What Cisco's Bosses are saying…

"E-learning will emerge as the next big application, determining a company's ability to survive and compete"

– John Chambers, President & CEO

"The impact of E-learning on Cisco will be as big, if not bigger, than E-commerce"

– Keith Fox, VP, Corporate Marketing

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The E-learning Market Opportunity

"Within 2 years, the market for E-learning software and services in Asia-Pacific will exceed US$2 billion"

– IDC, Gartner

Some AP Customers for E-learning…

Financial Institutions

- ING-Asia, Standard-Charter

Manufacturing and IT

- Acer Group, Ericsson China

Service Providers

- C&W HKT, Samsung Unitel

Training Institutes

- Beijing Concord College, Hess Language Institute

Universities

- NUS, HK Polytechnic Uni.

Governments

- New South Wales, Guangdong

Media

- Star TV, Times of India

Property Developers

- MTRC, Henderson Land

What E-learning can mean to You…

Opportunity to sell high-bandwidth, converged solutions

- *Content Networking, AVVID, IP/TV, IP/VC…*

Opportunity to sell high-margin 'end-to-end' solutions

- *Avoid box-by-box comparisons*

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E-learning Solution Requirements

- Networking Infrastructure
- Software applications
- Content
- Integration partners

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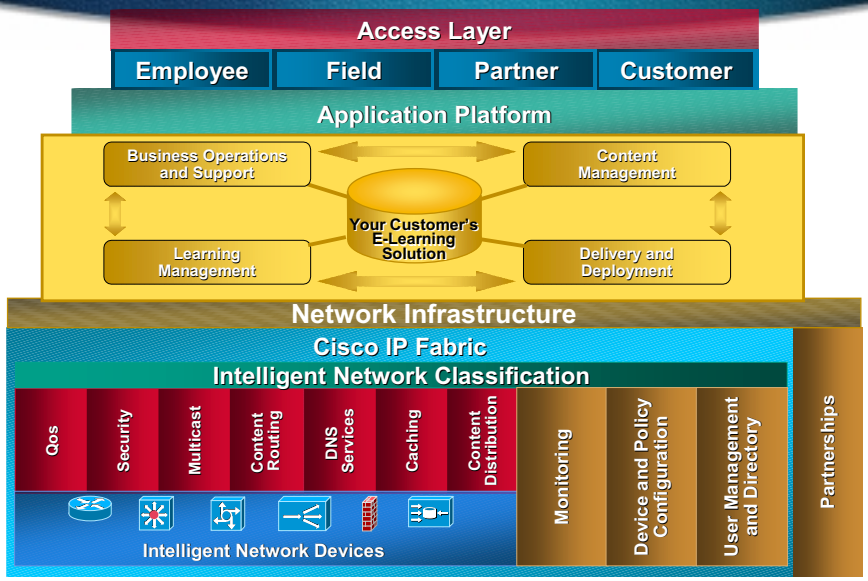
Cisco's E-learning Solutions Architecture



Taiwan's Acer Inc (Business example)

- Global IT manufacturer
- Developing comprehensive learning management system for its 30,000+ employees
- Working with educational and other institutions in Taiwan to deliver E-learning

National University of Singapore (Education example)

- Virtual learning environment with classes broadcast across campus network
- Computer telephony from anywhere on the campus

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Enterprise Edition

3203
1346_06_2000_c2_sec1

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Presentation_ID.scr

Agenda

Enterprise Deployments
- Hardware
- HTTP Redirect
- Video out to TV
- Alternate Media Delivery
- Content Channels
- SODA

Cisco Content Distribution

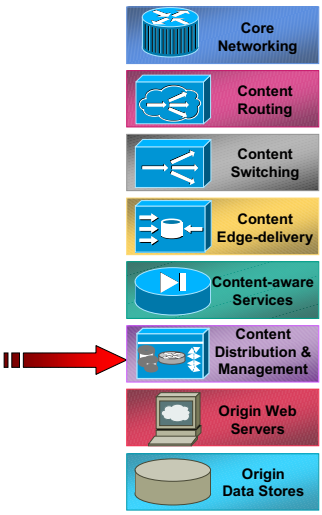
Cisco Content Distribution Manager

Cisco CDM 4600 Series

Cisco Content Engine

Cisco CE 500 Series

CDN CDM 2.0



Content Distribution Manager CDM-4630

- Content and Device Policy Manager
- Packaging: 7U Rackmount
- 600 MHz PIII Processor / 256 RAM
- Network: 10/100 Mb/s Ethernet (RJ45)
- Capacity: 30 GB media storage
- Redundant Power Supply

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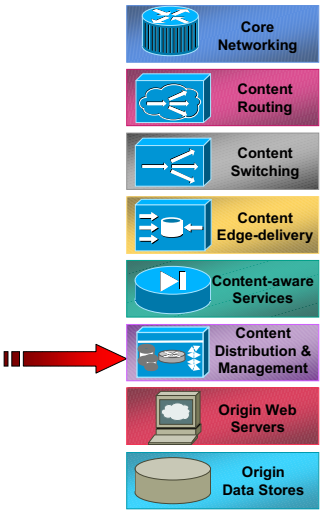
CDN CDM 2.0



Content Distribution Manager CDM-4650

- Content and Device Policy Manager
- Packaging: 7U Rackmount
- 600 MHz PIII Processor / 512 RAM
- Network: 10/100 Mb/s Ethernet (RJ45)
- Capacity: 140 GB media storage
- Storage Array (Futures)
- Redundant Power Supply

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Content Distribution Manager

- **Web-integrated management**
- **Control over:**
  - **Devices, media, and channels**
  - **Replication**
  - **Content requests**
- **Device settings:**
  - IP addresses
  - Proxies and firewalls
- **Import media:**
  - Drag and drop
  - File Transfer Protocol (FTP)
  - Web-server directory

Cisco Content Distribution Manager

Cisco CDM 4600 Series

Content Distribution Manager (Cont.)

- **File replication:**
  - Fault-tolerant transfers
  - MPEG, shockwave, & more
- **Channel distribution**
- **Tracks usage statistics**
- **Alternate media delivery**
- **Bandwidth control**

Cisco Content Engine

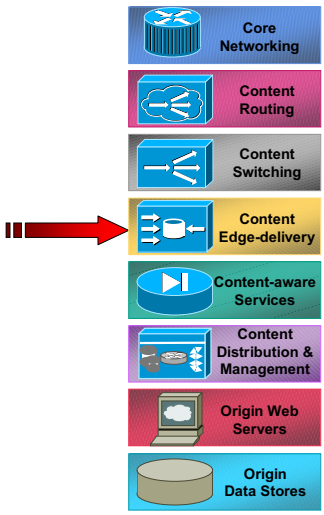
- NetAware installation
- Zero maintenance, zero administration
- 20 to 100 simultaneous users
- Transparent to end user
- 15-GB media storage for up to 150 hours of MPEG-1 video (expandable to 30 GB)

Cisco CE 500 Series

Cisco Content Engine (Cont.)

- **Self registering:**
  - Receives IP address from DHCP server
  - Homes to host studio
- **Self organizing:**
  - Registers with other content engines
  - Assesses network connections
- **Includes Real G2 server**
- **NTSC/PAL video decoder**

CDN CE 2.0



Content Engine 507

- Packaging: 7U Rackmount
- 600 MHz PIII Processor / 128 RAM
- Network: 10/100/1000 Mb/s Ethernet (RJ45)
- Capacity: 15 or 30 GB media storage

Content Engine 507 AV

- Packaging: 1U Rackmount
- 600 MHz PIII Processor / 128 MB RAM
- Network: 10/100 Mb/s Ethernet (RJ45)
- Capacity: 15 GB media storage
- Include 25 CALs for streaming servers – Cisco will resell or customer can work directly with vendor.
- Content Engine remote customer sites for delivery of content.

DNS vs HTTP Redirection

URLs defined:

<scheme>://<domain name>/<path>/<filename>

Under normal circumstances, a URL is parsed and subsequentially acted upon by a browser in the following manner.

An example URL might be:

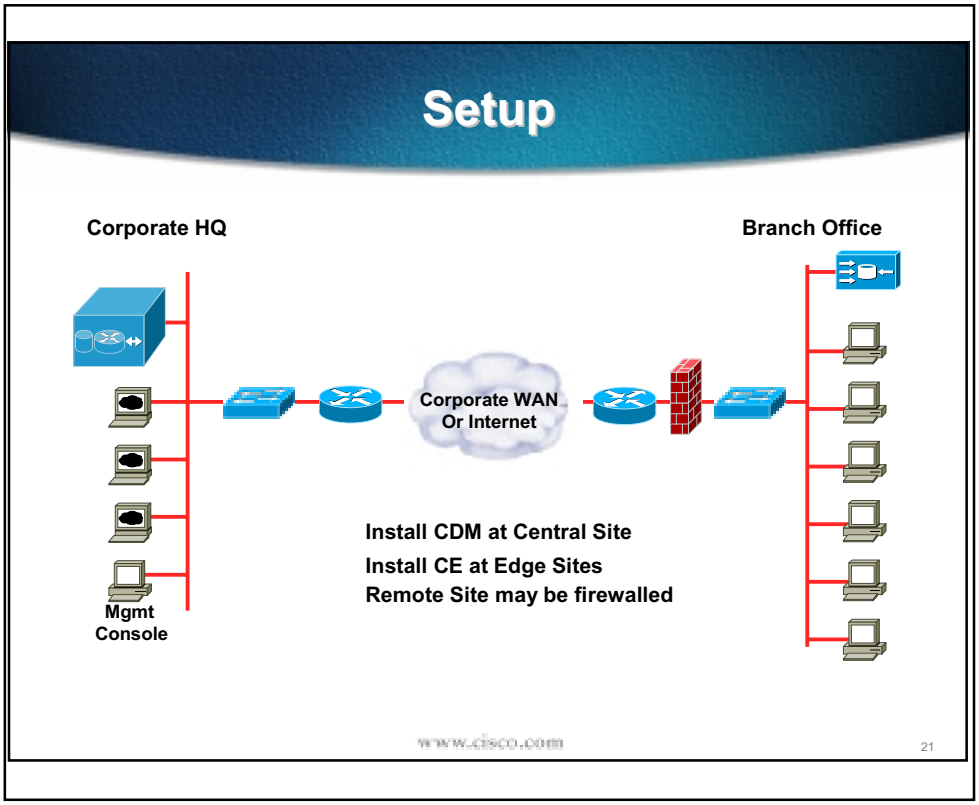
http://www.foo.com/dirA/picture.gif

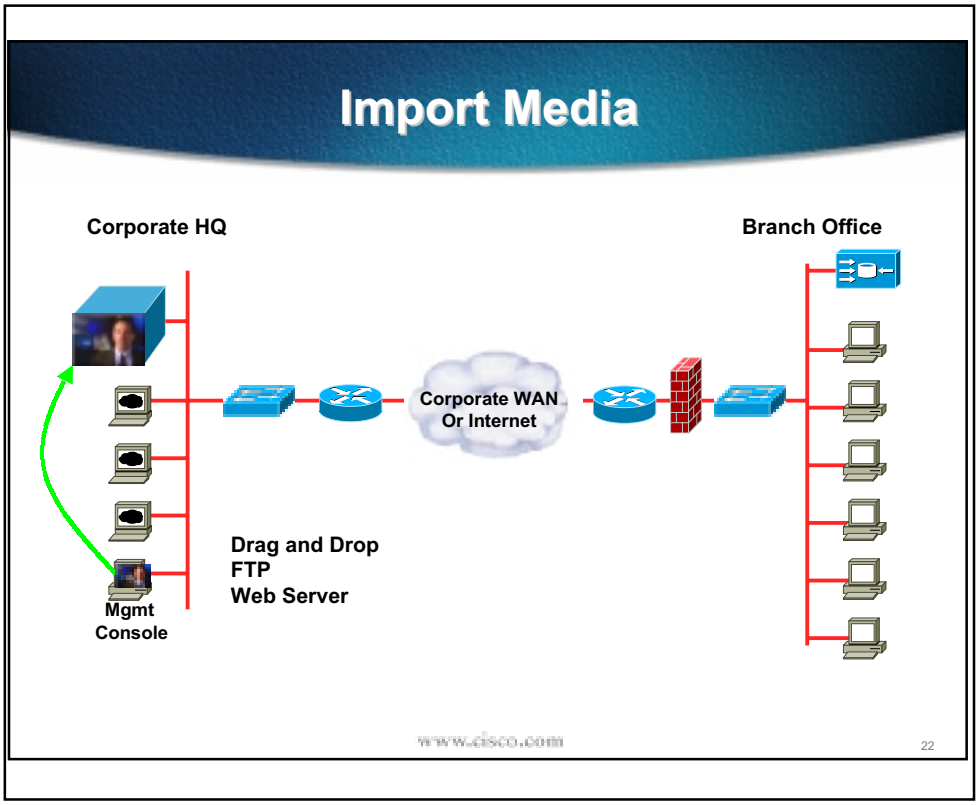
DNS Resolution

DNS Redirection occurs earlier in the process

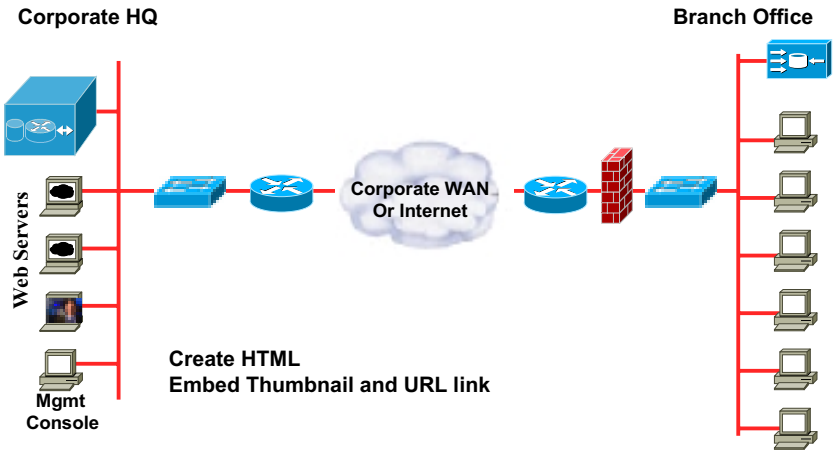
HTTP Mechanisms

HTTP Redirection will occur after DNS resolution



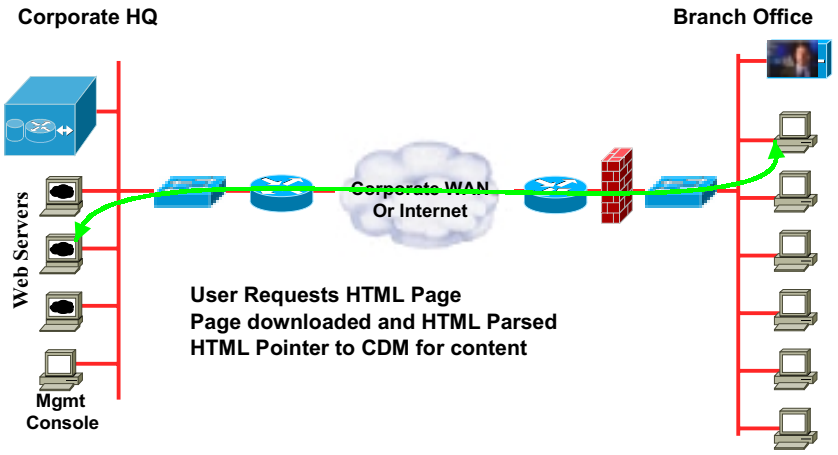


HTML Modification



Replication

User Requests



User Requests HTML Page
Page downloaded and HTML Parsed
HTML Pointer to CDM for content

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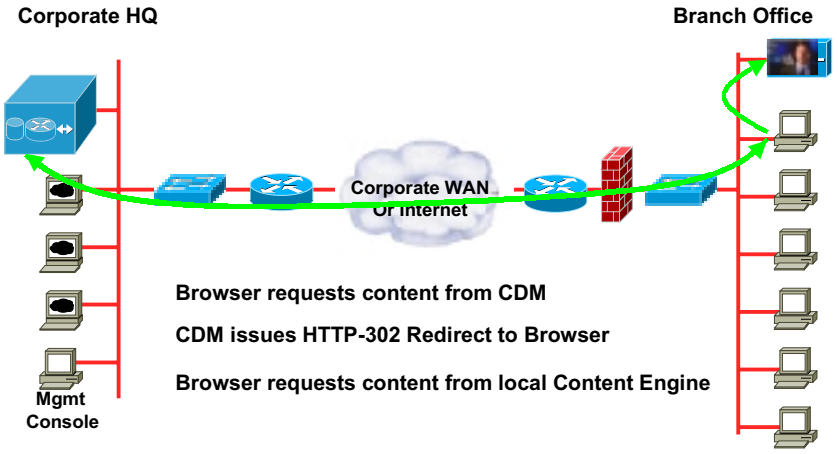
Redirection



Browser requests content from CDM

CDM issues HTTP-302 Redirect to Browser

Browser requests content from local Content Engine

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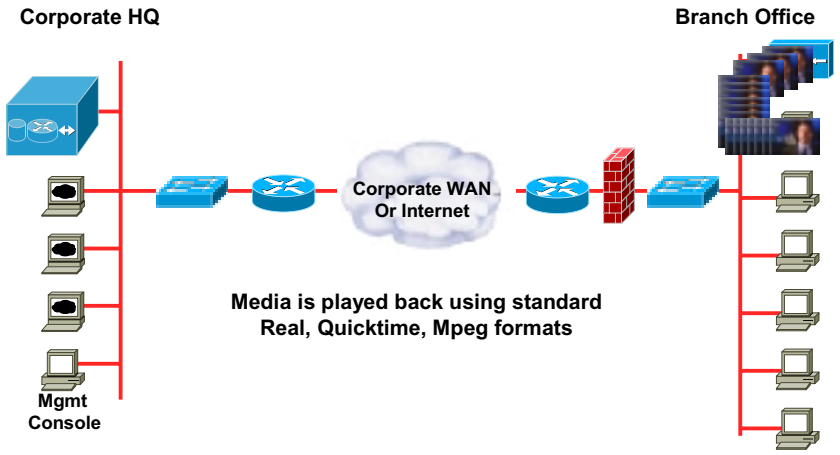
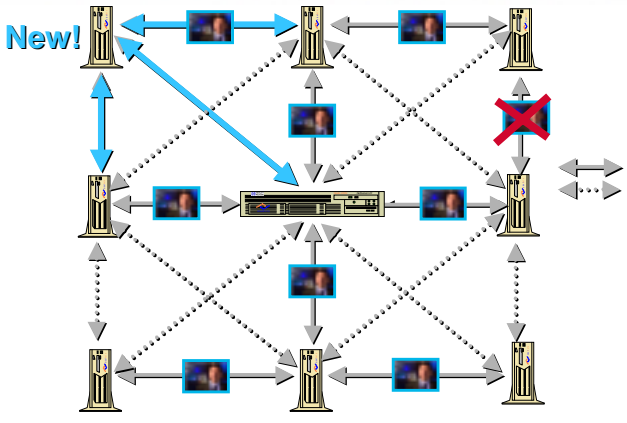
Media Playback



Replication Using Cisco Content Distribution (SODA Mesh)



Branch in Use

Branch Not in Use

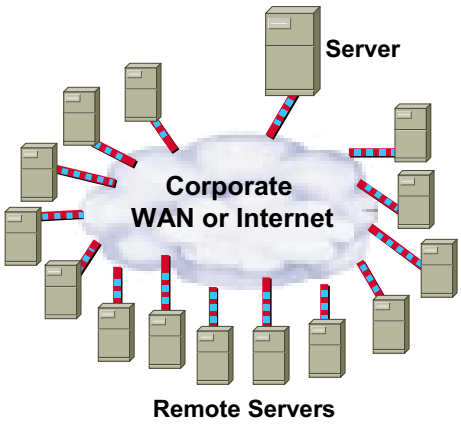
All Connections
Are Internet or LAN

- All elements are aware of all other elements
  - Routing tables are calculated
  - Replication can occur studio-to-appliance or appliance-to-appliance
  - Replication is fault tolerant

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

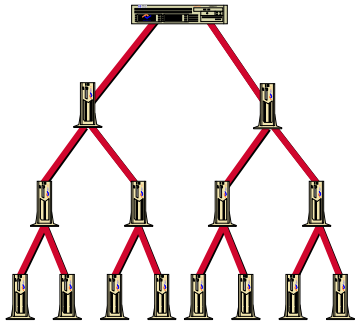


Cisco Content Distribution Replication (SODA Mesh)

- 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 = 2 hours



Video File Sizes

Data Rate (Kbps)	File Size for 1 Minute (MB)	File Size for 1 Hour (MB)
28	0.2	12.6
64	.05	28.8
128	1.0	57.6
500	3.8	225.0
1000	7.5	450.0
3000	22.5	1350.0
6000	45.0	2700.0

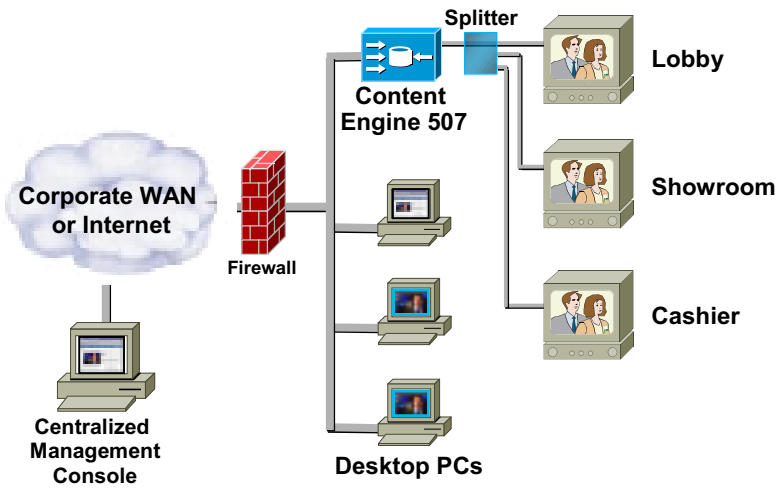
Sample Times to Replicate

Encoding Rate @ Tx Speed	60 Seconds	5 Minutes	1 Hour
56 kbps @ 128 kbps	26 Seconds	2 Minutes	26 Minutes
300 kbps @ 128 kbps	2.3 Minutes	11.75 Minutes	2.3 Hours
1 Mbps @ 1.5 Mbps	39 Seconds	3.2 Minutes	39 Minutes
2 Mbps @ 1.5 Mbps	1.3 Minutes	6.5 Minutes	1.3 Hours

NTSC or PAL Video Out

- Integrated MPEG decoder in the appliance
- Decodes media files to video and audio
- Centralized web VTR/VCR controls
- Applications
  - Kiosk
  - Video wall
  - Point-of-sale

NTSC or PAL Video Out Application



Video Out Controls V2.0

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Video Out Controls V2.1

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TV Scheduler V2.1

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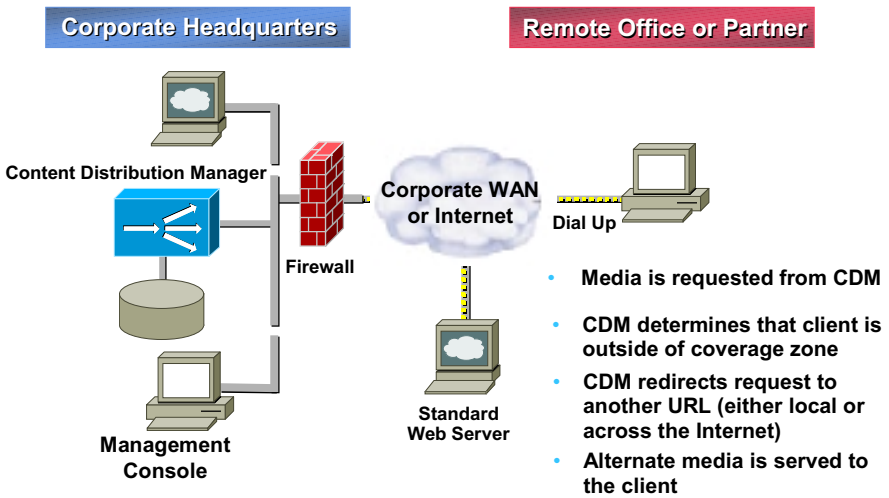
Alternate Media Delivery



- Media is requested from CDM
- CDM determines that client is outside of coverage zone
- CDM redirects request to another URL (either local or across the Internet)
- Alternate media is served to the client

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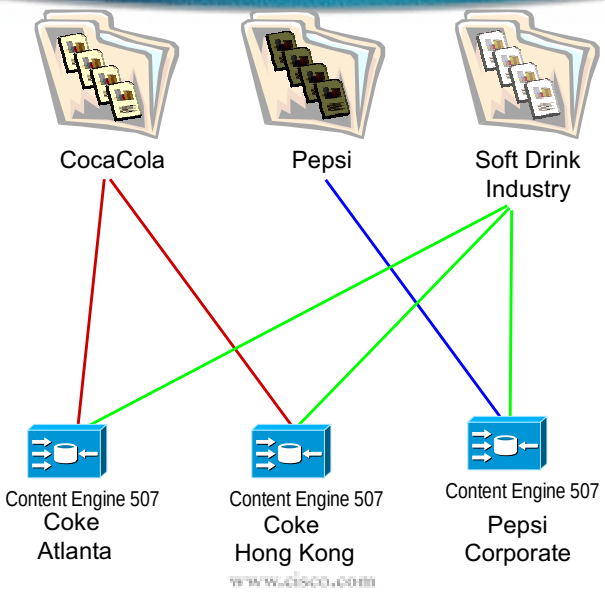
Content Channels

- **Group media into channels**
- **Assign appliances to channels**
- **Benefits**
  - Enables targeted distribution
  - Enables service offerings where media needs to be segmented
  - Lowers cost by eliminating inefficient use of bandwidth and disk space
  - Reduces security issues

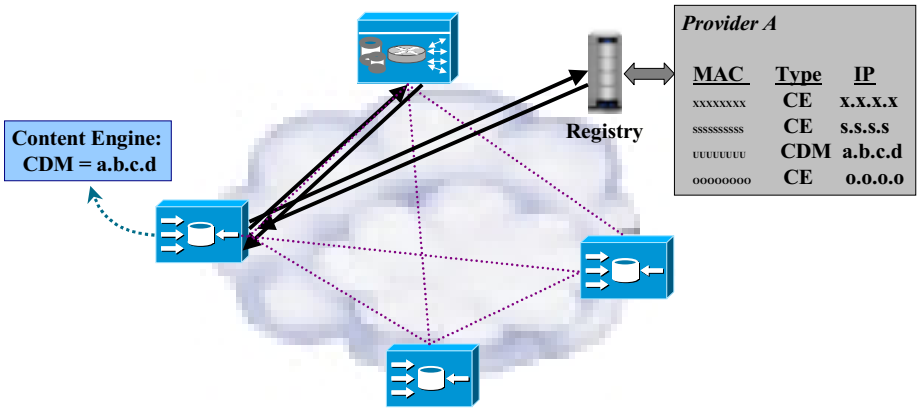
Content Channels



SODA

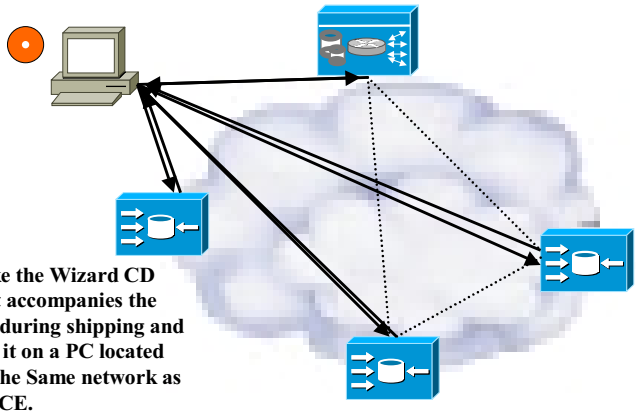
- The boot registry V2.0 &V2.1
- Channel distribution routing hierarchy
- URL redirection
- Keep a lives
- File replication

The boot registry
Initial boot strap V2.0



Content Engine brought to Registry
Content Engine boot strap the device Distribution Manager and joins the CDN

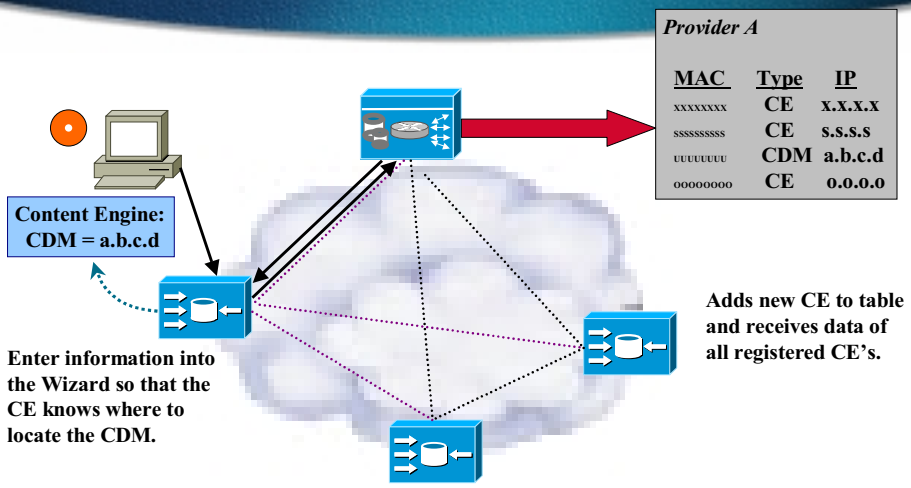
Installation Process V2.1



Take the Wizard CD that accompanies the CE during shipping and run it on a PC located on the Same network as the CE.

The Wizard application then boots the CE and supplies it with the CE's configuration information.

Installation Process V2.1



Wizard UDP

Version 2.0:

- **Broadcast from PC on port 2345**
- **Reply from CE on port 2343 (Config Info ping data)**
  2344 (Debug Data)

Version 2.1:

- **Broadcast from PC on port 52355**
- **Reply from CE on Port 52353 (Config info ping data)**
  52353 (Debug Data)

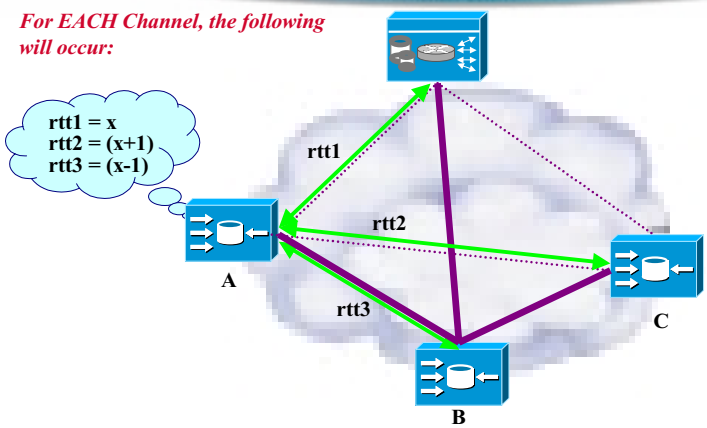
Building the distribution hierarchy - SODA

Goals of Self-Discovery

- Redirect user requests to the appropriate edge device
- Build a good distribution network for media

How the channel distribution routing hierarchy is built

For EACH Channel, the following will occur:

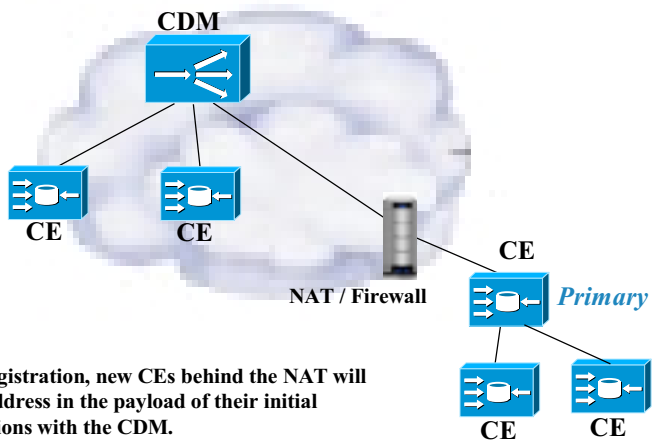


New Content Engines will "probe" every other node in the CDN as part of SODA's self-discovery process

Since "rtt3" is lowest value, active edge of spanning tree is between Content Engine A and Content Engine B

Content Engine will receive replicated content from Content Engine B since fastest link (note: this is a simplified depiction - historical averages are actually used)

Special cases in building the SODA hierarchy NAT and Proxies



During registration, new CEs behind the NAT will send IP address in the payload of their initial conversations with the CDM.

Coverage Zones

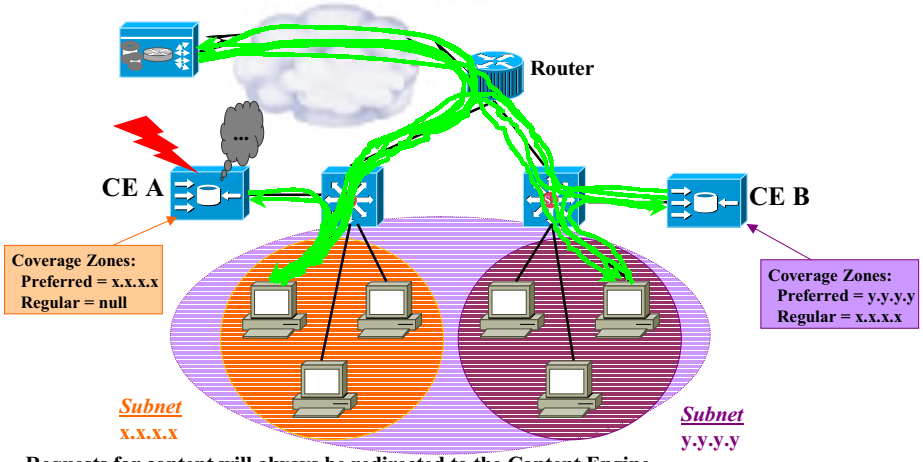
Preferred = CDM will always redirect to CEs that list the host Subnet as "Preferred"

Regular = CDM will redirect to CEs that list the host Subnet as "Regular" if it cannot find a CE that lists it as "Preferred"

```
Logic:

if (find Preferred CE) then
        redirect to CE_preferred
else if (find Regular CE) then
        redirect to CE_regular
else
        redirect to Alternate Media Delivery server
```

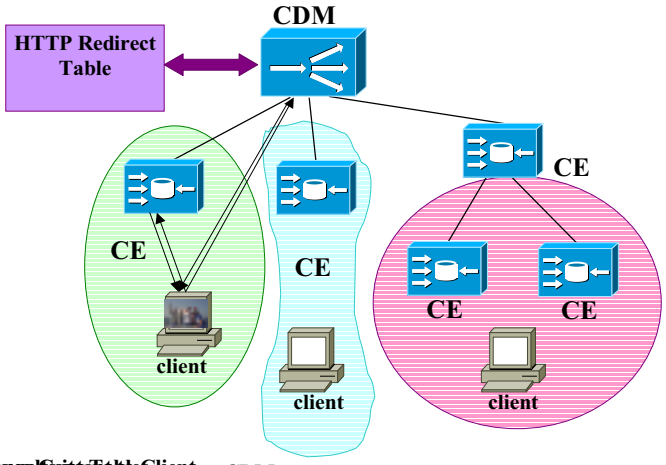
Coverage Zones



Requests for content will always be redirected to the Content Engine [illegible] that is listing that particular subnet as its "Preferred Coverage Zones"

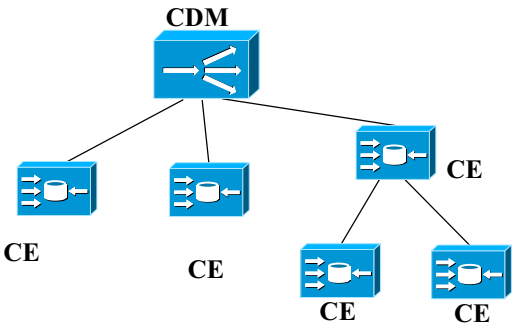
Overlapping "Preferred" and "Regular" Coverage Zones = Resiliency!

URL redirection
How it works



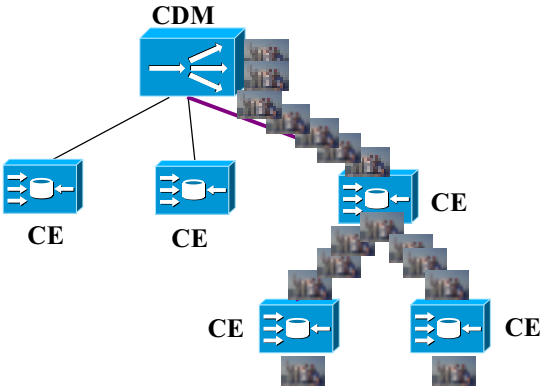
Client sends HTTP Request to CE - to "Local" CE

Keep alives



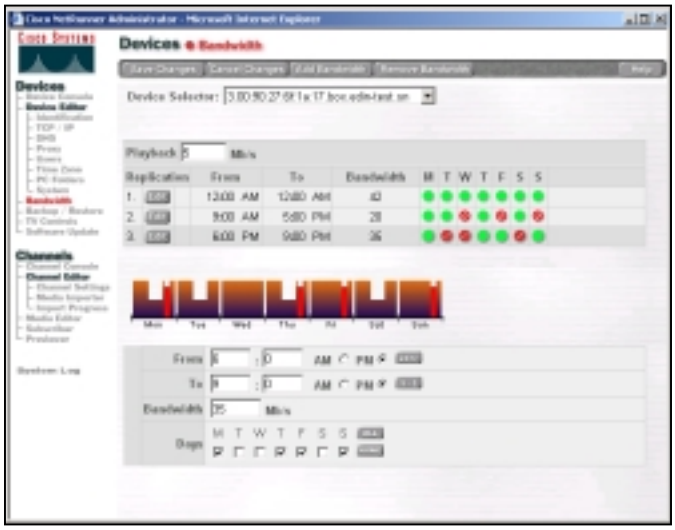
Each child in the hierarchy send a keep alive every 30 seconds to it's parent telling it health. Each parent sends a keep alive to its parent every 30 seconds with status on its health and of all the children that are registered below it.

File replication



Replication occurs by each CE pulling down the media file from its parent in the distribution routing hierarchy.

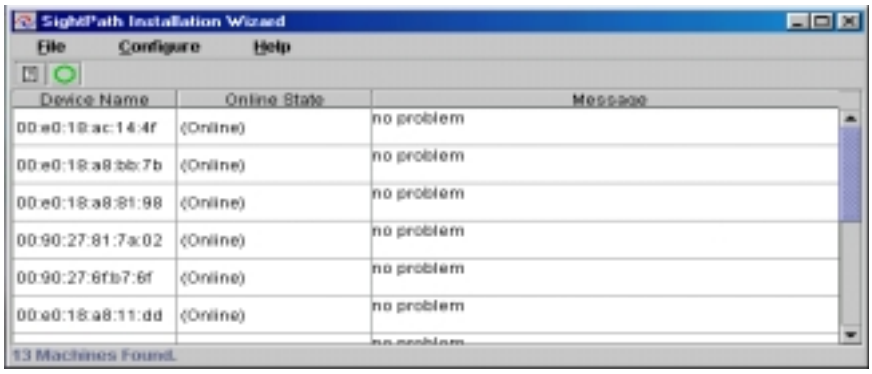
User Interface for Replication Bandwidth Controls



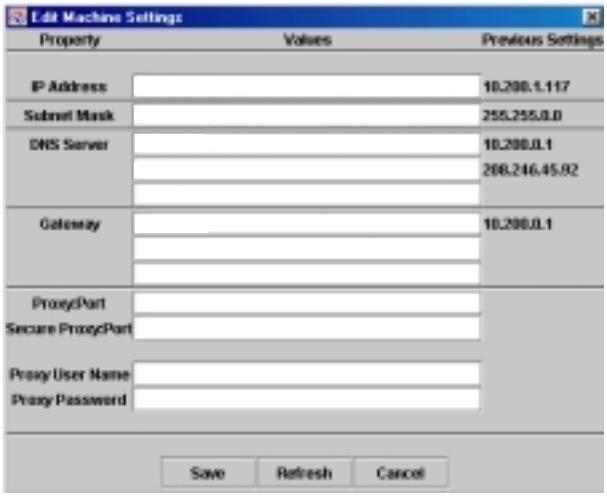
Security

- HTTPS for Replication
- Username & Password for Admin
- SSH (future)
- Channel segregation

Wizard 2.0



Network Info in Wizard 2.0



Deployment considerations

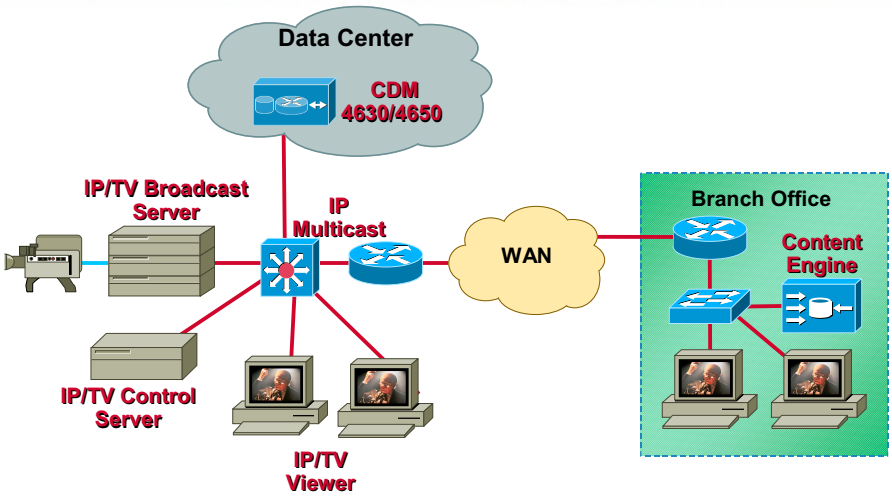
- Network Bottlenecks
- WAN bandwidth availability
- LAN bandwidth availability
- Proxies
- Firewalls

HTTP streaming versus RTP/RTSP

HTTP streaming works by downloading an entire movie to your hard disk

- Depending on the client the entire file may need to be transferred before it can be viewed.
- Depending on the client disk space for the entire file is required
- HTTP streaming is great for short movies and anything else you intend to play over and over again
- HTTP streaming may pass through more firewalls
- HTTP streaming does not give the viewer as much positional control of the playback
- Depending on the HTTP server and client if progressive playback is support may have issues with read ahead and control serve rate which could result in stuttering during playback or complete pauses
- HTTP streaming does not have mechanism to monitor quality of reception of video.
- HTTP streaming is not as network efficient as RTP. Since HTTP is on TCP have all issue with TCP slow start, and TCP retrans

Live CDN Solution



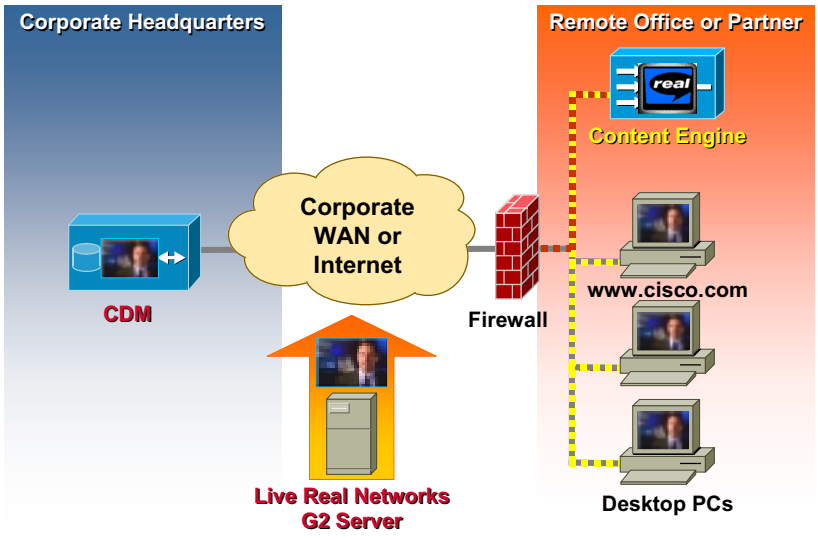
Live CDN Solution

- Deploy high-quality live video (MPEG 1,2,4)
  - Information retention is proportional to the quality of the live video
- Deploy IP multicast for live video distribution

Live CDN Solution (IP Multicast in the Campus)

- Distribute live video in the campus via IP multicast
- Branch offices use the Cisco On-Demand CDN solution to watch the video after the event
  - IP/TV Broadcast Server captures the live video and imports it into the CDM
  - CDM distributes the content to branch offices for on-demand viewing

Alternate Live CDN Solution (Before IP Multicast Deployment)



Alternate Live CDN Products (Before IP Multicast Deployment)

1. Cisco Content Distribution Manager

   Redirects clients to the optimal content engine

2. Cisco Content Engines with Enterprise CDN software

   Split a single, live stream into multiple local streams

3. Live Real Networks G2 Server (sold by Real Networks)