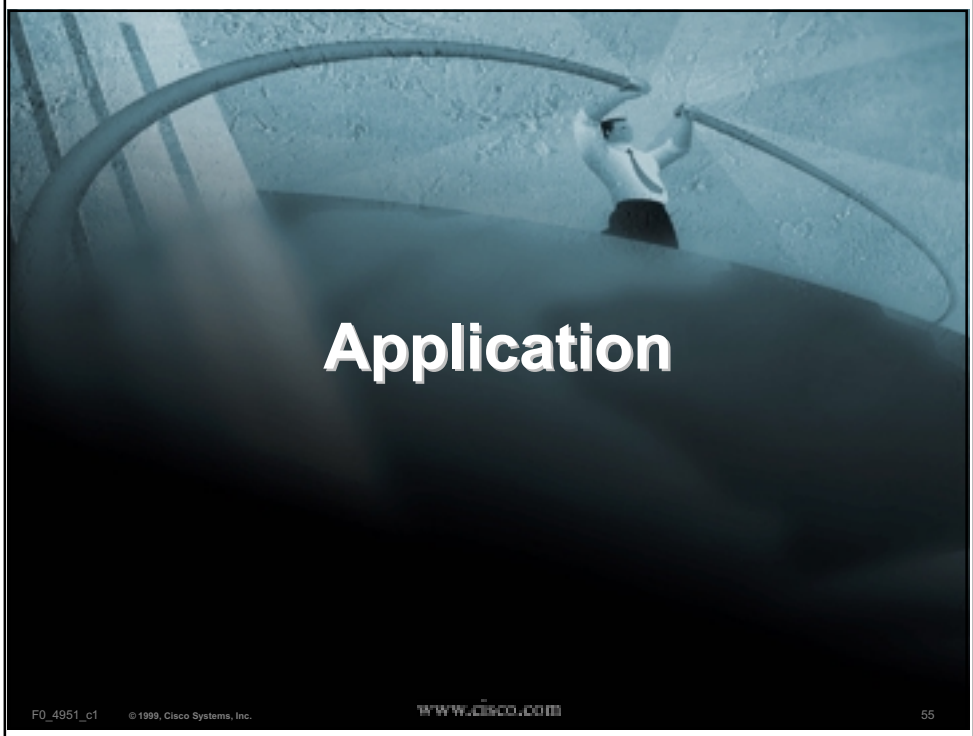
PHILIPS

Cisco Systems
Empowering the Internet Generation

kasenna

Plus over twenty industry-leading companies that have already indicated they support the goals of the Alliance and intend to become Participant members

www.ism-alliance.org
www.isma.tv



Slidecast

- **Slidecast**
  - **Slides sent as separate RTP video stream**
  - **Uses H.261 CODEC to digitize data in video memory – it does a video capture of presenter's screen. Limits frame size to 352x288.**

Slidecast Screenshot

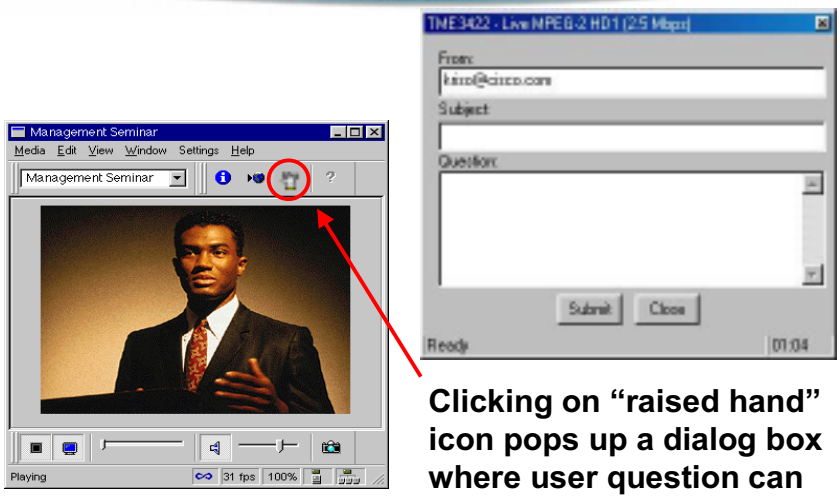
See the Presenter

See the Presentation Materials

Question Manager

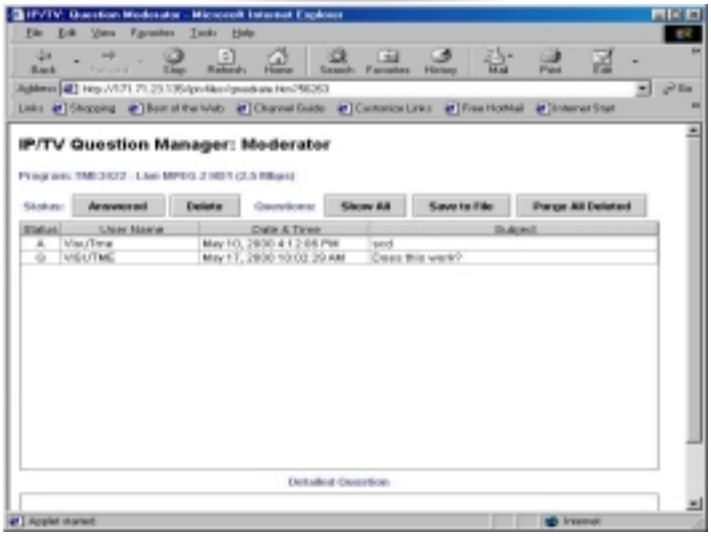
- Optional feature for Live Broadcasts that provides option for viewer to give immediate Feedback to live presenter or to video crew
- Can be used to facilitate Q&A sessions at the conclusion of a live broadcast
- Questions can be exported from the Question Manager Moderator for answering at a later time

Question Manager – Viewer side



Clicking on "raised hand" icon pops up a dialog box where user question can be typed

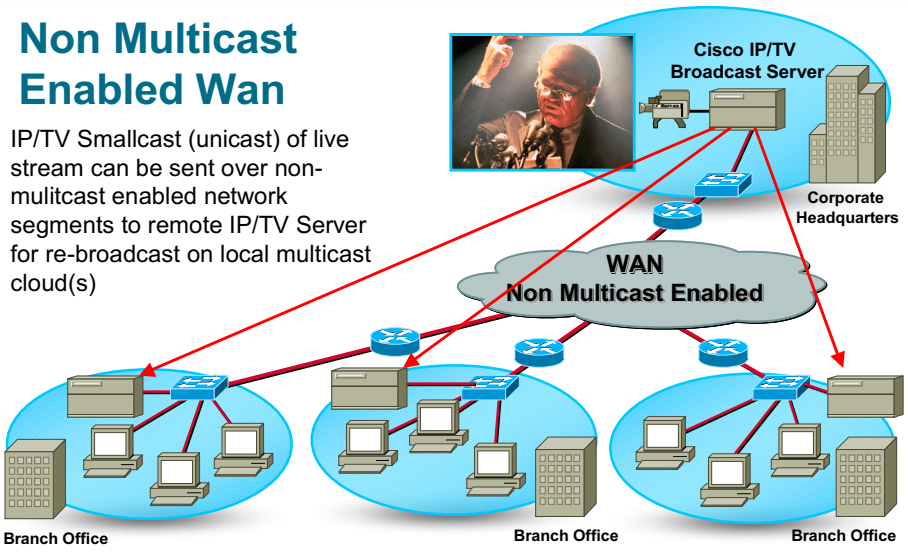
Question Manager Moderator – Admin side



Live Corporate Communications with SmallCast

Non Multicast Enabled Wan

IP/TV Smallcast (unicast) of live stream can be sent over non-mulitcast enabled network segments to remote IP/TV Server for re-broadcast on local multicast cloud(s)

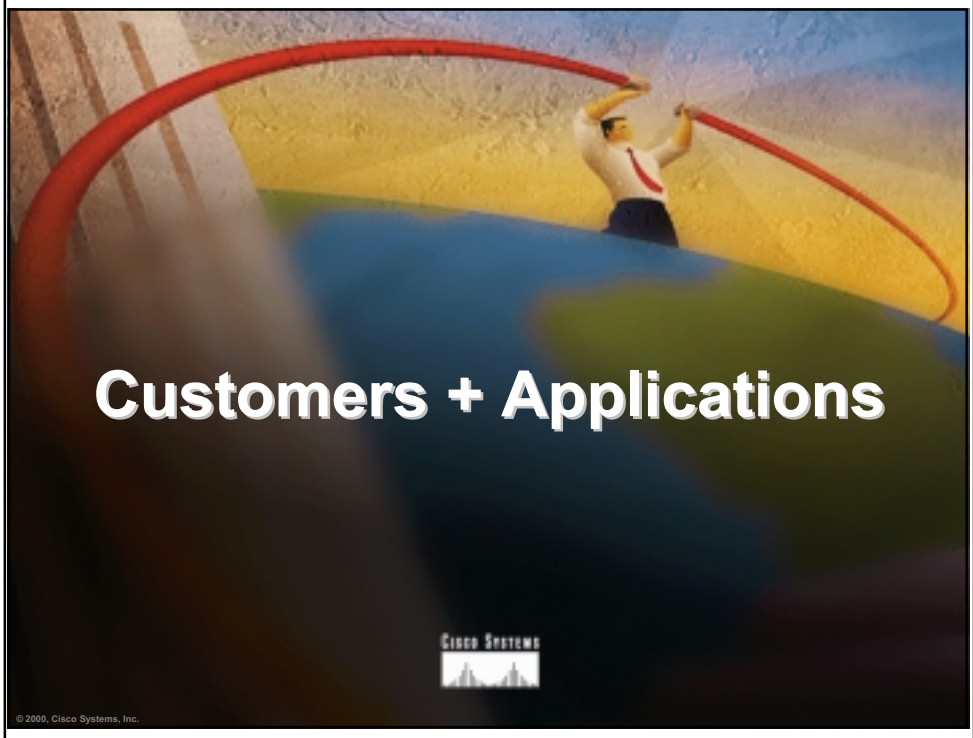


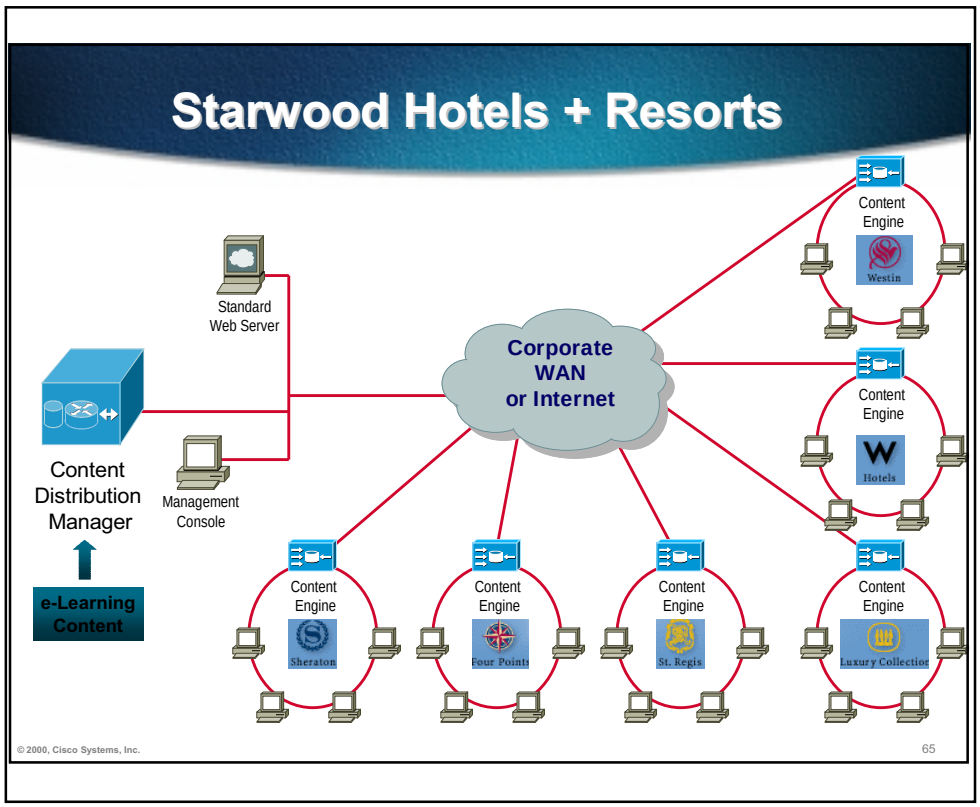
Cisco IP/TV Key Technologies and Strengths Summary

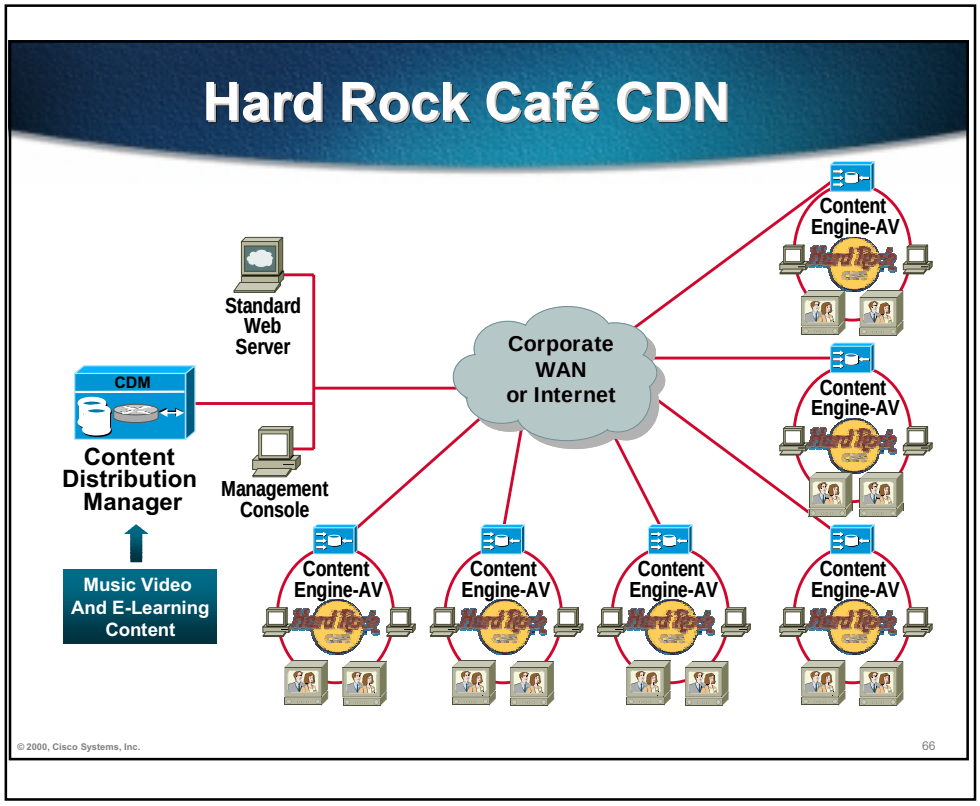
- Standards Based RTP Streaming
- Efficient Network usage with Multicast delivers live video to large audiences
- Program listings
- High Quality Live video broadcasting and recording
- E-Learning tools (Slides and Question Manager)

High level positioning of IP/TV and CDM/CE today (cont)

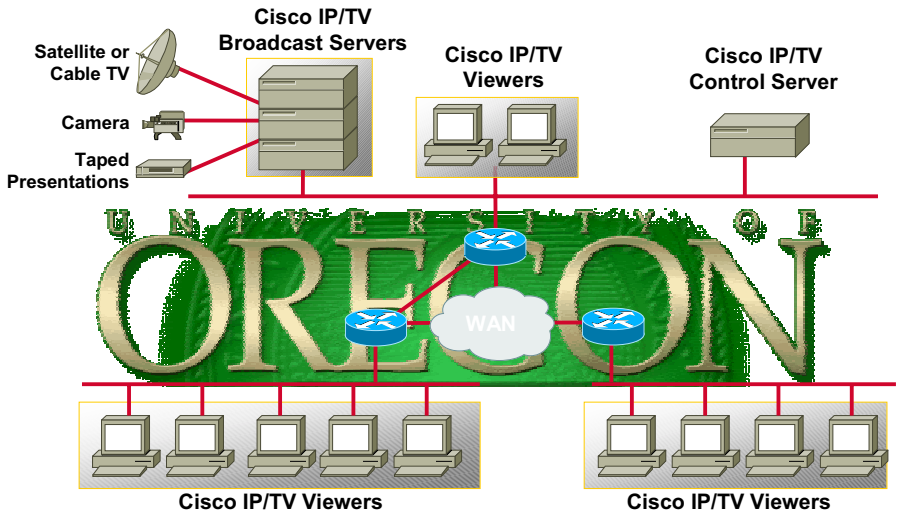
- IP/TV is best for live broadcast events using IP Multicast. IP/TV VOD is good for smaller deployments – doesn't do firewalls or Dialup connections well. Uses FTP file distribution between IP/TV Servers – no intelligent replication.
- CDM/CEs are best for large VOD deployments – works well through firewalls – intelligent SODA file distribution to CEs







Live Learning: University of Oregon Cisco Broadcast Server

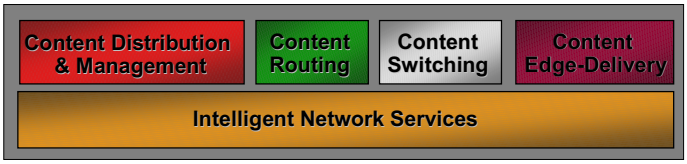


Other Key Customers + Applications:

- **FedEX**
  Internal Comm, Live
- **Messner Vetere Berger McNamee Schmetterer**
  Client Comm, Internal Comm
- **Cookson Electronics**
  Customer Product Training
- **Citigroup**
  Server Load Balancing
- **University of Oregon**
  Distance Learning, Live
- **University of Iowa**
  Distance Learning
- **@mosphere / BBDO**
  Client Comm, Internal Comm
- **Intel**
  Internal Comm
- **PRIMEDIA Workplace Learning**
  Training for customers, Internal Comm
- **Procter & Gamble**
  Caching

The Cisco Difference

Content Delivery Networks



- Cisco is the first and only vendor to deliver a complete ***system*** for Content Delivery Networks and Next Generation Content Based Services
- **Enterprise** - Content Delivery Networks (CDNs) allow Enterprises to deploy a new generation of scalable, accelerated, web-based, content-rich E-Business and E-Learning solutions including rich Web content and TV quality streaming media.
- **Service Provider** - Content Delivery Networks (CDN) services represent a highly profitable, billable, new revenue opportunity for Service Providers. CDNs enhance the customer/user Web experience and significantly accelerate delivery of rich Web content and TV quality streaming media.
- ***Revolutionize the Web! Broadband Content Everywhere***

CISCO SYSTEMS

EMPOWERING THE INTERNET GENERATION℠