

Building Enterprise CDNs Using Cisco's ACNS Software

AGENDA

- **Application & Content Networking System (ACNS) Overview**
- **Cisco Content Engine (CE)**
 - Product Review
 - Caching Technology (using WCCP)
 - Security Mechanisms
- **Cisco Content Delivery Manager (CDM)**
 - Product Review
- **Content Networking**
 - Distribution and Routing Technology - How it works?
 - Streaming Media Support
- **Content Networking Case Studies**
- **Q&A**

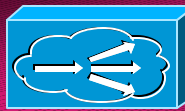
Key Components of A Cisco Application & Content Networking System (ACNS) Solution

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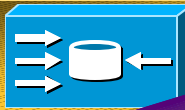
Content Service Switch

Enable content services such as content-aware load balancing of cache and server farms, e-Commerce, overflow services, **enhanced security and high availability**.



Content Router

Provide **intelligent** user HTTP Redirections to most appropriate CE. Works with CDM as primary content router or secondary fail-over content router if the CDM is down or busy.



Content Edge Cache

Accelerate **any HTTP or streaming media-type content** by storing and delivering content close to end users on their local networks. **Easy delivery** through browsers, players.



Content Distribution & Management

Provide **central management** and provisioning for the CDN. Controls content replication and combines **integrated** Content Routing technologies.



Content Acquisition

Provide **central management** and provisioning for the CDN. Controls content replication and combines **integrated** Content Routing technologies.



Intelligent Network Services

IP infrastructure services integrated for **scalability, reliability and security**, such as QoS, VPNs, IP Multicast, Security.

Network Integration

Solving E-Business Challenges with Cisco Content Networking Solutions

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- **Cisco Solution:**

Distribute and serve RICH-MEDIA content at the network edge

Fast, efficient content distribution, routing and management

Broad array of media and file type support

- **Key Benefits:**

Overcome WAN congestion

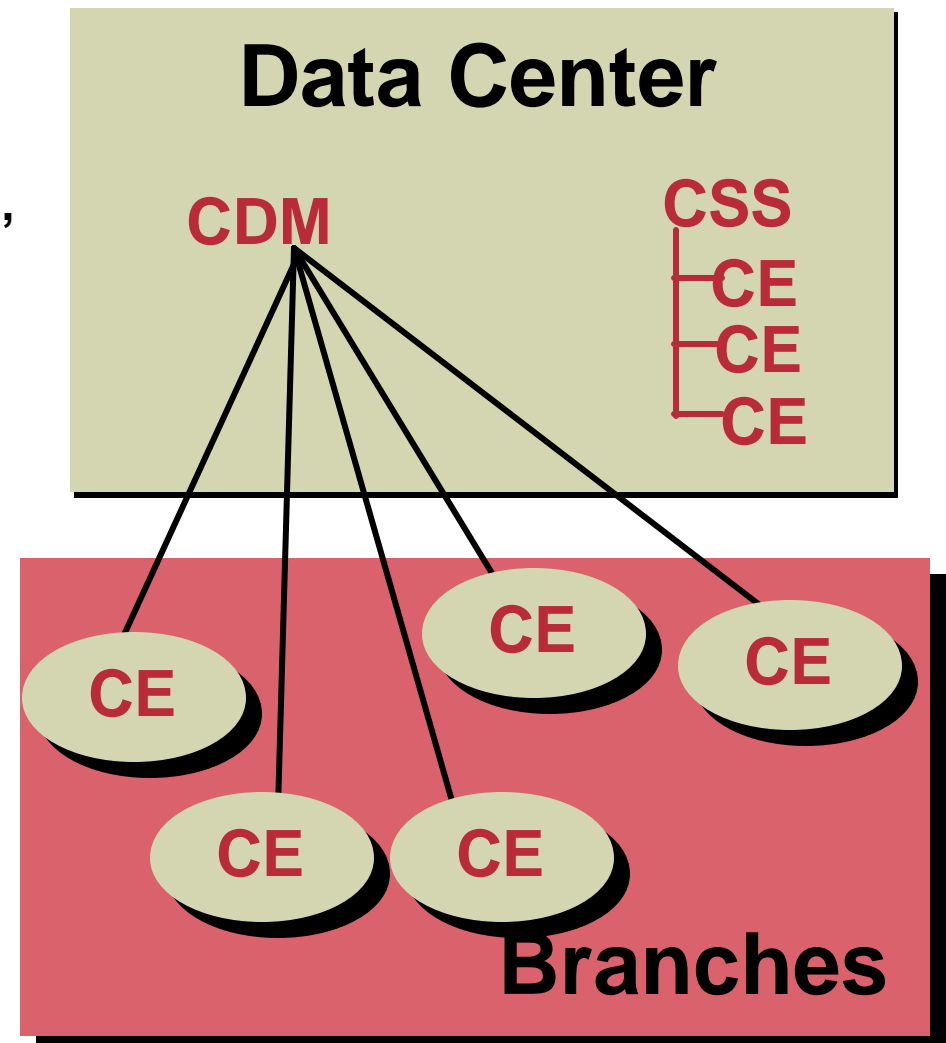
Easy to manage, scale

Secure

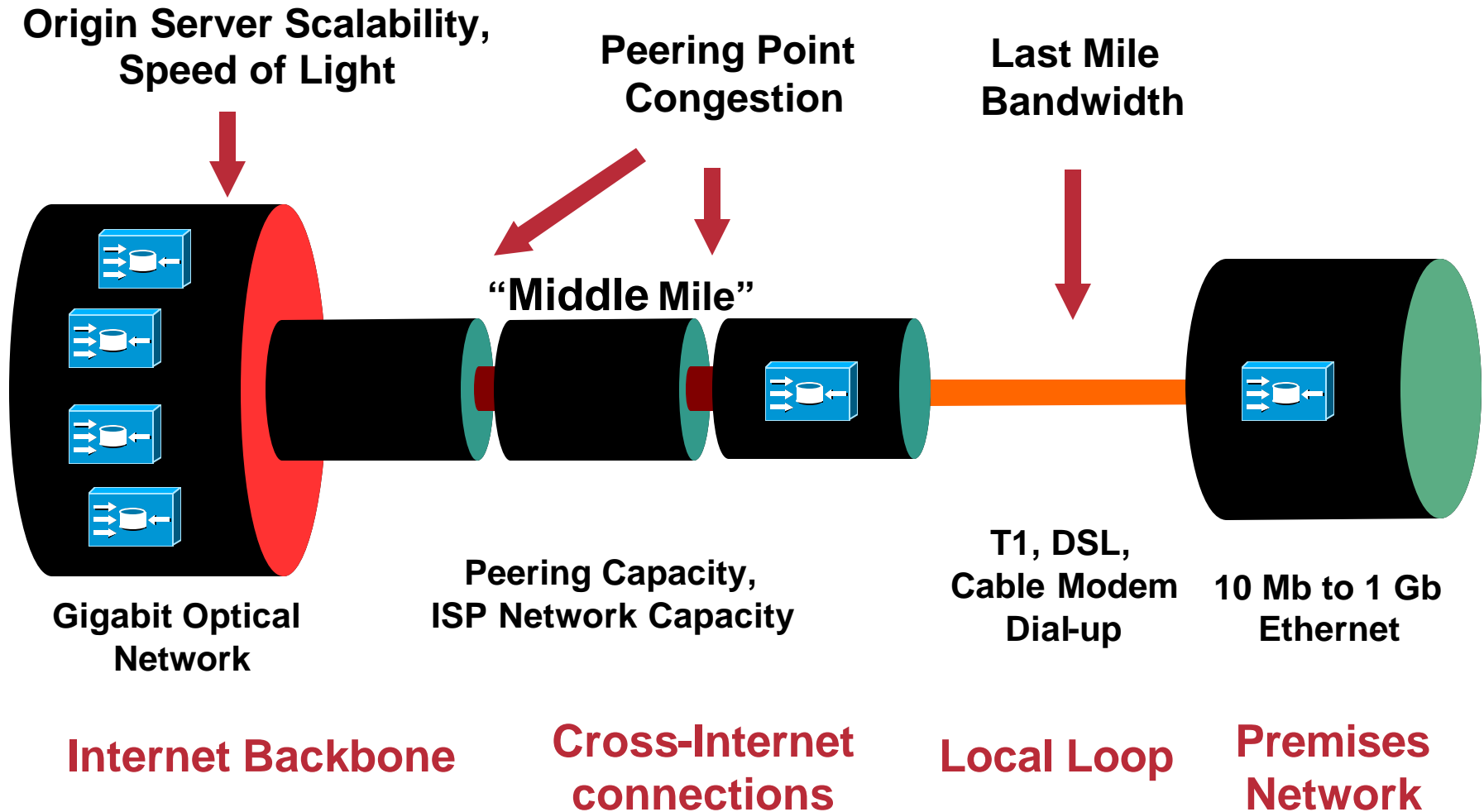
Easy to use

Adds value to existing network investment

Enhances user experience



Overcomes Performance Bottlenecks



A Closer Look at Four Key Services for Enterprises

Cisco.com

- **Content Acceleration, Filtering**

- Content Engine (CE) / WCCP

- Reduce WAN bandwidth costs
 - Increase productivity
 - Filter “non-productive” Web content

- **Point of Sale**

- CDM, CE, IP/TV

- Increase revenue per store
 - Enhance merchandising
 - Efficiently distribute advertising, marketing collateral

- **Website & eCommerce Optimization**

- CE, CSS11000, Cat, PIX, IDS, & SSL Accelerator, CTE

- Grow online revenues via higher web security, reliability scalability
 - Enhance universal access with content prioritization / personalization
 - Reduce operating costs via better manageability, server utilization

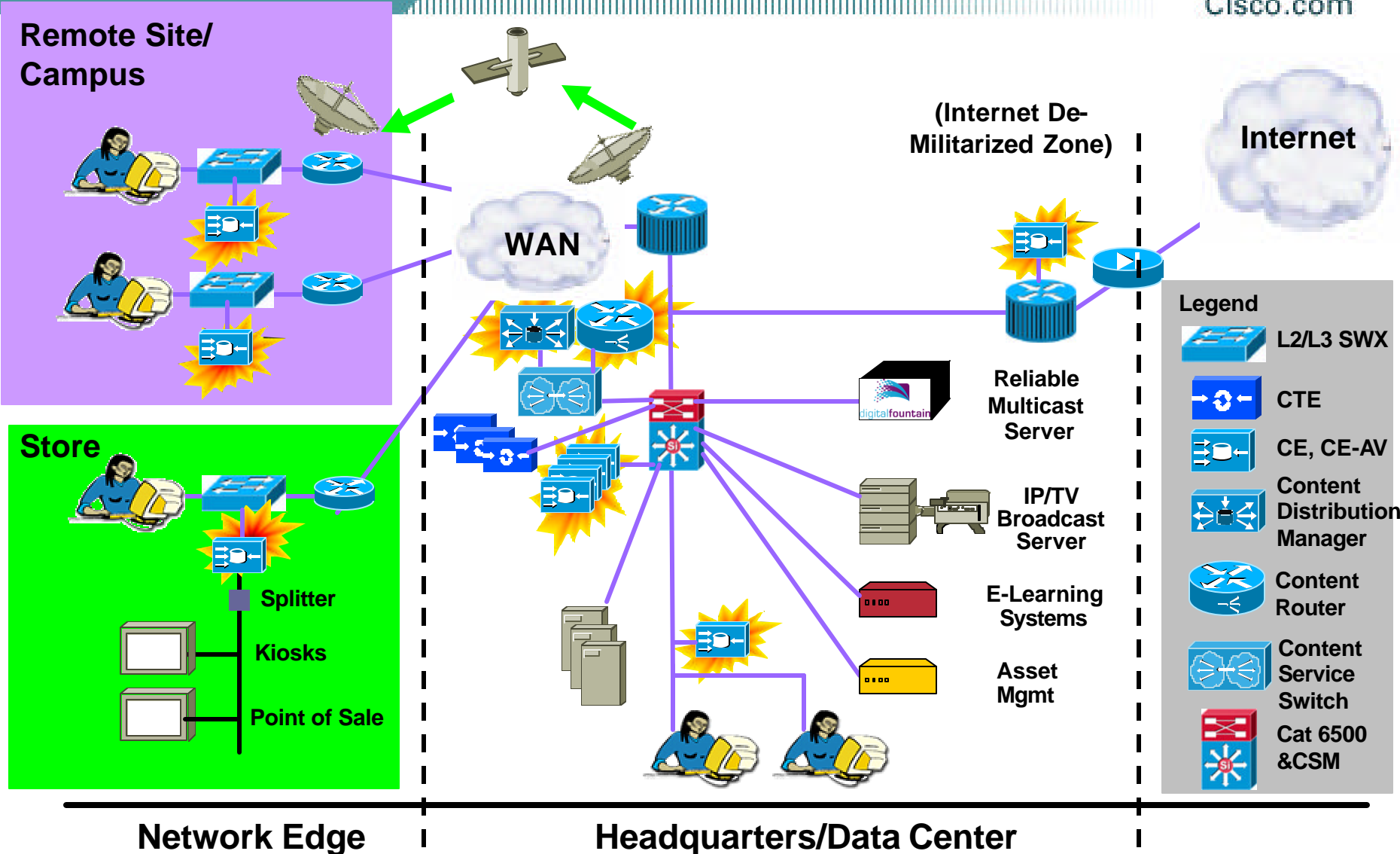
- **E-Learning, Corporate Communications**

- CDM, CE, IP/TV

- Effectively share knowledge
 - Deliver high-touch broadcasts
 - Improve productivity, job satisfaction and retention
 - Reduce costs, increase revenues

The Complete Cisco ACNS-Based Solution

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Cisco Enterprise ACNS Product Portfolio

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Content Edge Delivery



CE-7320



Content Series
ARCH

- Cache CE
Transparent Cache
Intranet Reverse Prox.
- ECDN CE
Pre-positioned content
Real, WMT
VOD Streaming
Live Streaming
TV Out (507/560 AV)
- IP/TV ARCH
MPEG1,2
VOD Streaming
Scheduled Multicast

Storage



SA6

- Storage Arrays
Increases Perform.
Increases Storage Capacity

Content Distribution Mgmt



CDM-4650



CDM-4630
IPTV-3412-CTRL

- ECDN CDM
Central Mgmt
Content Distribution
Media Import
Bandwidth Mgmt
Policy Mgmt (channels)
Log Aggregation
- IP/TV CTRL
Program Scheduling
Program Listing
Multicast Mgmt

Content Routing



CR-4420

- ECDN CR
HTTP Redirection
Fail over (CSS)

Content Acquisition



IPTV
x-

- IP/TV BCAST
MPEG1,2
WMT
Live Capture
Live Streaming

Content Engine (CE): Product Overview

What is the Difference Between Caching & Enterprise Content Delivery Network?

- **Transparent Caching:**

Stores and serves content from edge nodes on the local network based on users' requests and content freshness (pull model).

- **Enterprise Content Delivery Network (ECDN):**

Pre-populates content (especially large files) from Content Distribution Manager to edge nodes ahead of users' requests (push model). Serves content on local network as requested.

ACNS supports both in a single platform

Cisco Content Engines

- **Concurrent Caching and ECDN in a single appliance**
- **Scalable product family**
 - Ultra High End: CE 7320
 - High End: CE 590
 - Mid Range: CE 560
 - Low End: CE507
- **Network-Integrated**
- **Low maintenance and remote administration**
- **Expandable**
 - Clustering
 - Cisco Storage Array



CE 7300 Series



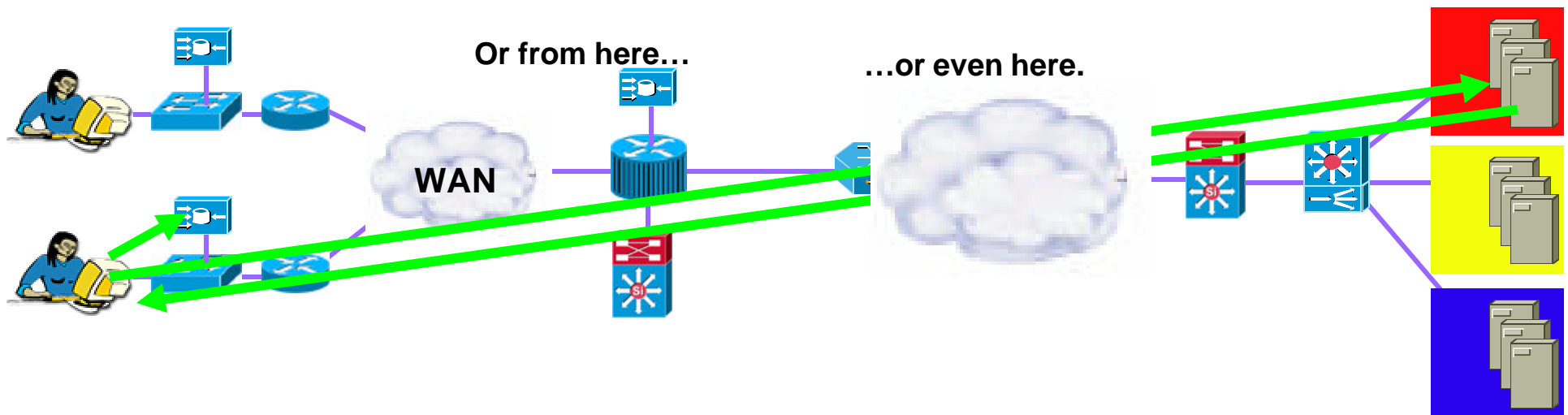
SA-6



CE 500 Series

Content Engine (CE): Caching Technology How it works

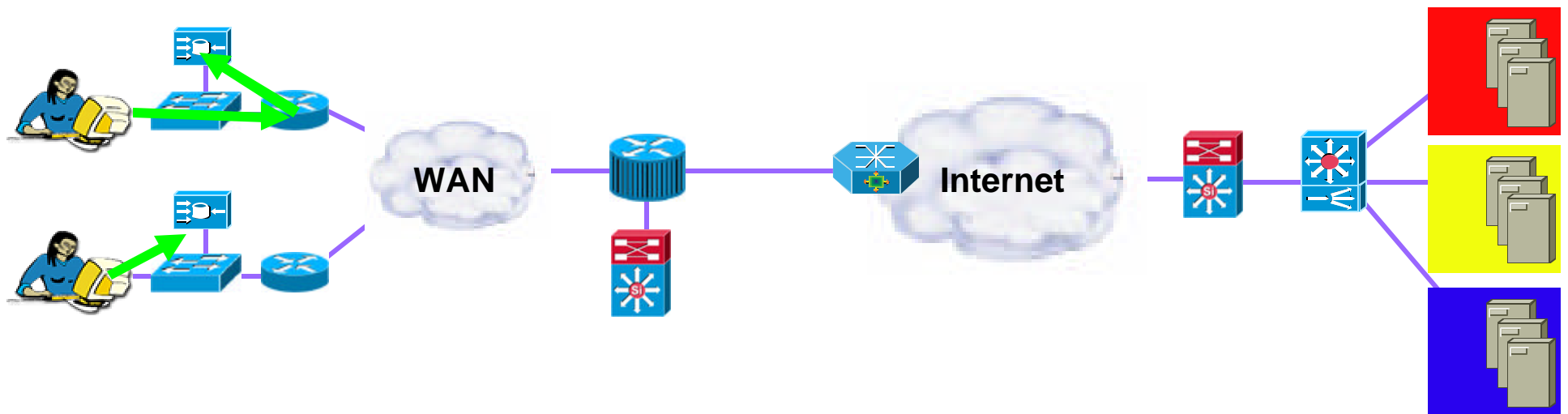
What does Caching do?



Normal requests for HTTP delivered objects and streaming media files must traverse the entire network for all traffic

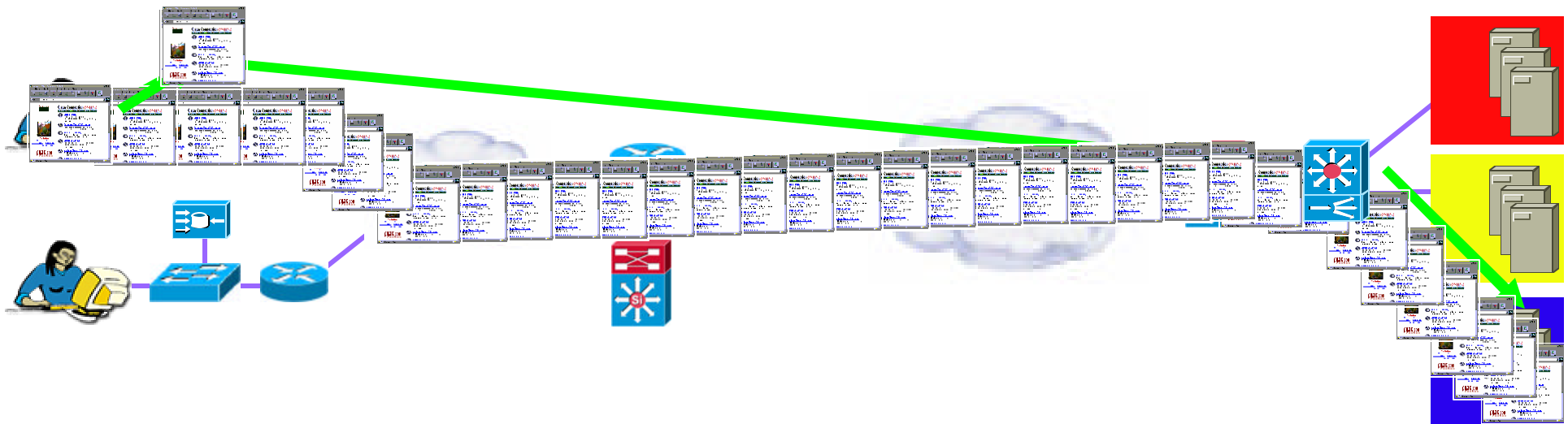
Caching delivers the object to the user from the closest site that has the content the user is requesting

Caching Implementations



- Caches are inserted into the network near WAN edge routers.
- Client requests get redirected to caches via WCCPv2 or via proxy auto configuration.

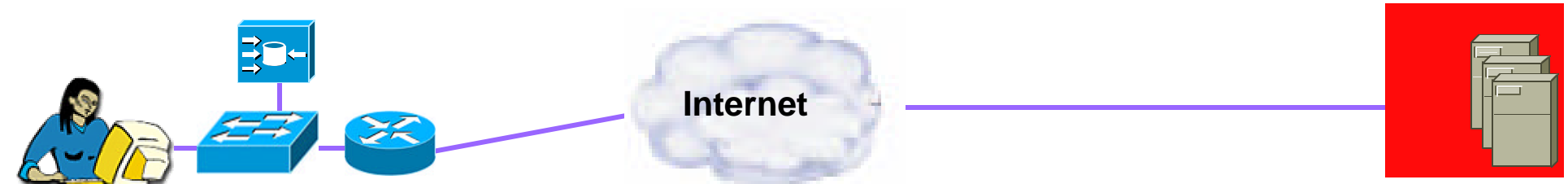
Caching Implementations



- Cache misses go to the origin site and through a content switching operation
- The HTTP-200 response and the object are received by the cache
- The cache simultaneously copies the object to disk as it responds to the client.
- Cache hits are served directly from the cache

Caching Implementations

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- Web pages are made of a series of objects.

- The HTML file is downloaded first. The browser then parses the web page top-down looking for HTML tags like- 'IMG SRC=xxxxx'

- The browser then downloads these objects. The HTTP version negotiated between the browser and the server dictates whether one or multiple TCP sessions are used for the delivery of these objects.

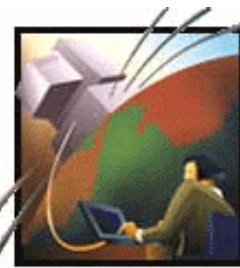
Cisco Connection **ONLINE**

WHAT'S NEW LOGIN REGISTER NAVIGATE HELP

menu_bar.gif



button1.gif



logo2.gif

cisco_connection.html

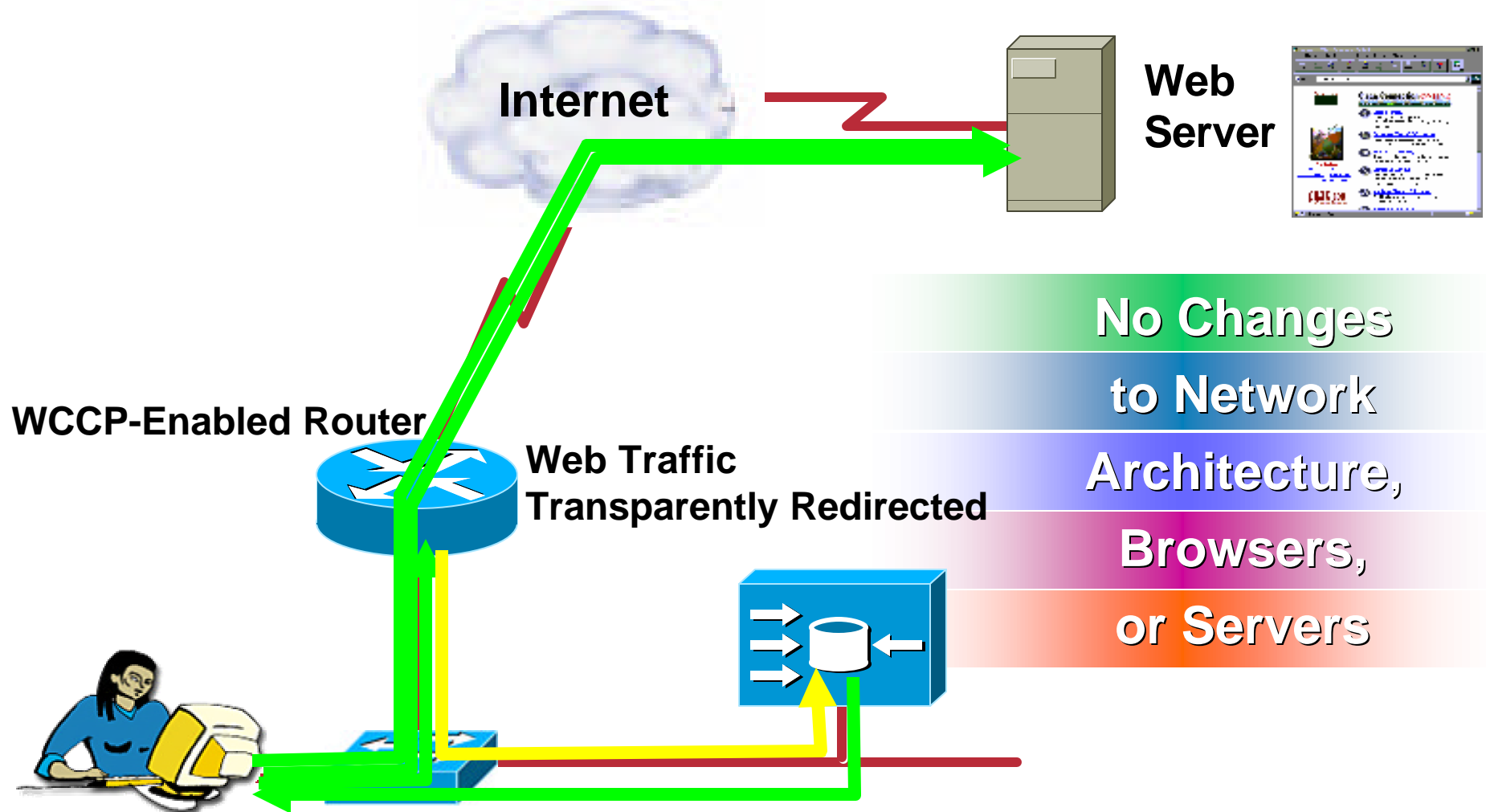
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on_root.shtml">Cisco  
Solutions<BR>  
</A></B><FONT SIZE=-  
enterprise, small/me  
small/home office, S:  
education.</FONT></T  
</TR>  
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</TD>  
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<TR VALIGN="Middle" .
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Transparent Network Caching with WCCP

- **Basic transparency**
Transparently redirect traffic on multiple ports to CE (WCCP v2)
- **Fault tolerance**
- **Fault prevention: bypass**
- **Scalable clustering**

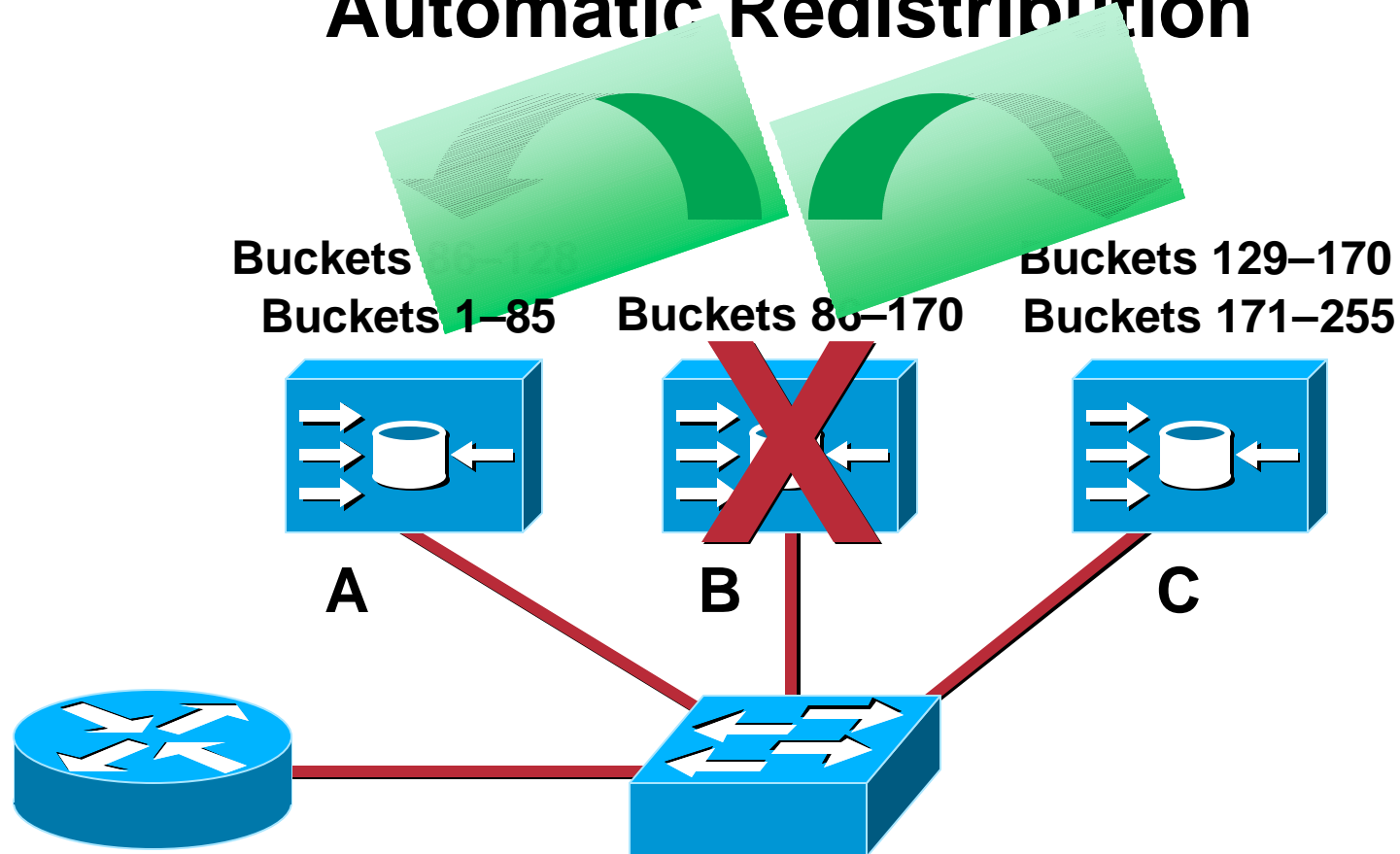
Basic Transparency

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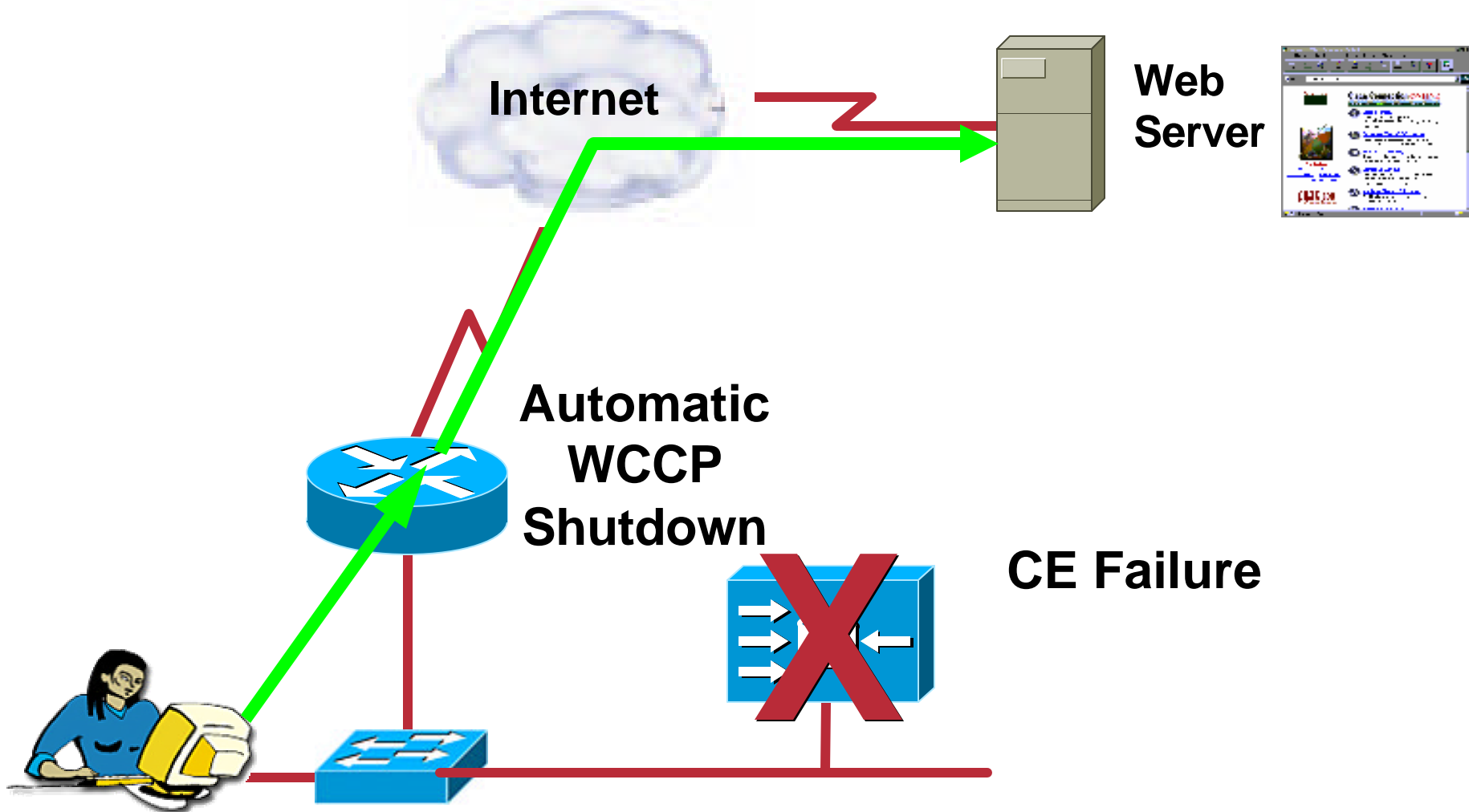


Fault Tolerance

Automatic Redistribution

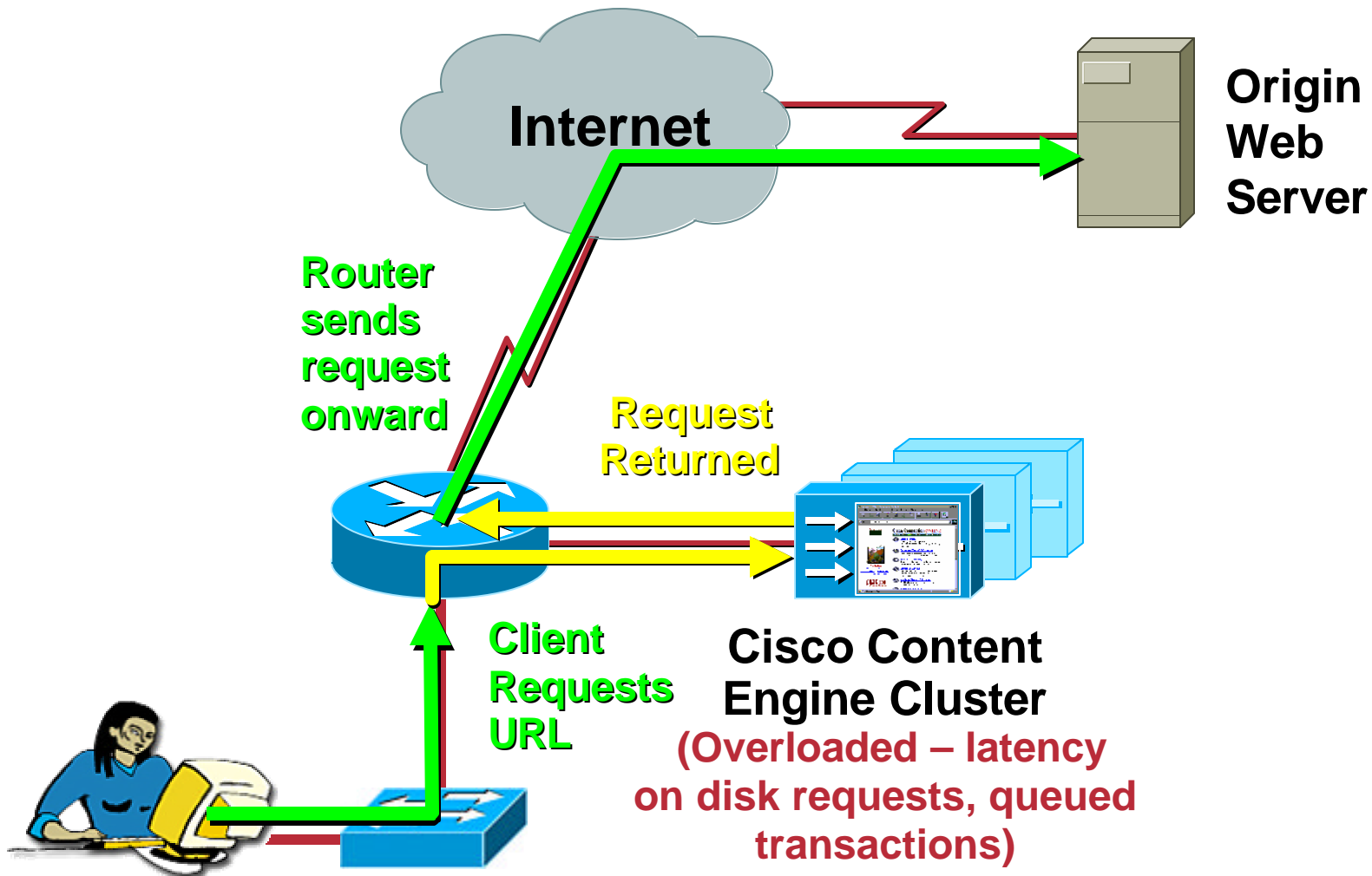


Fault Tolerance



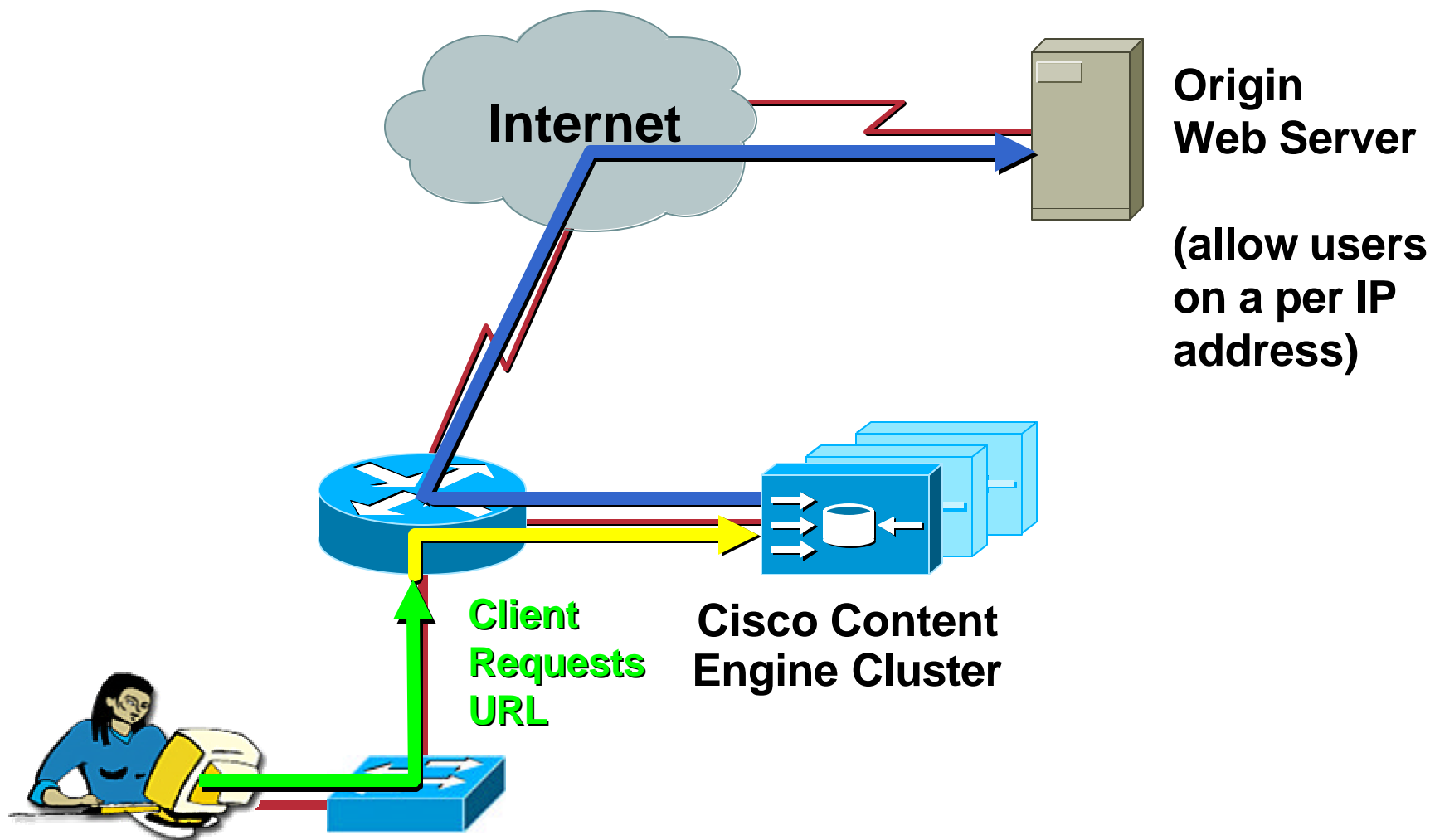
Fault Prevention: Overload Bypass

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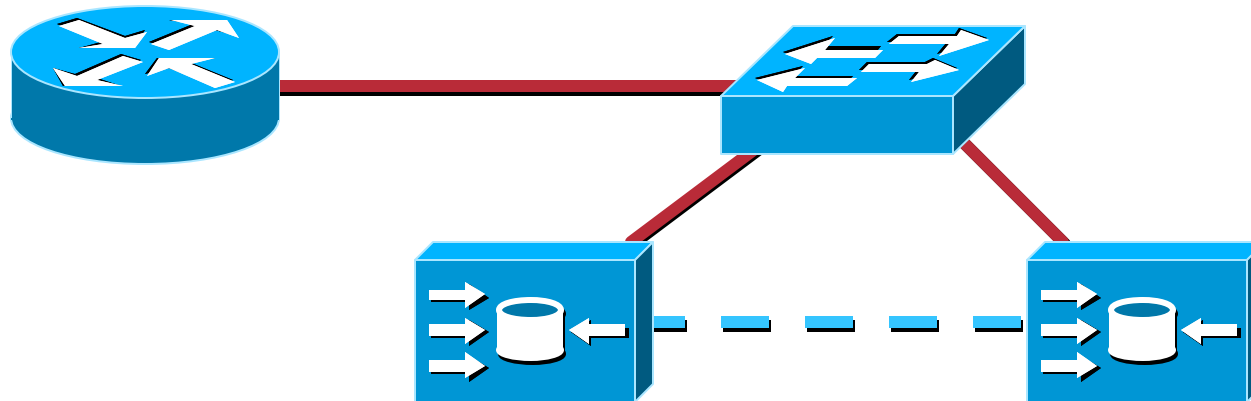


Fault Prevention: Dynamic Client Bypass

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Scalable Clustering

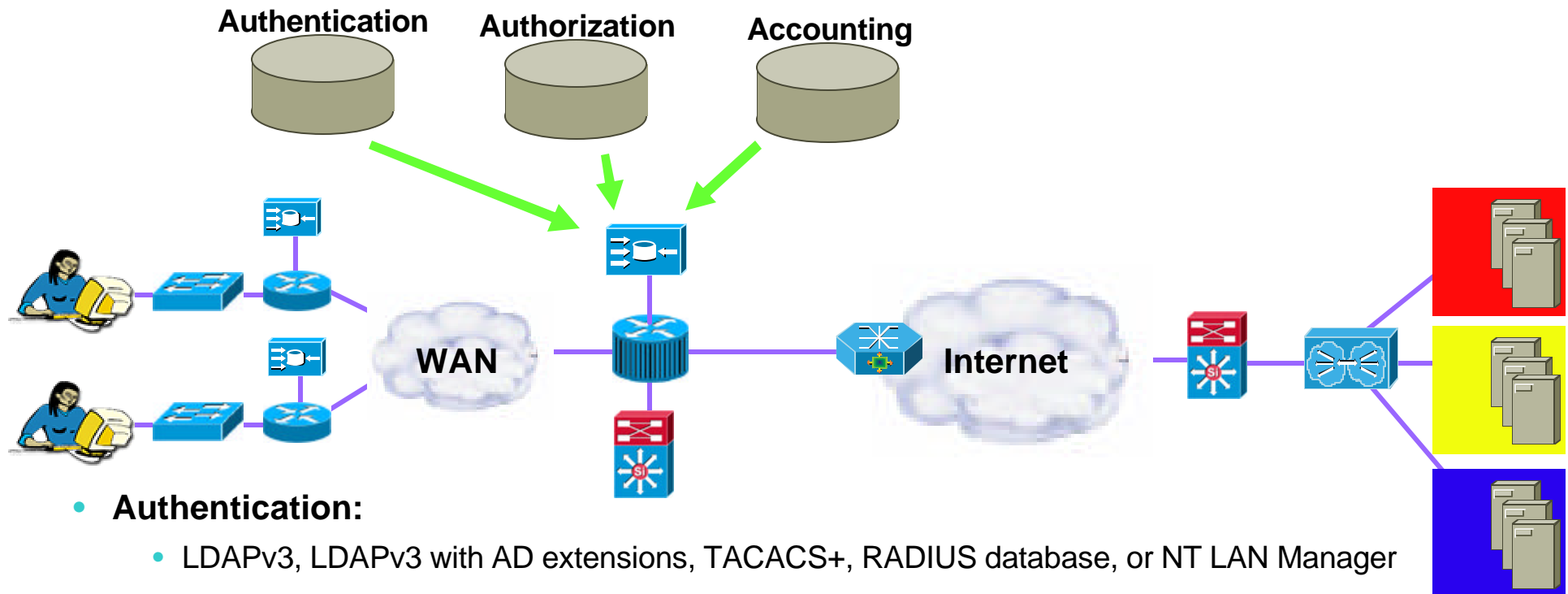


- **Load balancing by hashing on dest/source IP address**
- **Linear, incremental scalability**
- **Hot insertion**
 - Does not break flows
- **High availability, redundancy**
- **WCCP clean shutdown**
 - Tell other caches and router it is being removed

Content Engine (CE): Security Mechanisms

Secure: Content Filtering & Access Management

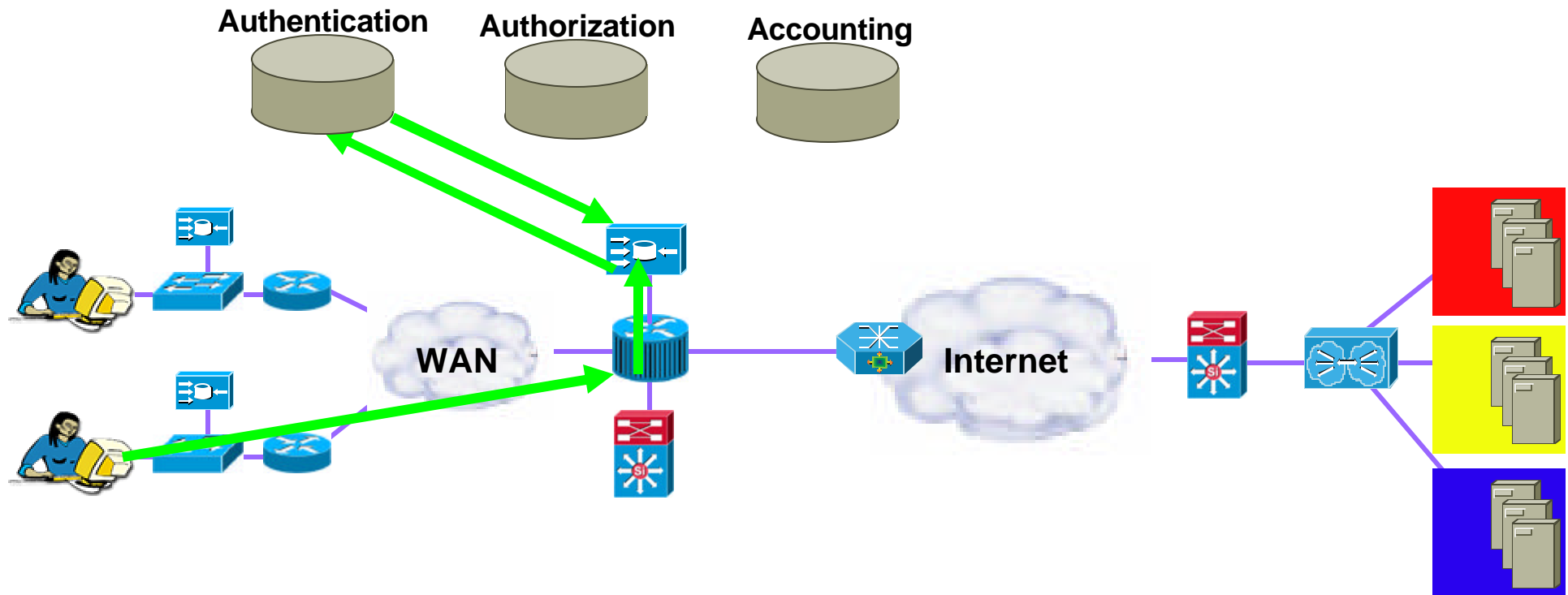
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- **Authentication:**
 - LDAPv3, LDAPv3 with AD extensions, TACACS+, RADIUS database, or NT LAN Manager
- **Authorization and content filtering:**
 - Websense/N2H2 client in CE passes credentials to Websense/N2H2 Server for authorization and to block non-productive or objectionable content
 - Secure Computing Smartfilter software – suite of plug-in APIs to allow for Smartfilter hooks during HTTP transactions
- **Accounting:** Transaction logging done by CE via industry-standard Squid logs
- **Works behind firewalls**

Internet Management Authentication

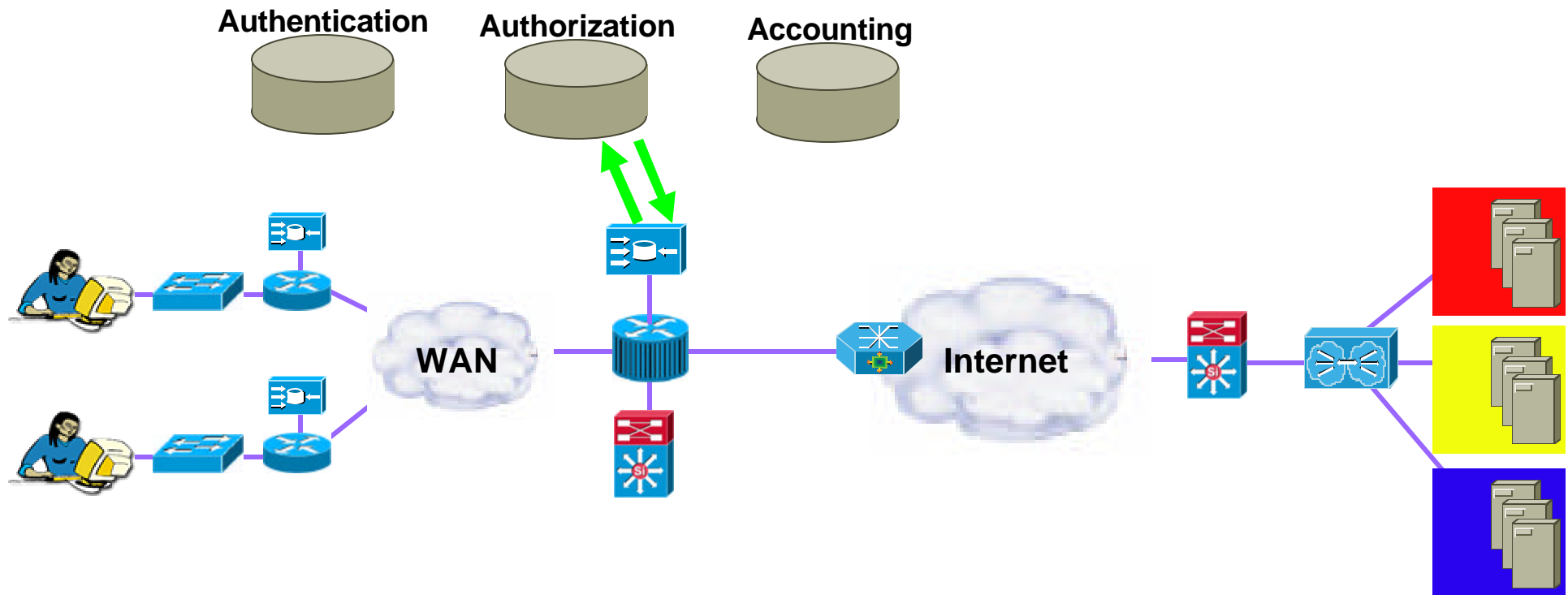
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- As user requests are redirected to the caching infrastructure requests may need to be authorized for viewing certain content or material.
- User credentials can be acquired via two-ways.
- The CE can present an HTTP-AUTH message to the client
- The CE can read the NTLM credentials passed via an IE browser on an NT network

Internet Management Authorization

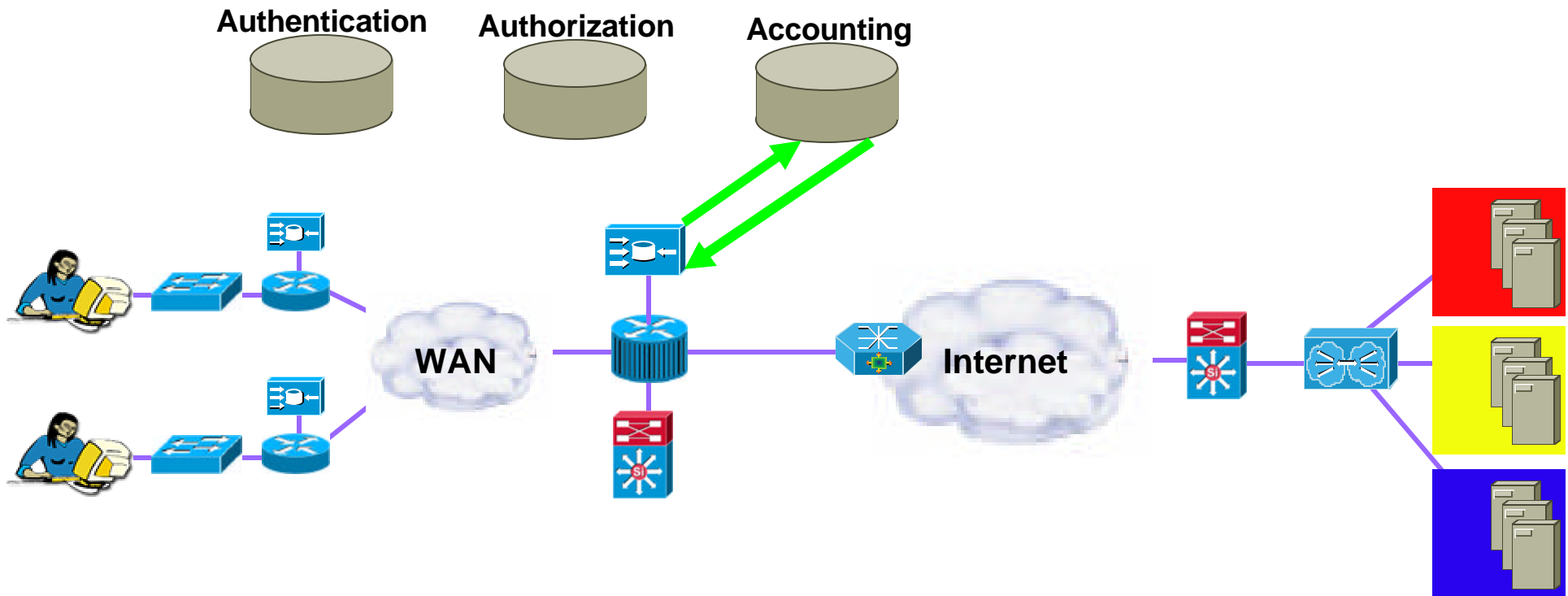
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- Once the user is authenticated and a reasonable sense of identity has been established then the user must be authorized use of the selected resource.
- This entails passing of the identified user credentials plus the content request to a system like WebSense/N2H2 which is designed to provide user-level site authorization services.
- URL filtering (deny and permit) as well as Smartfilters can also be used

Internet Management Accounting

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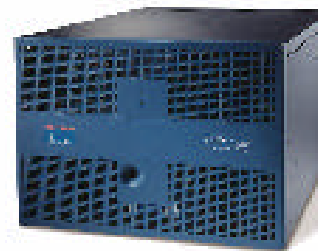
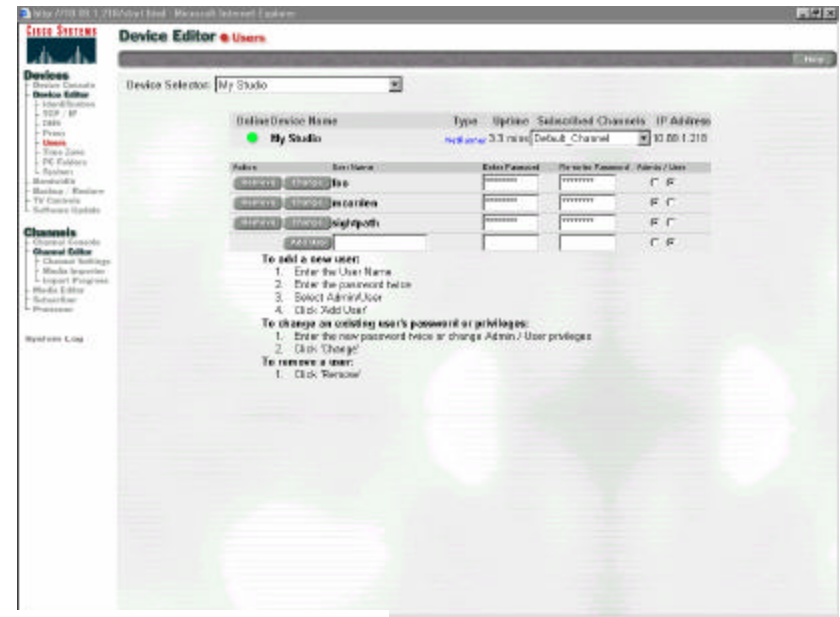
- IF WebSense/N2H2 authorizes the user the go to the site the CE will log this in the SQUID log format.
- The logs can be rolled up by date/time or by size.
- CDM is used for centralized logging

Content Delivery Manager (CDM): Product Overview

Content Distribution Manager (CDM)

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- **Web-integrated Centralized Policy Setting Device**
- **Control Over:**
 - Devices, Media, Channels
 - Replication and Redirections
- **CDM-4650 (7RU): Enterprise Customer Premises Rollouts, 140GB storage**
- **CDM-4630 (1RU): Departmental Pilots or Small Customer Premises Rollouts, 33GB storage**
- **Device Settings:**
 - IP Addresses, Proxies and Fire Walls
 - Coverage Zone Configurations
- **Import Media:**
 - Drag and Drop, File Transfer Protocol (ftp)
 - Web Server Directory



CDM-4650



CDM-4630

File Replication (SODA)

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- **Occurs from CDM to CE and CE to CE; efficient use of existing customer WAN and LAN architectures**
- **Fault Tolerant replication utilizing markers**
 - File transfer disruptions resume at marker locations
 - Allows bandwidth settings to be set to zero for critical business times
 - Efficient data transfer for large files and/or small pipes
- **Provides a high level of fault tolerance compared to other methods like FTP**
- **Optional replication with SSL**
- **Optional: Content Preloading – URLs defined on CE**

Bandwidth Controls

- **Enables CDM administrators to control bandwidth usage over the WAN and LAN**
- **2 Types of Bandwidth Controls**
 - Replication based on time of day allows for the efficient use of WAN bandwidth during off peak hours
 - Content Streaming Throttle sets a maximum streaming bandwidth usage rate selectable on each CE
- **Enables any corporation to utilize streaming media without impacting mission critical business applications**

Channel Distribution

- **Allows the CDM to host multiple virtual CDNs**
- **Targeted file distribution**
- **Different Departments or Different Companies on a single CDM**
- **Examples include:**
 - Marketing Channel (CEs 1-10)**
 - Engineering Channel (CEs 11-25)**
 - Benefits Channel (All CEs)**

CDM Administrator Interface

The image displays two overlapping web browser windows from Cisco Systems. The top window is titled "Cisco NetRunner Administrator - Microsoft Internet Explorer" and shows the "Devices • Bandwidth" configuration page. The bottom window is titled "Cisco CDM - Microsoft Internet Explorer" and shows the "Devices • TV Controls" configuration page.

Cisco NetRunner Administrator - Devices • Bandwidth

Device Selector: 3.00:90:27:6f:1a:17.box.edin-test.sn

Playback 5 Mb/s

Replication	From	To	Bandwidth	M	T	W	T	F	S	S
1. Edit	12:00 AM	12:00 AM	42	●	●	●	●	●	●	●
2. Edit	9:00 AM	5:00 PM	20	●	●	●	●	●	●	●
3. Edit	6:00 PM	9:00 PM	35	●	●	●	●	●	●	●

Channel Selector: PAL Videos

Available Media:

- PAL_1Mb.mpg
- PAL_2Mb.mpg
- PAL_3Mb.mpg
- PAL_4Mb.mpg
- PAL_System_HD1_4Mb.mpg
- PAL_System_SIF1.mpg
- PAL_System_SIF2.mpg
- PAL_System_SIF3.mpg
- AVSEQ09.mpg
- Toy2.mpg

Playlist:

- AVSEQ09.mpg

Playback controls: LOOP (), PLAY ▶, LAST ◀, NEXT ▶, REPEAT ◀▶, PAUSE ||, STOP ■

Content Networking: Distribution and Routing Technology How it works

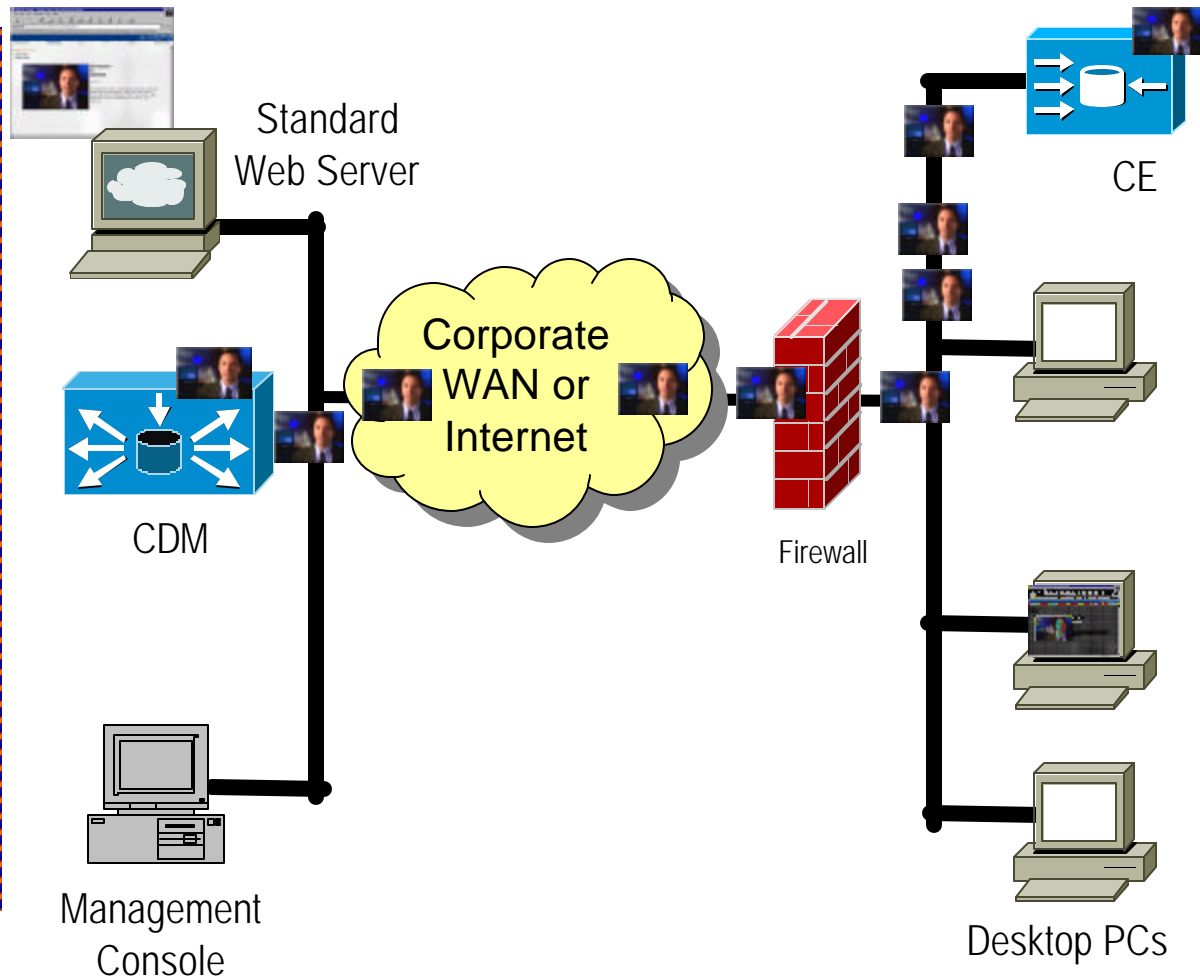
CDM and CE Set-up

Corporate Data Center

Remote Office or Partner

Set-up

1. CDM Install
2. CE Install
3. File Import
4. Automatic URL Generation
5. Copy to Web Server
6. CDM Channel Assignment
7. File Replication



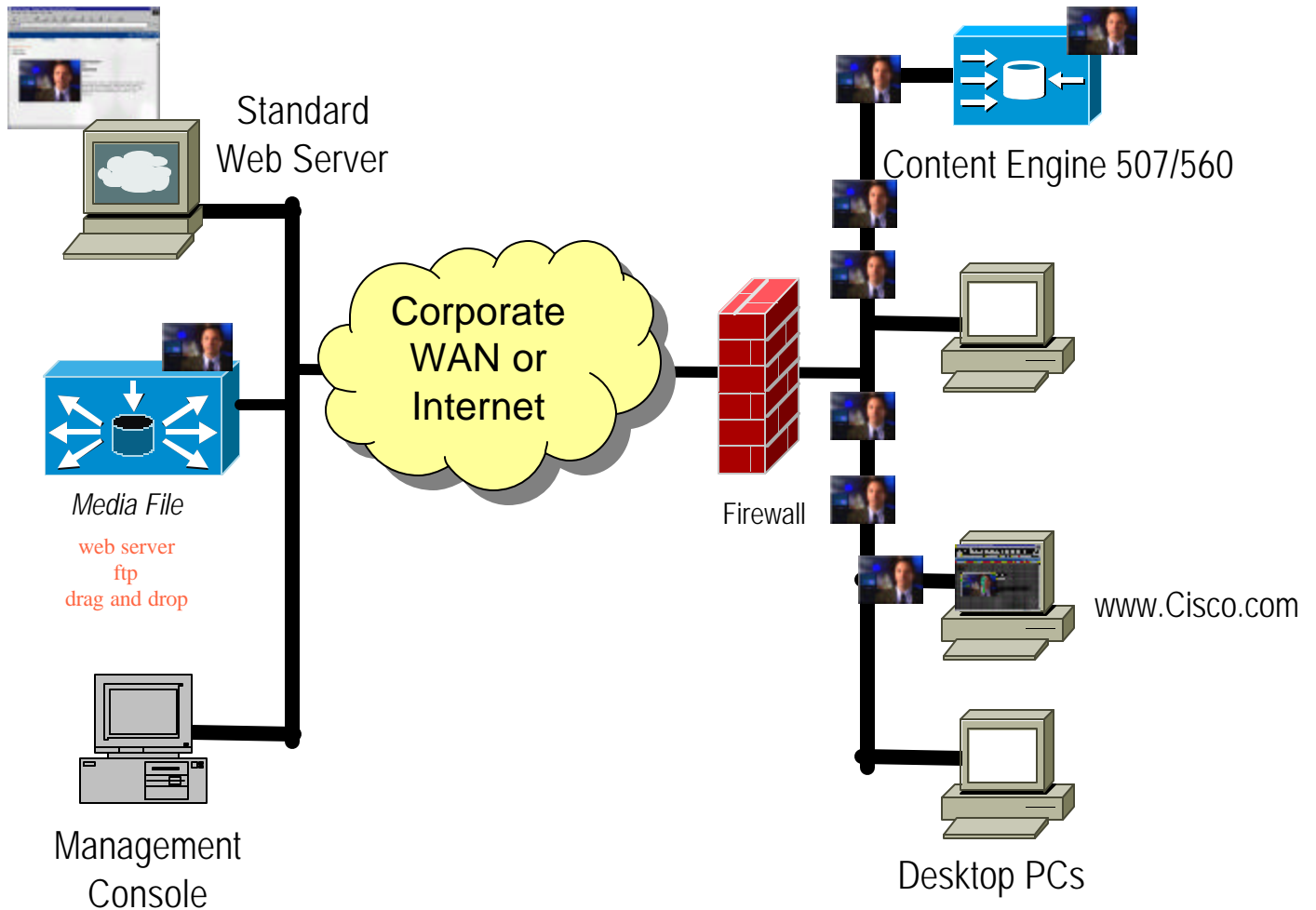
Redirection and Delivery

Corporate Data Center

Remote Office or Partner

Redirection and Delivery

1. User types in URL of web page
2. User Selects embedded object
3. Embedded object links to CDM
4. CDM determines user location and http redirects browser to local CE
5. Local CE delivers file to the desktop PC



Self Organizing Distributed Architecture (SODA)

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- **Channel distribution routing hierarchy**
- **Redirection (http)**
- **Keep alives**
- **File Replication**

Building the distribution hierarchy - SODA

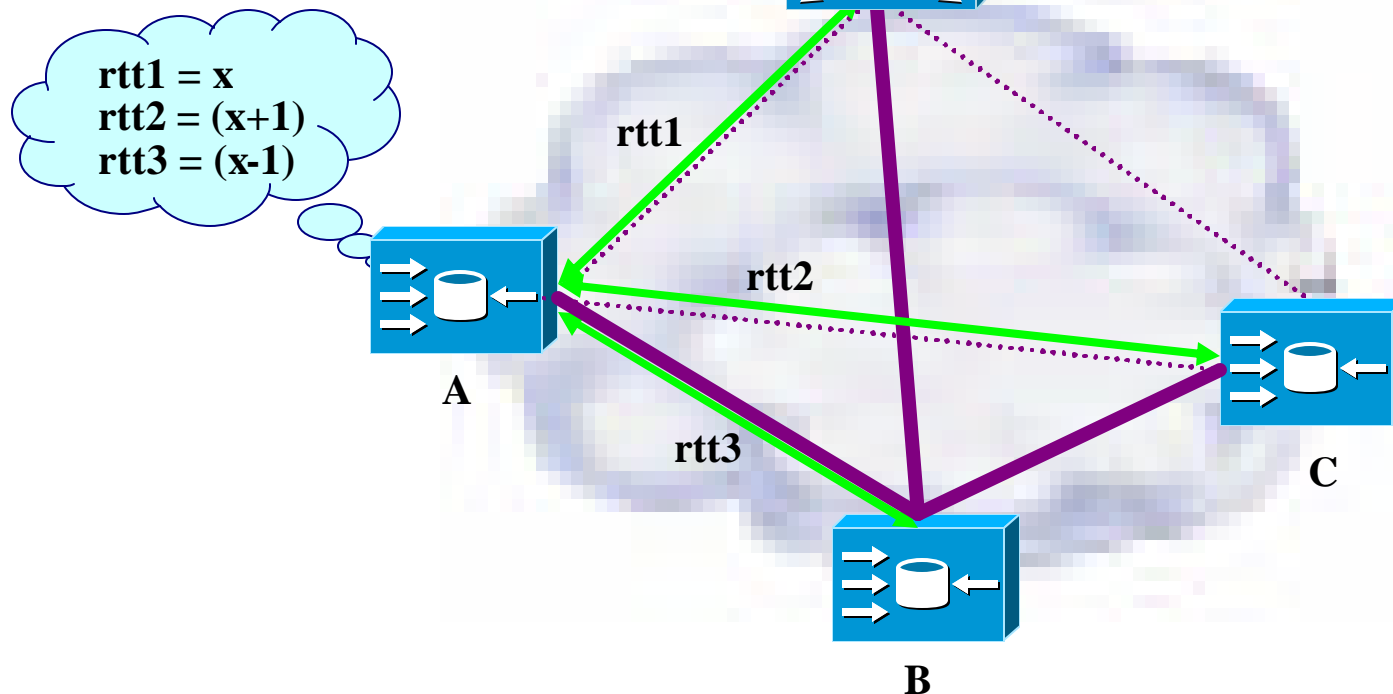
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- **Builds an efficient distribution hierarchy for rich media**
- **Self discovery and configuration**
- **Self-healing**
- **Automatically adjusts for NAT or proxy devices**
- **CDM is the root for the distribution tree**
- **Each channel has a unique distribution tree**
- **Dynamically probes each node for:**
 - Link Speed**
 - Node Health**
- **Goals of Self-Discovery**
 - Redirect user requests to the appropriate edge device**
 - Build a good distribution network for large files**

How the channel distribution routing hierarchy is built

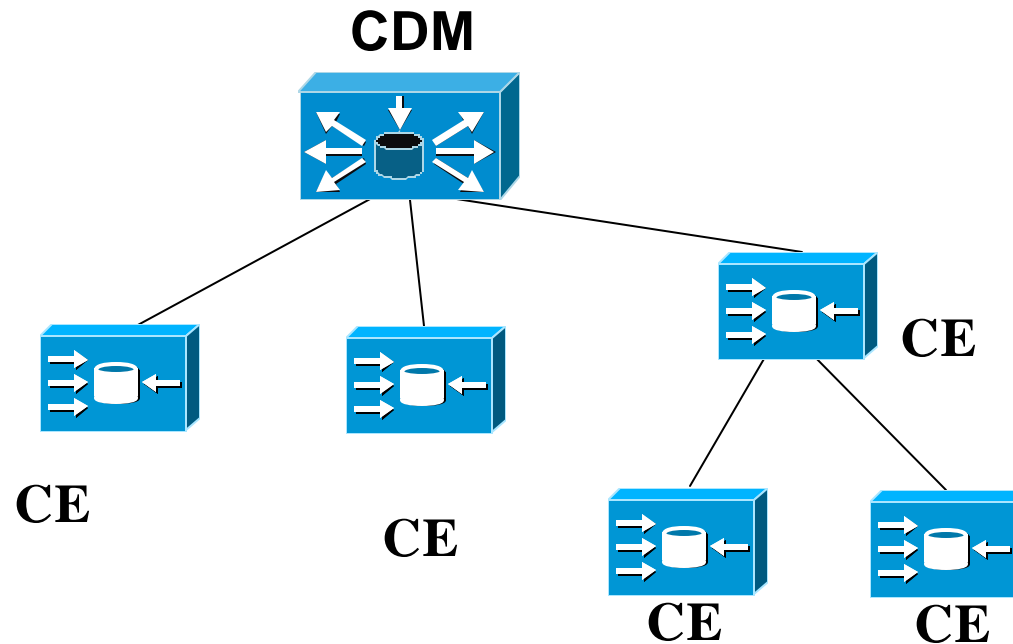
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For EACH Channel, the following will occur:



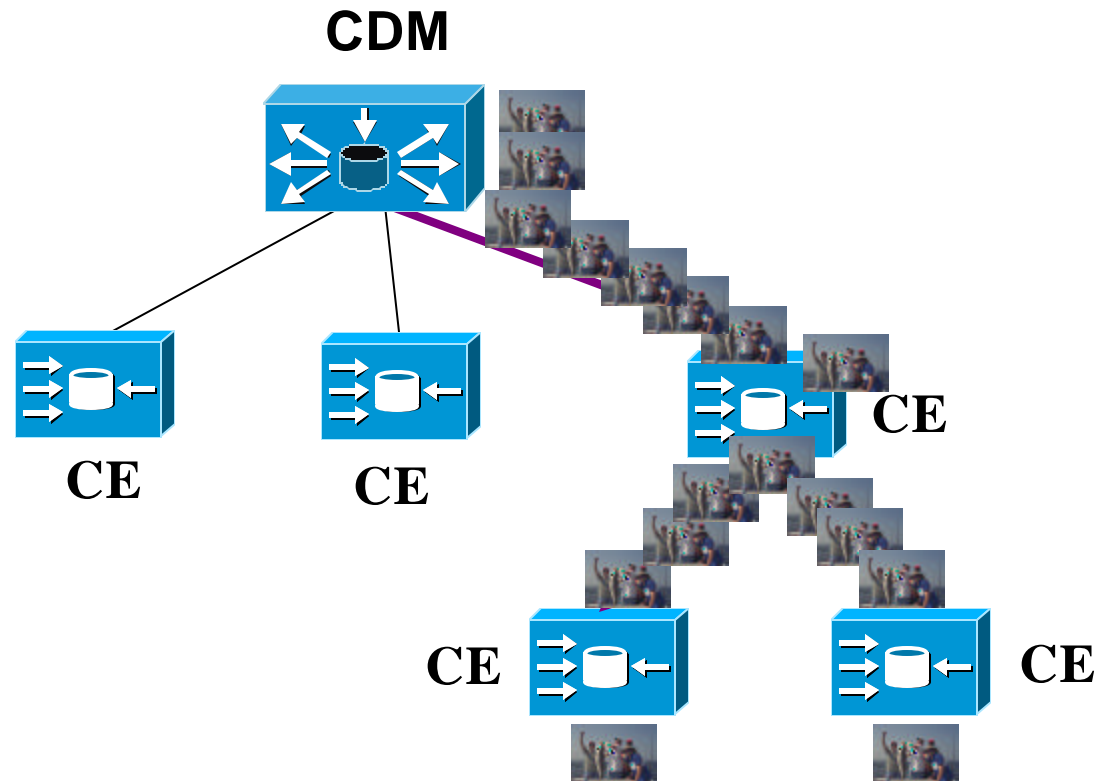
1. New Content Engines will “probe” every other node in the CDN as part of SODA’s self-discovery process
2. Since “rtt3” is lowest value, active edge of spanning tree is between Content Engine A and Content Engine B
3. Content Engine will receive replicated content from Content Engine B since fastest link

Keep Alive Signals



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

File Replication

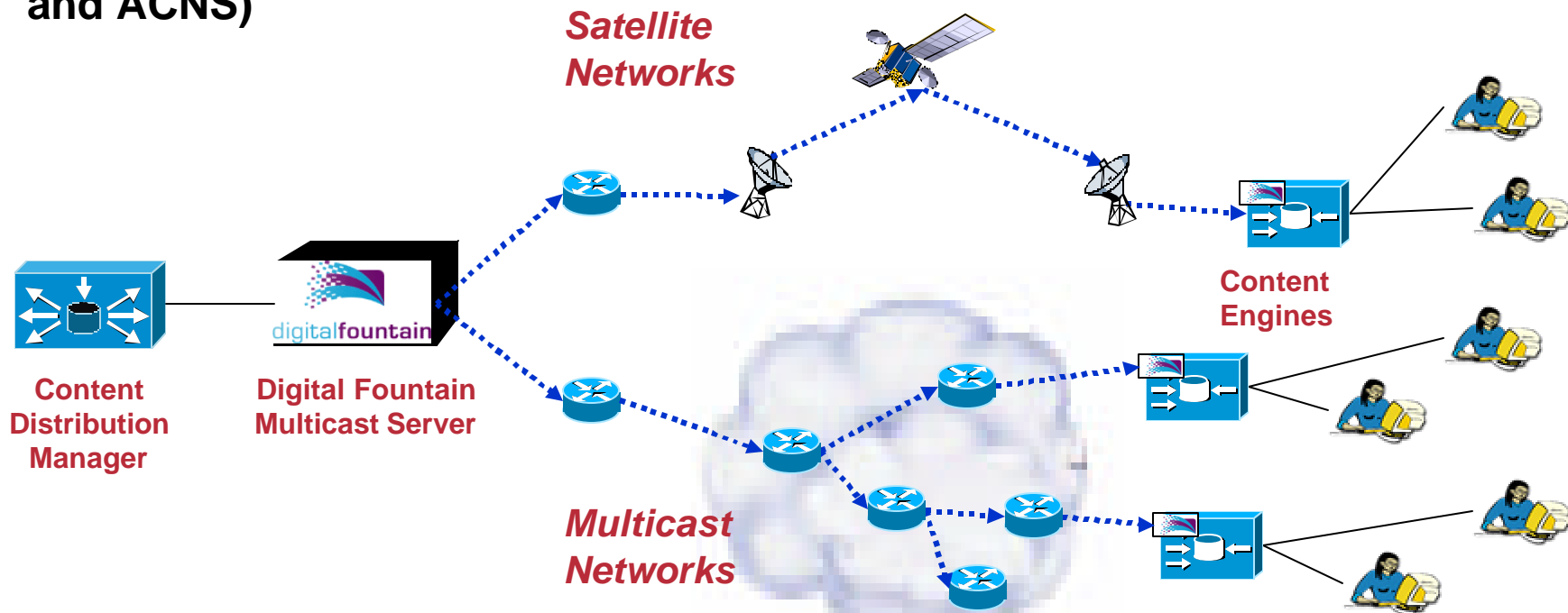


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Cisco ACNS Solution: Digital Fountain Technology Integration

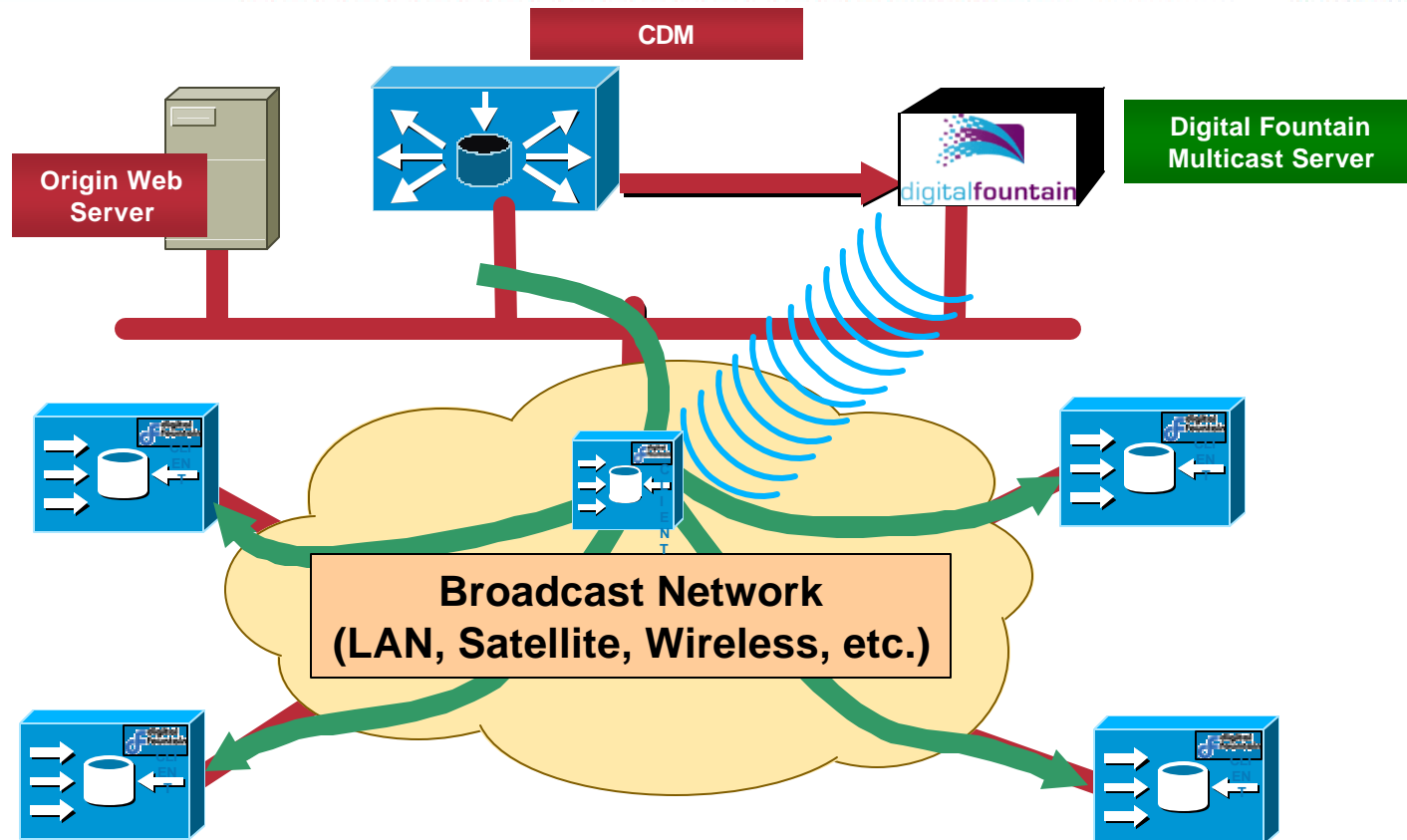
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- Reliable distribution of content into Cisco Content Engines effectively minimizing bandwidth usage
- Tightly integrated solutions, available only from Cisco
- Works in multicast networks, including satellite systems
- Solution includes a stand-alone Digital Fountain branded Multicast server and CE Digital Fountain Client software option (supported in ECDN 3.0.2 and ACNS)



Multicast File Replication

Cisco.com



- Create “multicast” channel in the CDM
- Push Content from the CDM to the Digital Fountain Multicast Server
- CDM notifies CEs of the multicast address
- Digital Fountain Multicast Server and CEs join the multicast group

High Availability: Content Router 4430

Cisco.com

- **Fault Tolerant architecture for ECDNs:**
 - Allows for a highly scalable, distributed ECDN routing architecture
 - Performs http redirects in a ECDN
 - Uses Cisco Content Switch to fail-over from CDM when it is down or busy
- **Up to 5 CR-4430s can be used in a single ECDN**
- **Works with CDM4650 or 4630**



CR-4430

Cisco Content Router 4430

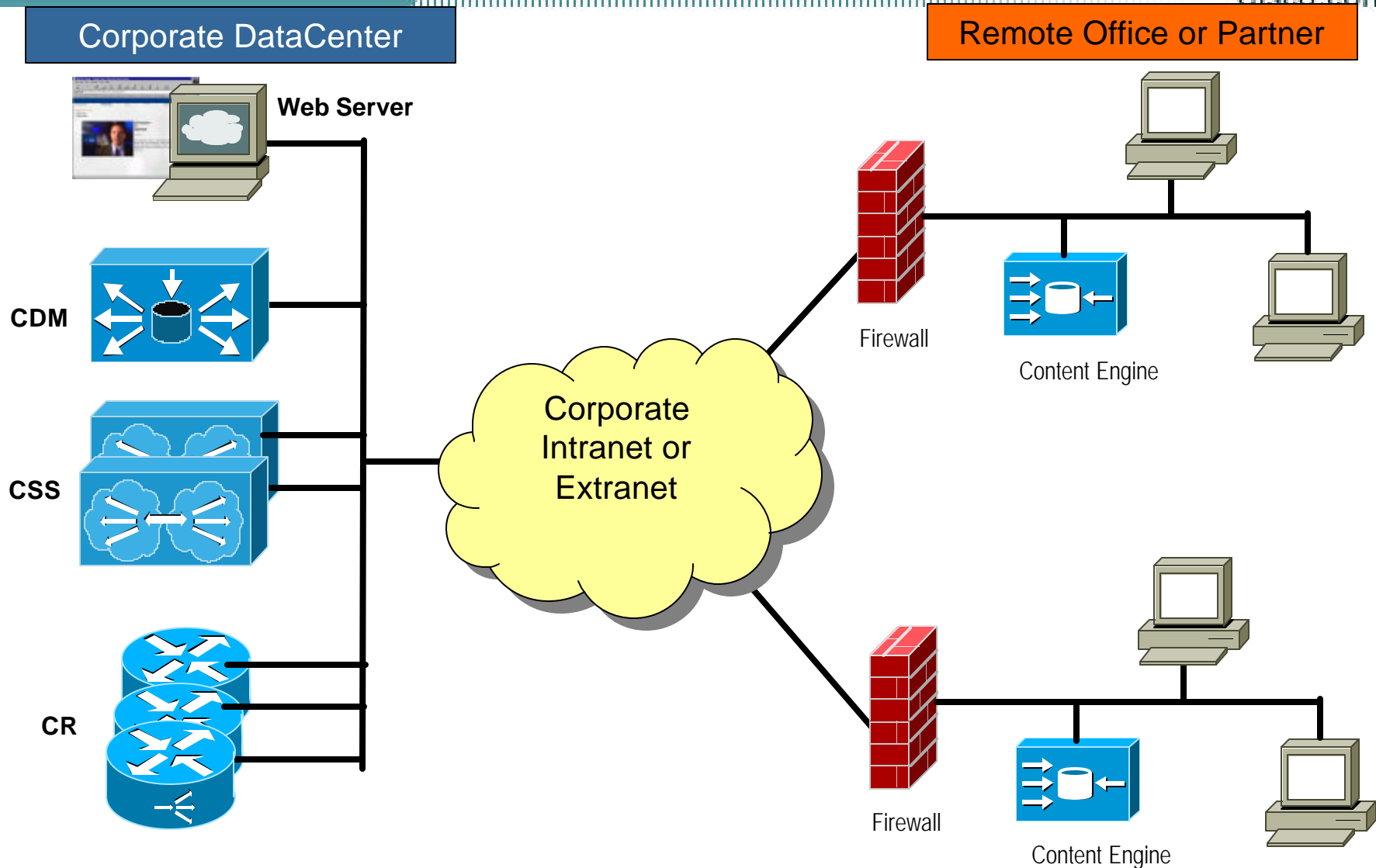
High Availability Operation

Cisco.com

- **CDM updates the CRs with the SODA routing tables**
- **Using a VIP the CSS load balances CE requests between the CRs and optionally the CDM**
- **Upon CDM failure:**
 - Policy changes cannot be made to the network**
 - CSS detects CDM and/or CR failure and adjusts the load balancing**
 - HTTP redirects continue to be processed**

Highly Scalable, Fault Tolerant ECDN

Cisco.com



Content Networking: Streaming Media Support

ACNS Streaming Media Support

Cisco.com

- **HTTP On Demand Delivery:**
 - any streaming and non-streaming file formats (Real Network's rm, Microsoft's asf, MPEG, MP3, PDF, Flash, Shockwave, Quicktime, etc.)
 - No fast forward and rewind.
- **Video On Demand: Uses RTSP/MMS for control**
 - Unicast (one stream/user). Users view programs when they want and have VCR-like controls (Fast Forward, Rewind, Pause)
 - Native Real RTP/RTSP and Microsoft MMS for transport/control
- **IP Multicast: IETF standard**
 - Uses Cisco IOS on Cisco Routers to allow one stream to serve multiple users. Users "tune" into the stream.
 - Allows live and scheduled video programs to be scaled to wide audience with low bandwidth usage
- **Stream Splitting:**
 - Unicast streams from origin servers are sent to "splitter" CEs which in turn resend by multicast or unicast to multiple connected users
 - Allows live programs over network that is not multicast-enabled.

When To Use Which Mode?

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VOD

- Gives users flexibility for viewing at a time convenient for them
- Gives users ability to watch at their own pace
- Unique stream per user
- Deploy Content Engines at network edge
- CDN is critical to conserve WAN bandwidth usage and to enable high quality video

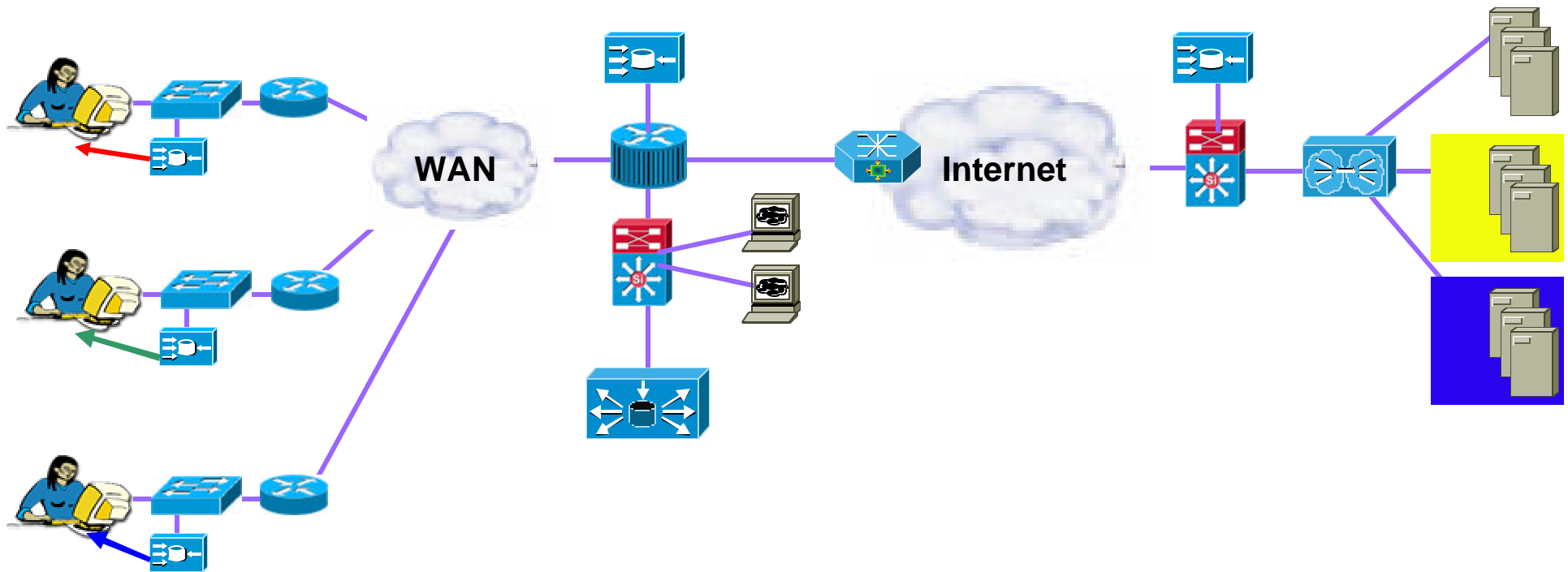
Stream Splitting

- Live video
- Network is not multicast-enabled
- Users are connecting to a broadcast from geographically separate locations
- Content Engines are deployed
- Video servers are not under your control (Internet based)

Multicast

- Time-critical events (e.g. CEO speech)
- Majority of users will be available for live event
- Conserve network bandwidth
- Network is configured to support multicast
- All clients are multicast enabled

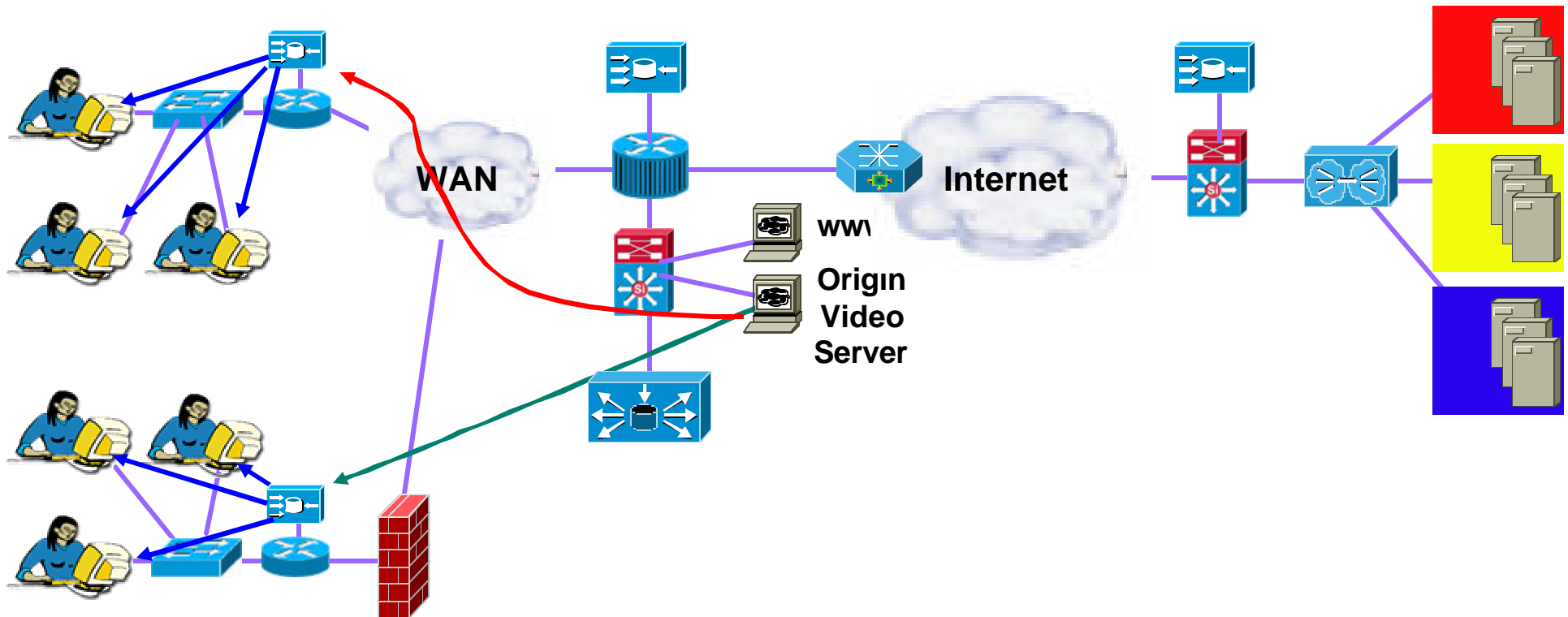
On Demand Video



If CE is a Real Proxy: Origin Video Server controls the limits of video licenses served by CE. WCCP used for re-direction. No pre-positioning of content allowed.
 If CE is a Real/WMT Server, no authentication to the origin video server is required. Content can be pre-positioned into CE.

- Distribute video file
- Separate controllable stream per user
- Separate controllable stream per user
- Separate controllable stream per user

Live Stream Splitting

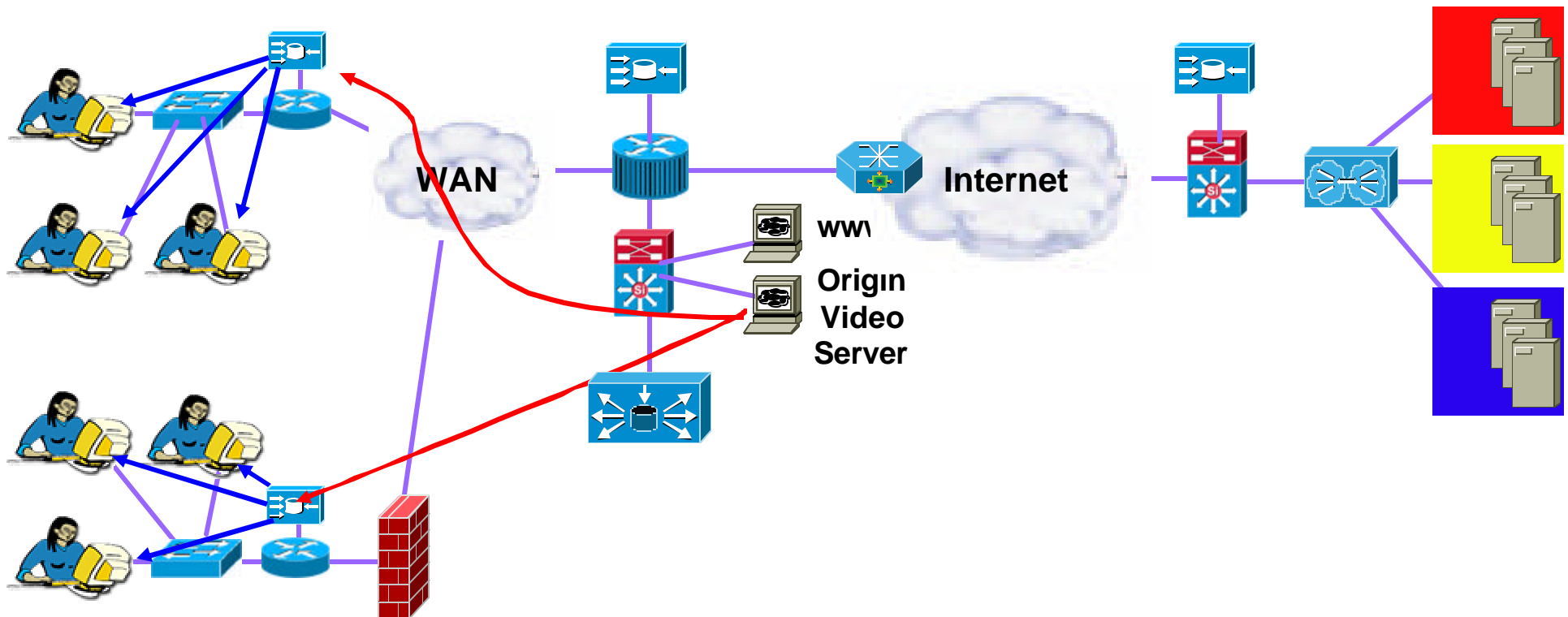


If CE is a Real Proxy: Origin Video Server controls the limits of video licenses served by CE. Authentication of user license is done via back-channel. WCCP used for redirection.

If CE is a Real/WMT Server, no authentication to the origin video server is required.

- Live streaming video unicast to CEs
- CEs unicast or multicast to local users

IP Multicast



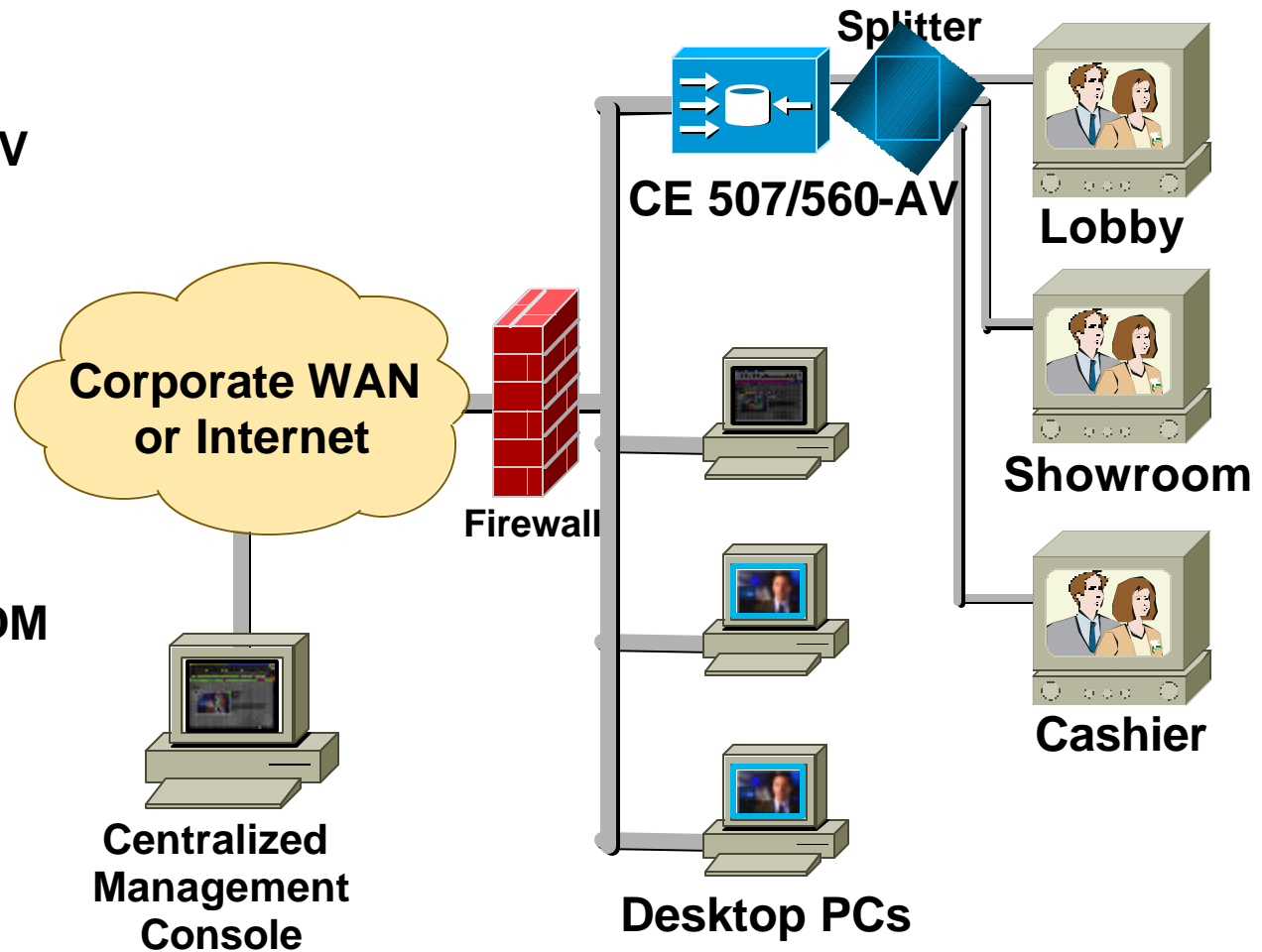
If CE is a Real Proxy: Origin Video Server controls the limits of video licenses served by CE. Authentication of user license is done via back-channel. WCCP used for re-direction.

If CE is a Real/WMT Server, no authentication to the origin video server is required. Content can be pre-positioned into CE.

- Live streaming video multicast to CEs
- CEs multicast to local users

MPEG Video Display

- Integrated MPEG decoder in the CE AV model
- HTTP delivery of media
- NTSC and PAL TV output support
- Centralized Web VTR/VCR Controls and Playlist from CDM
- Applications
 - Kiosk
 - Video Wall
 - Point-of-Sale



Video-Out Controls

The screenshot displays the Cisco CDM web interface for TV Controls. The browser title is "Cisco CDM - Microsoft Internet Explorer". The main heading is "Devices ● TV Controls". On the left, there is a navigation menu with sections for "Devices" (Device Console, Device Editor, Identification, TCP/IP, DNS, Proxy, Users, Time Zone, PC Folders, System, Bandwidth, Backup/Restore, TV Controls, Software Update) and "Channels" (Channel Console, Channel Editor, Channel Settings, Media Importer, Import Progress, Media Editor, Subscriber, Previewer). Below the menu is a "System Log" section.

The main content area features a "Channel Selector" dropdown menu currently set to "PAL Videos". Below this are two panels: "Available Media" and "Playlist".

Available Media:

1	<input type="checkbox"/>	PAL_1Mb.mpg
2	<input type="checkbox"/>	PAL_2Mb.mpg
3	<input type="checkbox"/>	PAL_3Mb.mpg
4	<input type="checkbox"/>	PAL_4Mb.mpg
5	<input type="checkbox"/>	PAL_System_HD1_4Mb.mpg
6	<input type="checkbox"/>	PAL_System_SIF1.mpg
7	<input type="checkbox"/>	PAL_System_SIF2.mpg
8	<input type="checkbox"/>	PAL_System_SIF3.mpg
9	<input type="checkbox"/>	AVSEQ09.mpg
10	<input type="checkbox"/>	Toy2.mpg

Playlist:

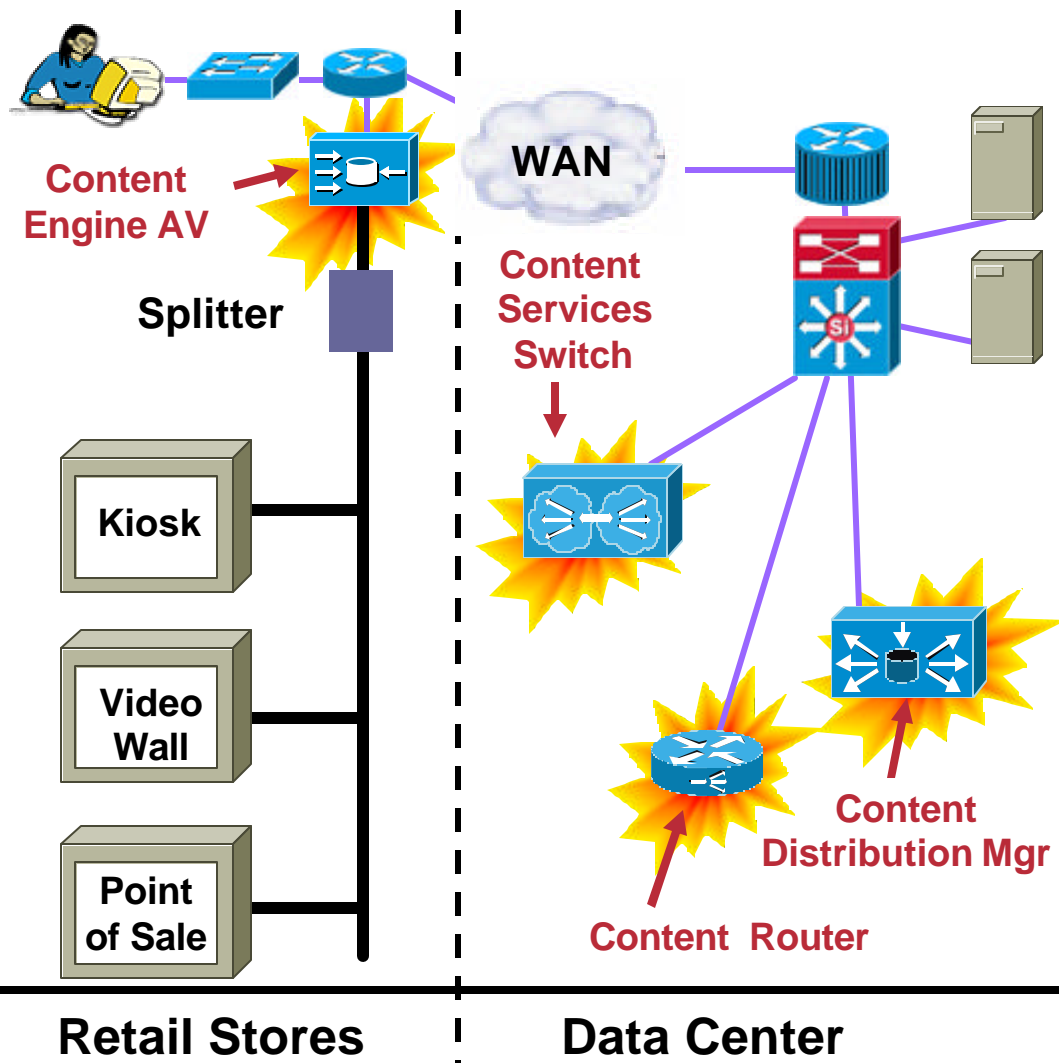
1	<input type="checkbox"/>	AVSEQ09.mpg

At the bottom of the interface is a playback control panel. It includes a "LOOP ()" indicator, a "RANDOM 132" indicator, and a "LOOP" button. The main control area contains buttons for "LAST", "NEXT", "REPEAT", "PLAY", "PAUSE", and "STOP". A "DISPLAY" label is visible below the "PLAY" button. An "Info" icon is located on the right side of the control panel.

Content Networking: Case Studies

Point-of-Sale Content Delivery Network

Cisco.com



Benefits:

- Fast, efficient delivery of tailored promotional content to stores /branches/kiosks
- Central content control
- Includes e-learning, caching benefits

Products:

Content Distribution Manager 46XX, Content Engine 5XXAV, CR 4430, CSS 11051 or CSM

Customer Success Story — Point-of-Sale/Service CDN



Who:

- Hard Rock Café: The originator of theme-restaurant dining
- Worldwide network of 104 cafes, in 36 countries, with 28 million guests each year

Challenge:

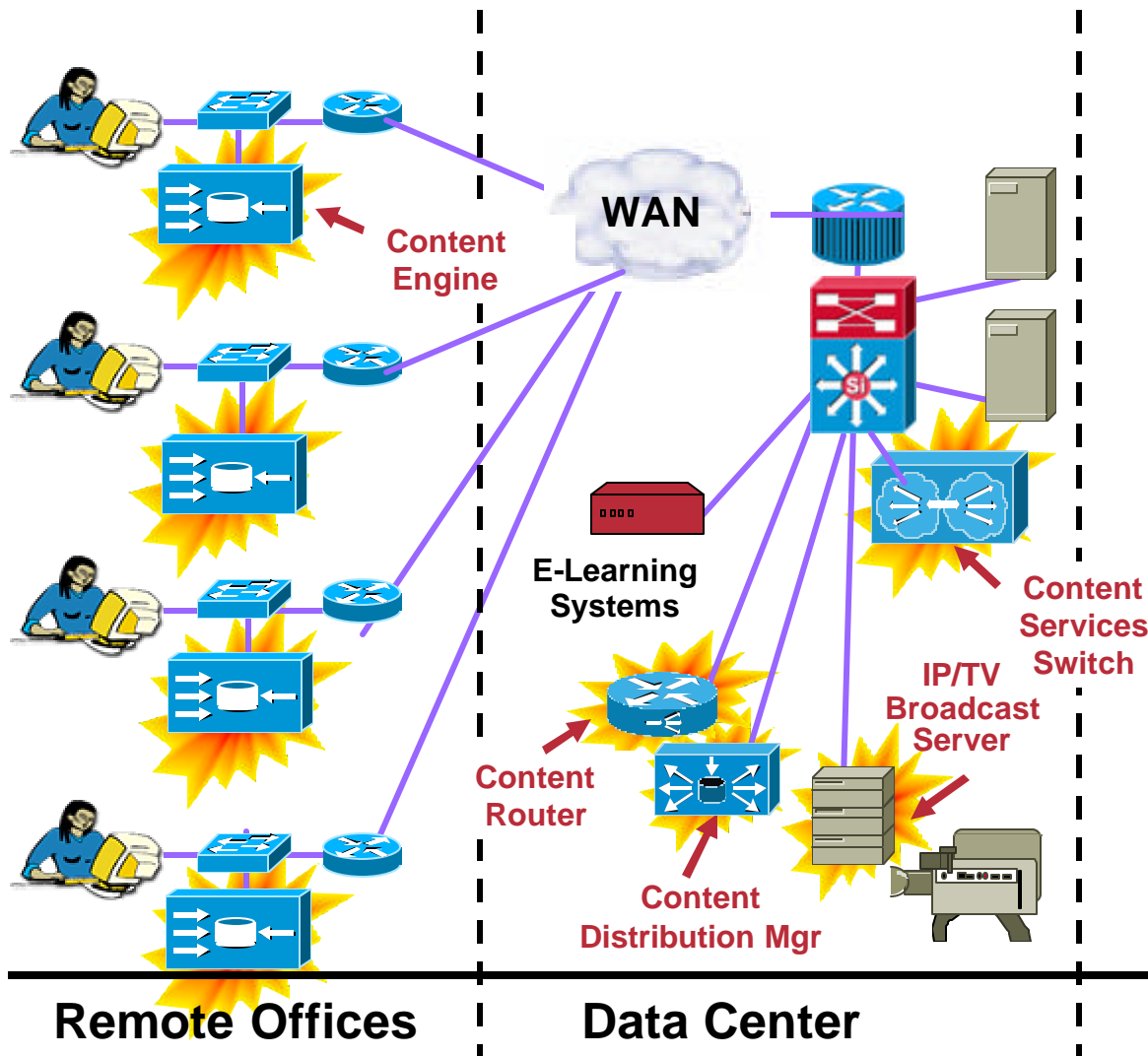
- Manage worldwide, video distribution from HQ in Orlando, FL
- Cost-effectively deliver high-quality video to each café worldwide
- Eliminate tape inventory costs and maintenance
- Increase revenue thru promotional opportunities

Solution:

- Cisco's Enterprise Content Delivery Network (eCDN)
 - CDM at HQ in Orlando
 - CEs at each café location delivering video on local bandwidth and:
 - Central management of video content
 - Higher quality, and more reliable video than other methods
 - Scalability for future implementations

E-Learning & Corporate Communications Content Delivery Network

Cisco.com



Benefits:

- Enables cost-effective deployment of rich media
- Dramatically reduces training costs / increases productivity
- Reduces network congestion

Products:

Content Distribution Mgr
46XX, Content Engine 5XX,
IP/TV Broadcast Server

From Simple to Sophisticated E-Learning: *The Blended Solution*

Cisco.com

Learning Management Systems

- Commonly called LMS
- Portal that “houses” all courses
- Tracking, billing, launches content
- **Saba, Docent**

Authoring, Knowledge Mgmt

- Tools to build formal or informal courses, content
- Used alone or with LMS
- Bundled with some LMSes
- **gForce, Generation21**

Learning Content

- Customer or pre-packaged
- Rich or HTML-based
- HTML-based often bundled with LMS
- **Cosmic Blender, iXL DVS, Ninth House, WatchIT, Primedia WPL**

Virtual Classrooms

- Simulated classroom via Web
- Interactivity, application sharing, hand raising, VOIP or concall
- Used along or with LMS
- **Centra, Interwise, Placeware**

Customer Success Story — On-demand E-Learning CDN



Cisco.com

Who:

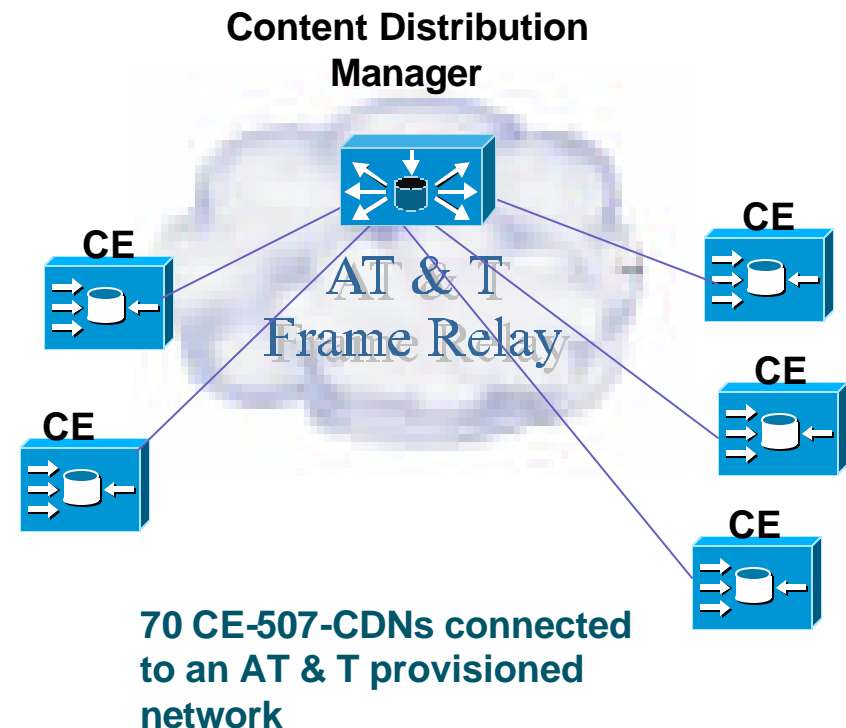
- \$1 Billion Placement Company
- 400 Franchisees Worldwide

Challenge:

- Deliver rich learning to hundreds of agencies without increasing WAN bandwidth
- Train franchisees, staff quickly and effectively

Solution:

- ECDN and Custom Training Content from 3rd Party Provider



Conclusion

More Intelligent Services at the Edge

Cisco.com

- **Transparent Caching**
- **Content Filtering / User Authentication**
- **Rich E-learning / Distance Learning**
- **Corporate Communications**
- **Business TV**
- **Virtual VCR Functionality**
- **Point of Sale Broadcasts / Advertising**
- **Marketing and Research Collateral Distribution**
- **Intelligent Large File Distribution**
- **Live, Scheduled, On-Demand Delivery - Turnkey**
- **MPEG, WMT, QT, Real, MP3, Shockwave, PPT, More**

Part of a Complete Content Networking Solution

Cisco.com

- **“Stepped Approach” - Start With Any Service and Expand from There...**
 - Transparent caching, On-demand E-learning, Live Communications, Web Optimization / Personalization, Etc.
- **Only Cisco Offers All 5 Components of a Total Solution...:**
 - Content Distribution, Management, Edge Delivery, Routing and Intelligent Network Services

CISCO SYSTEMS



EMPOWERING THE
INTERNET GENERATIONSM