Introduction to Content Delivery Networks

Session NCM-110

Traditional Web Growth

Web Sites Are Centralized

Web Grows: More Users Richer Content

To Manage Growth, Server and Bandwidth Are Added
Anatomy of a Network

Origin Server Scalability, Speed of Light
Peering Point Congestion
Available Bandwidth

Middle Mile

Last Mile

Gigabit Optical Network
Peering Capacity, ISP Network Capacity
T1, DSL, Cable Modem Dial-up
10 Mb to 1 Gb Ethernet

Internet Backbone
Cross-Internet connections
Local Loop
Premises Network

The #1 Barrier for e-Business Applications: Bandwidth Bottlenecks

Origin Server Scalability, Speed of Light
Available Bandwidth

Gigabit Optical Network
Peering Capacity, ISP Network Capacity
T1, DSL, Cable Modem Dial-up
10 Mb to 1 Gb Ethernet

Datacenter
Internet Peering Connections
Local Loop
Edge Network
Enterprise CDN

Managed Enterprise CDN
E-Learning

- E-Learning provides a tremendous corporate cost avoidance.
- Average Week of training is over $2,500.00
- Current ‘Thumbnail’ window training programs are not as engaging as full-screen TV quality video.
- Integration with Training Content Providers
- Integration with Learning Management Systems
- Live Streaming and Live to VOD immediate authoring and distribution

Corporate Communications

- Sometimes referred to as ‘Ego-Casting’
- Allows central management and distributed implementation and delivery of corporate communications
- Perfect for:
  - Quarterly Reports
  - Sales Launches
  - Technical Updates
  - State of the Business Messaging
- Allows time-delayed global corporate employees to feel part of corporate culture...
Corporate Communications

- Centralized control of video distribution
- No tape rotation
- Granular ad-insertion and playlist controls
- Analog Video Output port enables ‘Wall of Eyes’ in retail stores.
- Can store over 100 hours of 500kbps WMT Video
  - While delivering employee training videos
  - While delivering product updates
  - While delivering corporate messaging

Retail Video Distribution
Enterprise Content Delivery Network

Content Acceleration

Enterprise Service Provider

Internet
WAN
Content Acceleration

Enterprise

Service Provider

Content Acceleration

Service Provider

Set DSCP = 5
Set DSCP = 6
Set DSCP = 7

Set DSCP-5 = 10Mbps
Set DSCP-6 = 25Mbps
Set DSCP-7 = 05Mbps

NH-PBR
DSCP-7 = CheapWan

Cheap WAN
Components of Content Networks

- Scalable E-Commerce
- Managed Internet Access
- Distributed Content

Components of Content Delivery Networks

Core networking technologies enable the network to be reliable, scalable, and highly available. These technologies include:

- Scalable routing protocols
- High Density Feature Rich L2/3 Switching
- Fast L3 Failover technologies
- Spanning Tree enhancements
- Multi-protocol WAN support
Components of Content Delivery Networks

Reliably Route User Requests to the Best Site Across CDN

Metrics Include: Presence of Content, Geographic Proximity, Network Conditions, POP Load, Content Engine Load, Latency

Products: CR4400, CR4450, Distributed Director, CSS11xx

Intelligently Switch Traffic Across Origin Servers for Load Balancing

Determines Availability of Content and Load on Server

Products:
- Local Director 417, 430, 450
- Catalyst 4840, CSS11xxx
Components of Content Delivery Networks

- Configure Delivery Nodes on Edge of Network
- Import Content and Maintain Copies at Edges
- Manage Bandwidth
- Measure Performance, Usage
- Encode Media
- Products: CE507, CE560, CE590, CE7320

Intelligent Network Services in the IP Infrastructure

- Required to Build Reliable, Scalable CDNs
- Examples: Security, QoS, VPNs, IOS, Multicast
Components of Content Delivery Networks

Automatically Distribute Content
Seamlessly Deliver Content of Any Type from Network Edge to Desktops or Kiosks
Provide Content Delivery, Streaming and Transparent Caching All-in-one
Based on CDM 4630, CDM 4650, CDM 4670

CDNs scale the performance of traditional web servers by offloading static content, streaming content, and freeing up the server to process dynamic HTML and CGI requests.
Components of Content Delivery Networks

With the reduction in static object web traffic the back-end databases will have to maintain fewer open database query sessions because the utilization of the web servers will be much more optimized.

Content Networking Interactions

Content Routing

Content Switching

Content Switching

Content Distribution & Management

Origin Web Servers

Origin Data Stores
Cisco Content Engine Hardware

Content Engine 500 Series:
- CE 507, CE 560, CE 590

Content Engine 7300 Series:
- CE 7320

Storage Array 6 (SA6)

Storage Array 12 (SA12)

Other Sessions

Content Switching -- Mauricio Arregoces
Content Routing -- Kirk Johnson
Content Delivery Networking Power Session -- DNS Fundamentals
Introduction to Content Delivery Networks

Please Complete Your Evaluation Form
Session NCM-110
### Protocol Layering- HTTP

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
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<tr>
<td>L6+</td>
<td>Application Data</td>
</tr>
<tr>
<td>L5</td>
<td>HTTP Data</td>
</tr>
<tr>
<td>L5</td>
<td>SSL Encryption</td>
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<tr>
<td>L4</td>
<td>TCP Session</td>
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<tr>
<td>L3</td>
<td>IP Packet</td>
</tr>
<tr>
<td>L2</td>
<td>Ethernet Frame</td>
</tr>
</tbody>
</table>
CCN/CDN Icons

Content Distribution Manager
- Content Distribution Manager

Content Switches
- Cisco Content Switch
- Layer 4 SLB

Content Routing
- Cisco Distributed Director
- CR-4400 Server
- Cisco Content Router

Content Engine
- Content Engine

Other Icons
- Multilayer Switch
- PIX Firewall
- Workgroup Switch
- Core Router
- Intrusion Detection

TCP and HTTP

Three-Way Handshake: Connection Setup
HTTP Request & Response
Three-Way Handshake: Connection Tear-down
HTTP Overview

HTTP is a connectionless protocol – relies on TCP

- **HTTP 1.0** *(Informational RFC 1945)*
  
  Feature: Simple; open, operation, close  
  Bug: Fetches single URL per TCP connection  
  Mean size of gets only a few thousand bytes

- **HTTP 1.1** *(Standards Track RFC 2616)*
  
  Reduce HTTP’s impact on the Internet, and make HTTP a ‘well behaved’ Internet protocol  
  Be as compatible as possible with HTTP/1.0, particularly for origin servers and clients

- **HTTP 1.1 New features**
  
  Persistent Connections & Pipelining  
  HTTP/1.1 requires **Host** header to be present, or an error will be returned  
  Ranges & Caching: Range Request, semantic transparency

HTTP 1.0 vs 1.1 Connections

**HTTP 1.0**

1. SYN
2. SYN/ACK
3. ACK
4. GET HTTP/1.0
5. HTTP/1.0 200 OK

**HTTP 1.1**

1. SYN
2. SYN/ACK
3. ACK
4. GET HTTP/1.0
5. HTTP/1.0 200 OK

Jim Gettys 10/17/96

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Presentation_ID.scr
HTTP 1.1 Connection: Pipelining

Multiple Requests Are Sent Before Waiting for Each Response

HTTP Redirection

Server Redirects Request to Different Host Name Which Triggers a New GET to Redirected Host