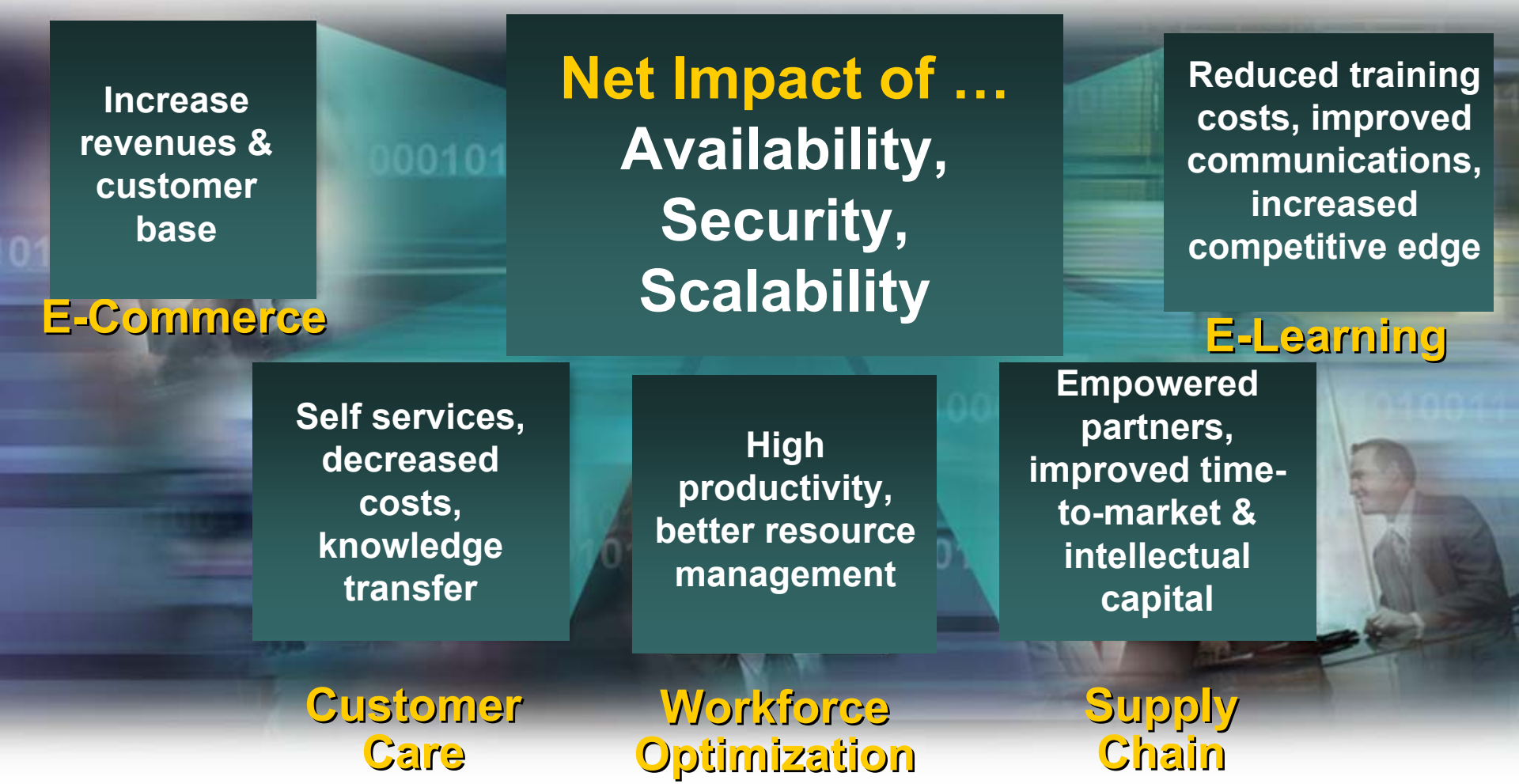
Content Delivery Networks

Nick Di Pietro, SE Toronto

Agenda:

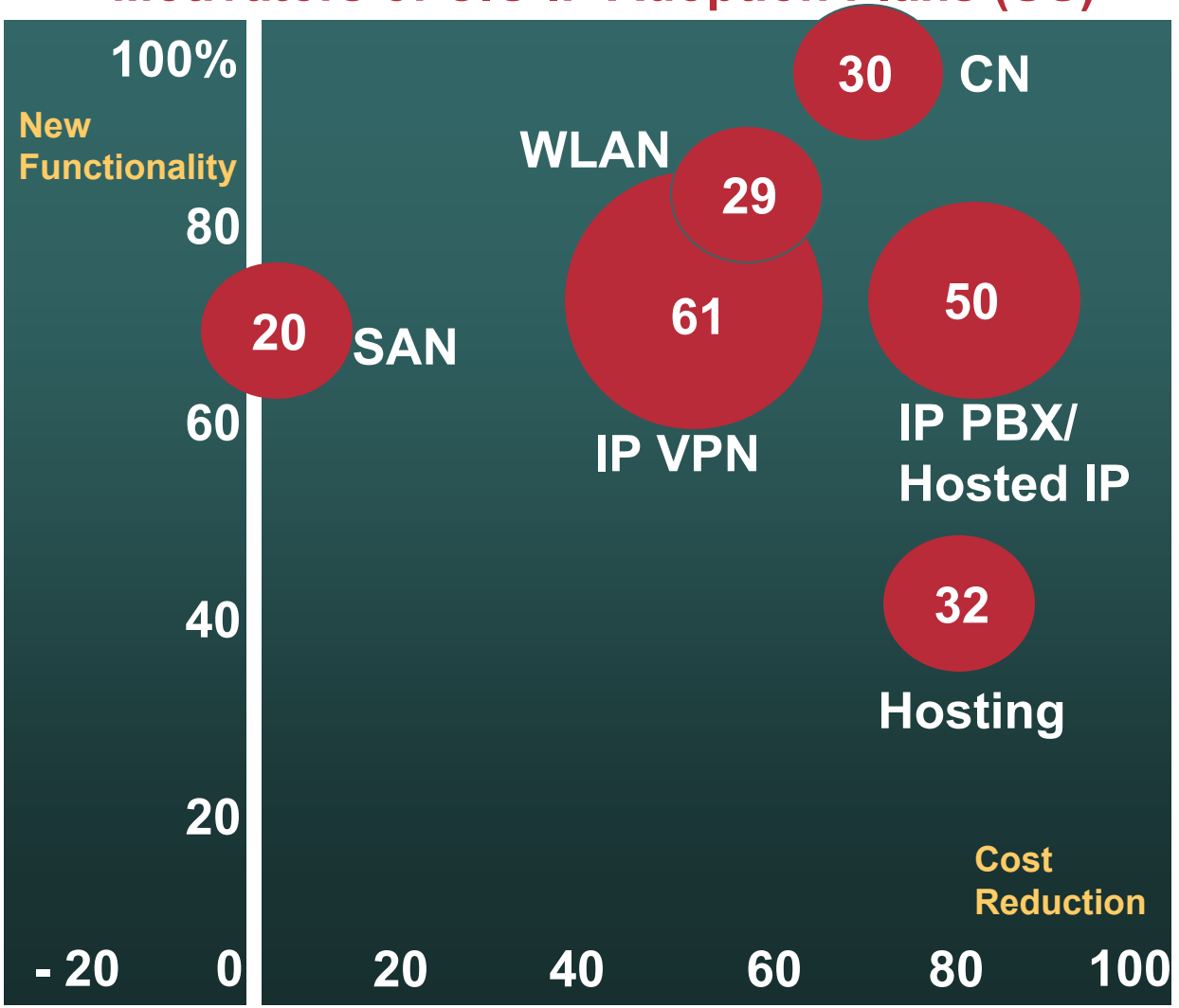
- Introduction to Content Networking
- Web Caching
- Content Delivery
- Streaming
- Security
- Conclusion

E-Business Opportunities and Network Requirements



Content Delivery is a Strategic Ingredient of E-Business Initiatives

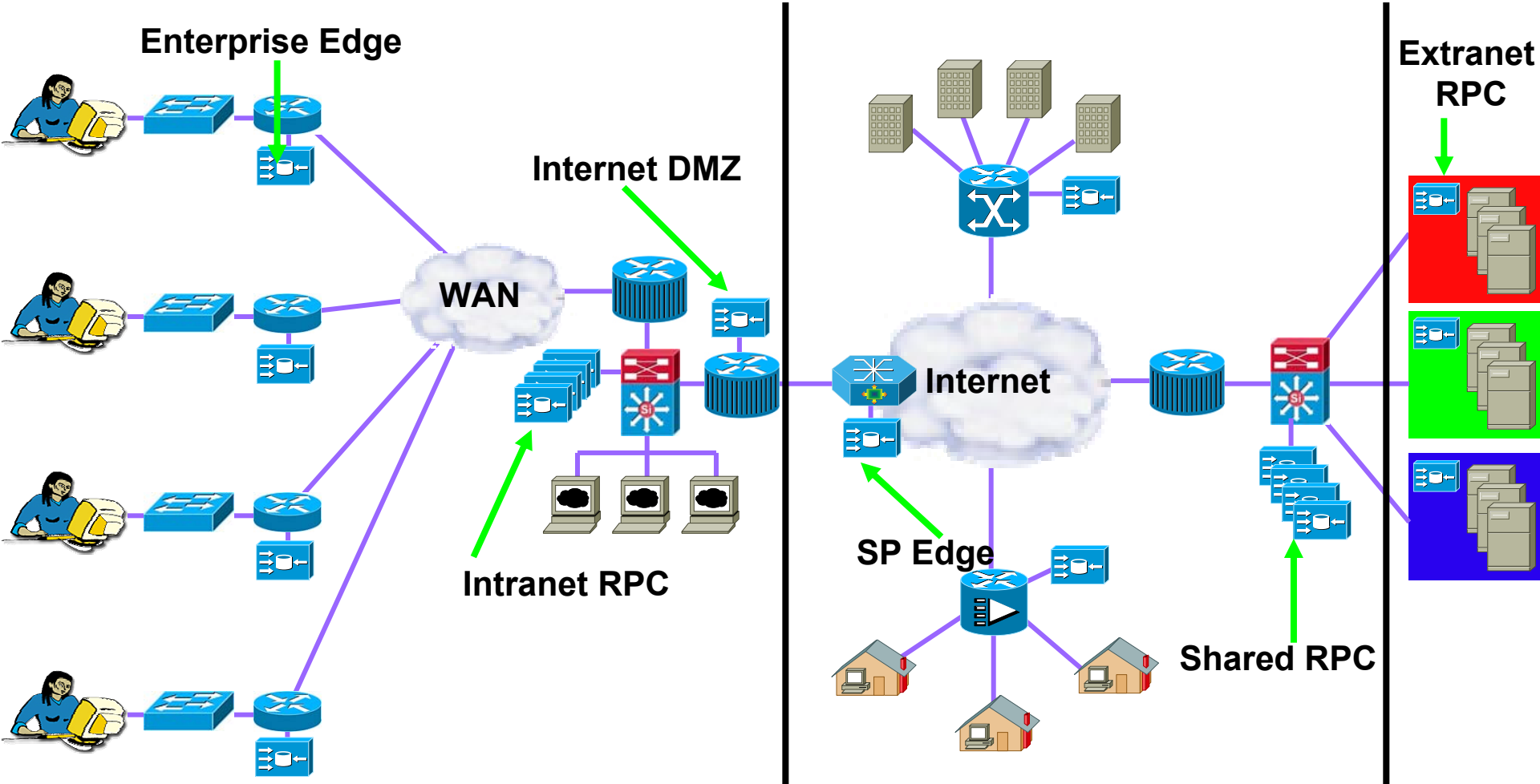
- **IBSG survey of 521 IT decision makers in Americas & EMEA globally (Jan/Feb 02)**
- **Expected benefits from new technology investments**
  - **Cost reduction**
  - **New network services**
- ***(% of CIOs planning to use IP products to support e-solutions >70%)***



Protocols, Technologies, and Terms What Is Content?

"Content is any file or stream delivered by a server that is acquired with HTTP, HTTPS, FTP, TFTP, RTSP, NFS, CIFS, and/or MMS."

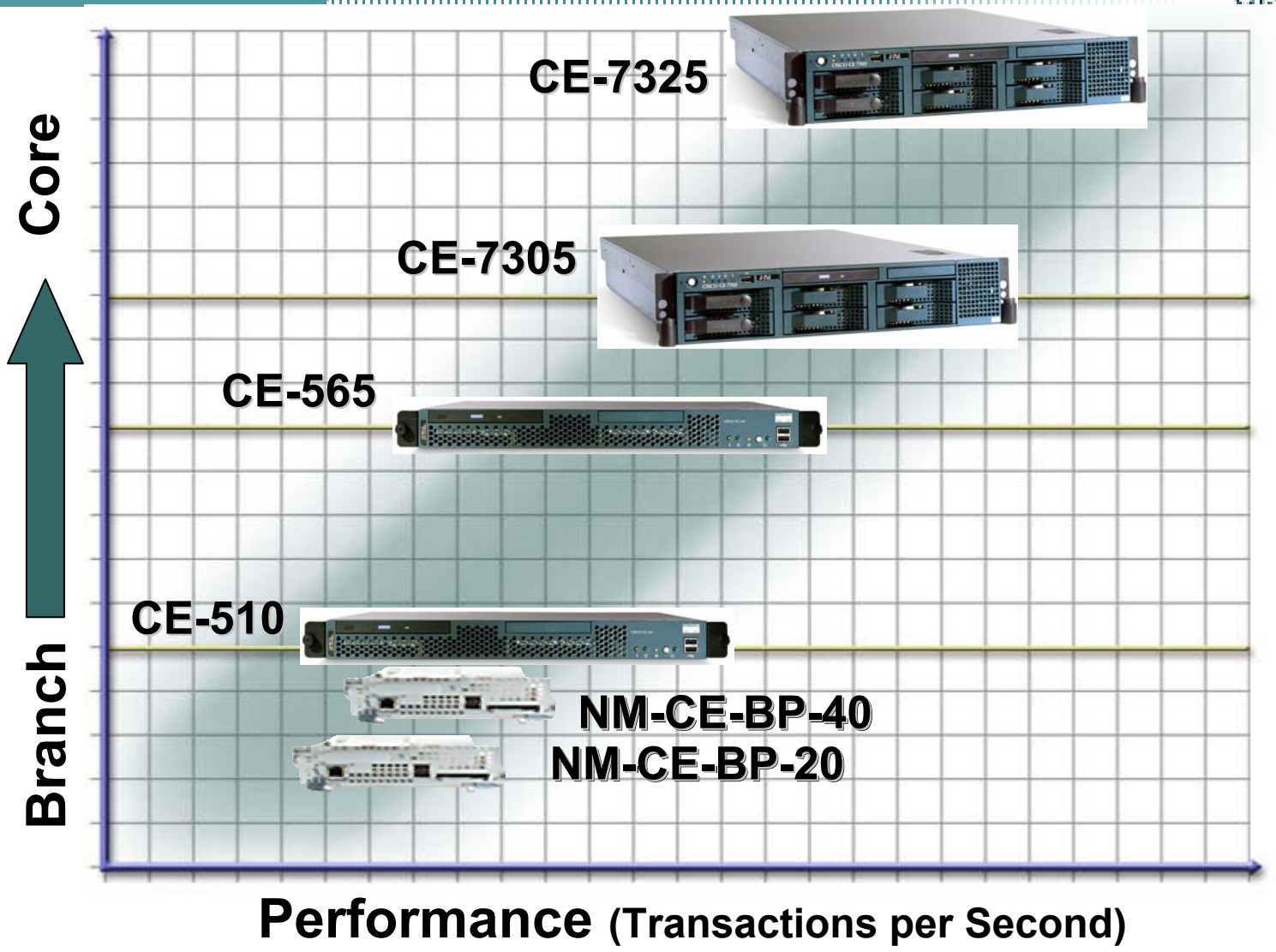
Many locations/applications for CDN:



Protocols, Technologies, and Terms CDN Terms

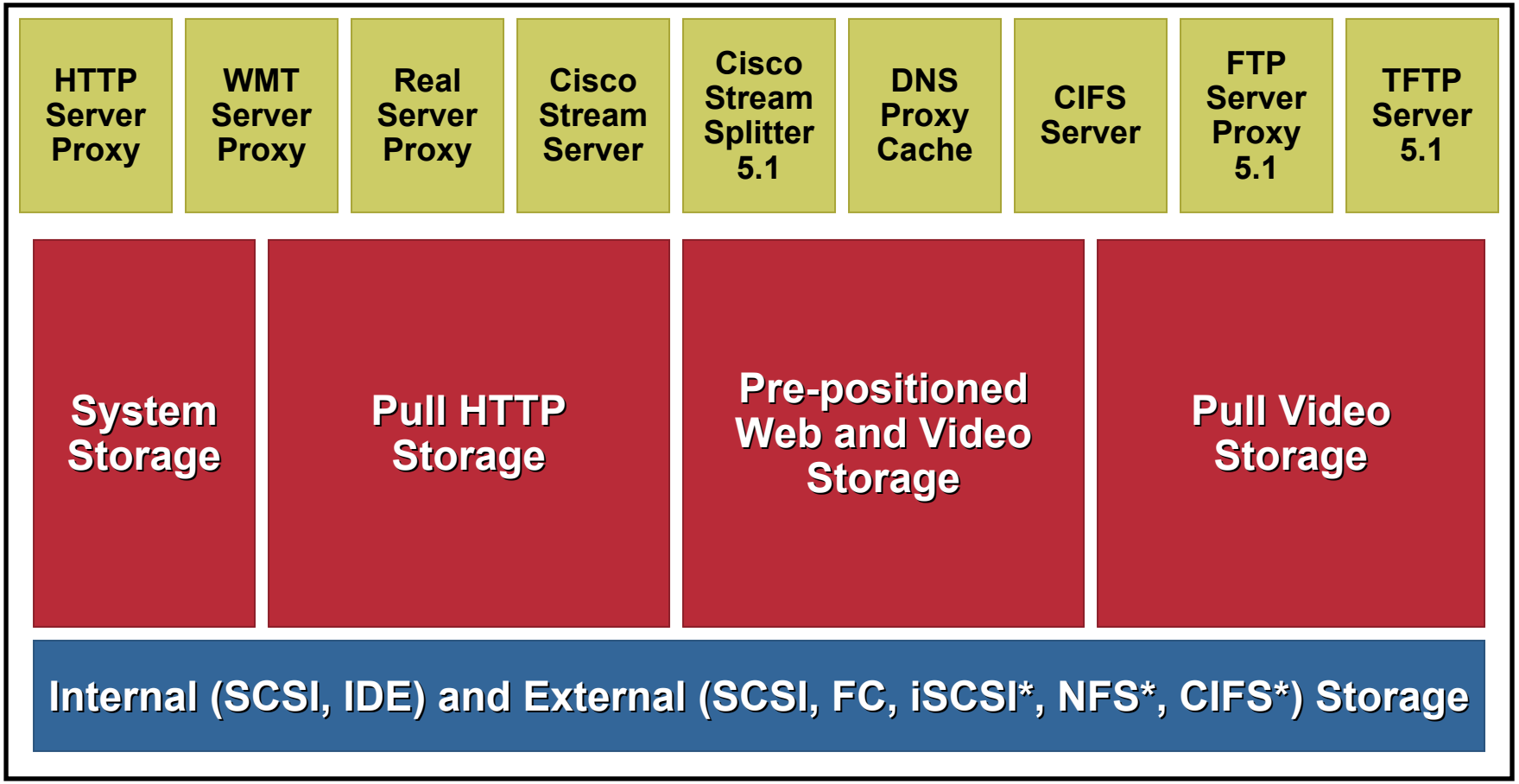
- Edge Delivery—Delivery of content local to the requestor avoiding network bottlenecks
- Client—Content requestor
- Server—Content sender or originator
- Proxy—Server to the actual client and client to the actual server
- Webcast—Live video stream originating on the Internet
- Web protocols—HTTP, HTTPS, FTP, TFTP
- Video protocols—RTSP, MMS
- Storage—NFS, CIFS/SMB
- Broadcast—Sent to all potential viewers
- Multicast—Subset of broadcast
- Near VOD—requests grouped and started at same time

Content Engine Hardware

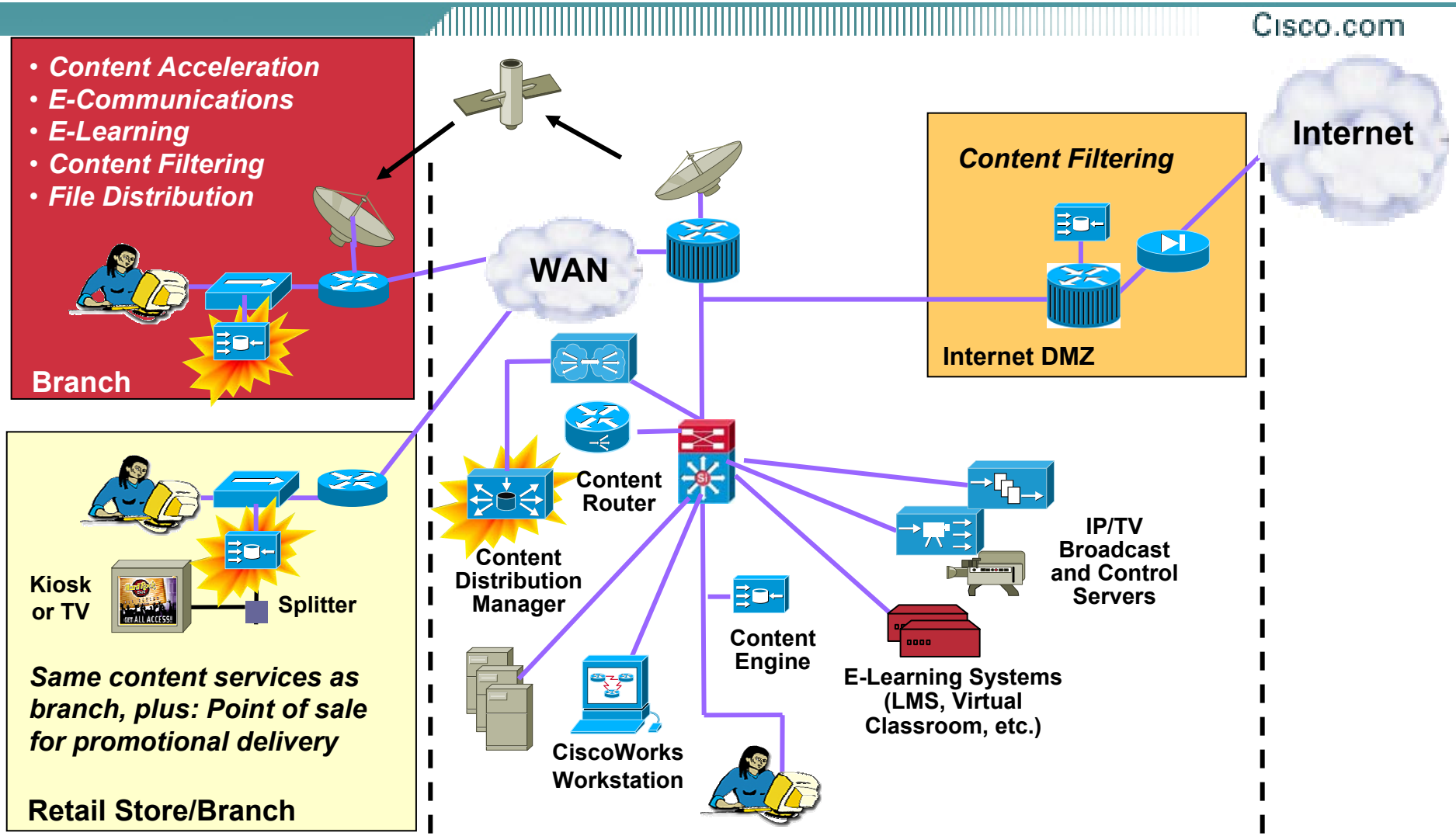


Content Engine Software: ACNS

Application and Content Networking Software

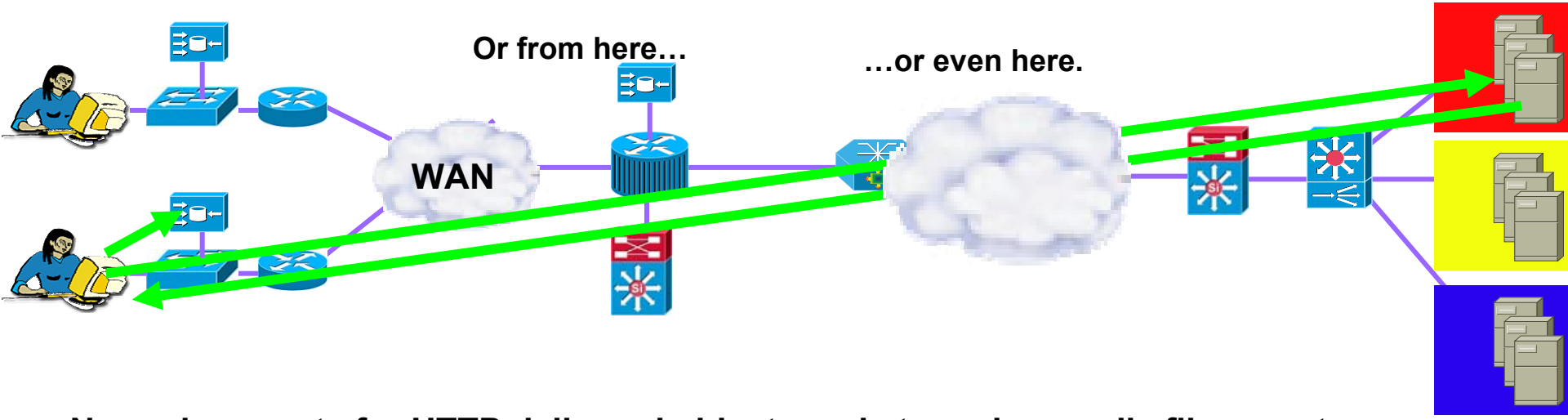


CEs at HQ and Network Edge Add a CDM, Creates a CDN



Web Caching

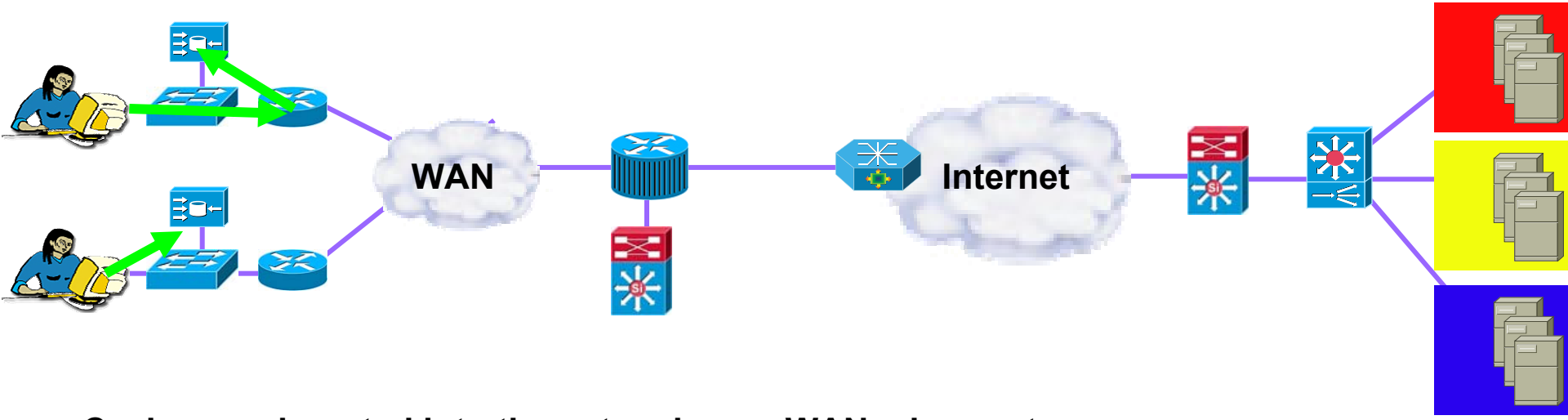
What does Caching do?



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

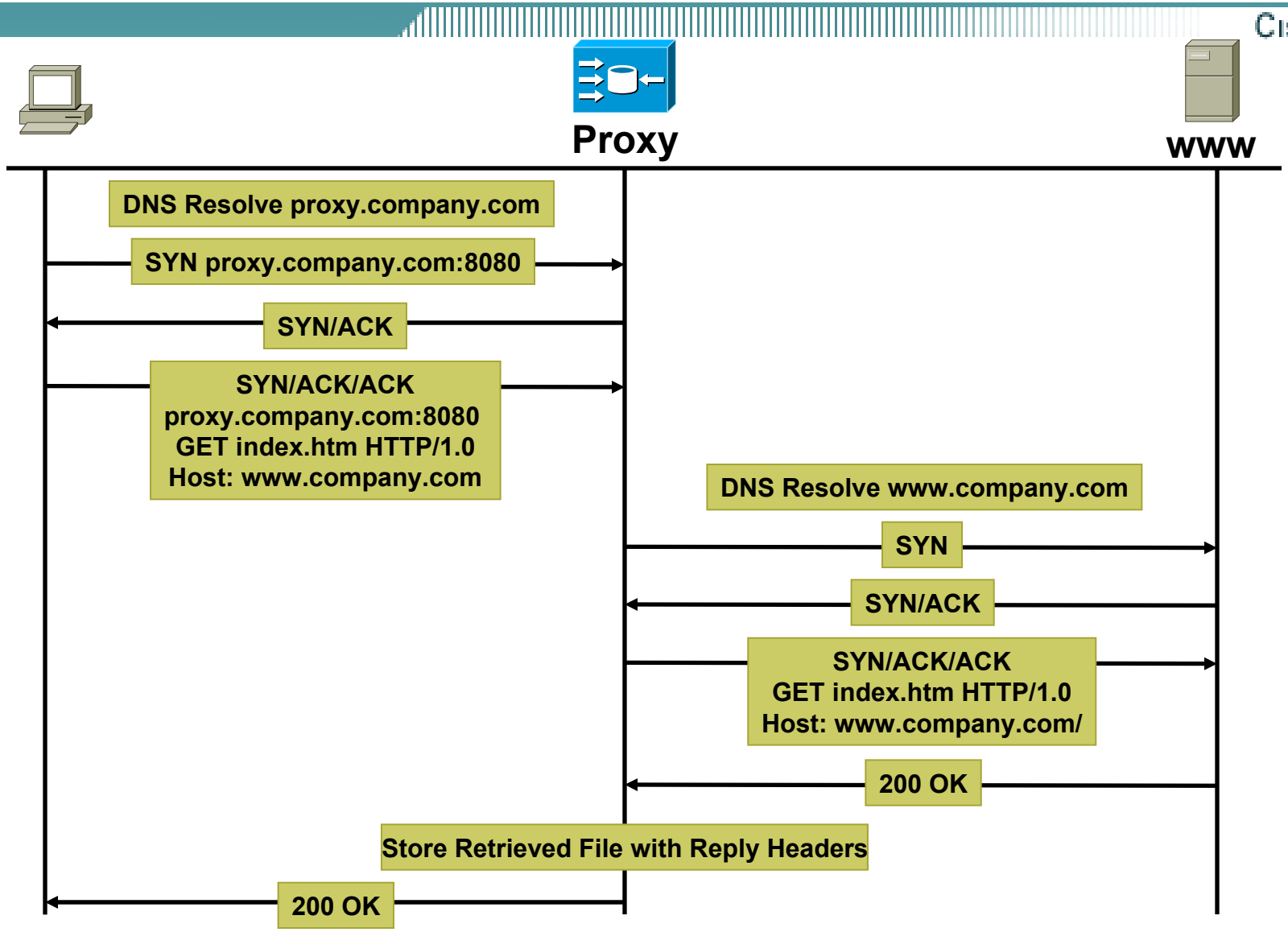
Caching delivers the object to the user from the closest site that has the content the user is requesting

Caching Implementations: Proxy vs. Transparent



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

What Is a Proxy Web Cache?

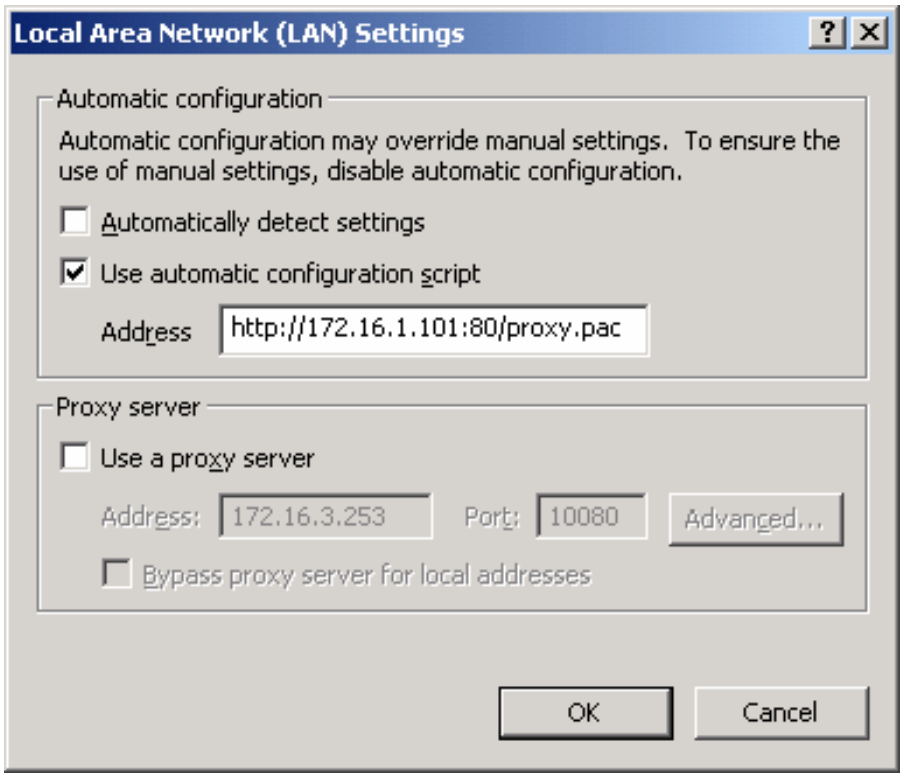


Proxy Auto Configuration (PAC) What Is a PAC?

- Proxy Auto Configuration file
- Centralized managed script
- Instructs browser to proxy by default
- Identifies domains for direct HTTP requests
- Identifies destination IP address for direct HTTP requests
- Provides an ordered list of browser proxies
- Browser polls proxies in list for availability

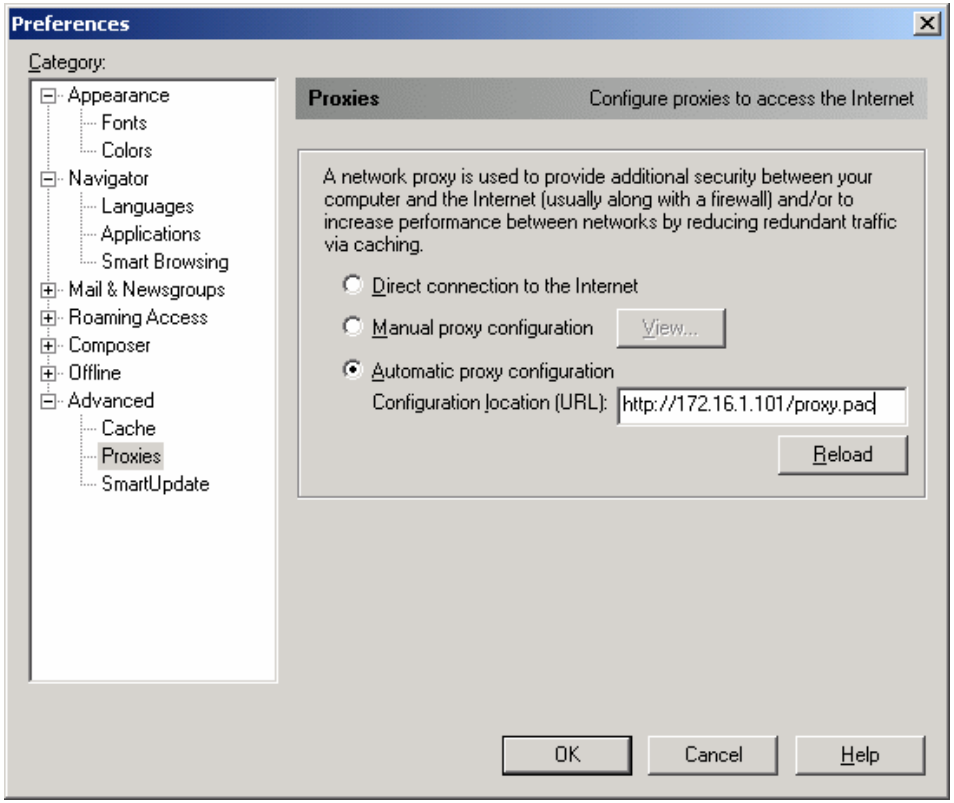
Proxy Automatic Configuration (PAC) MSIE Settings

- **Tools/Internet Options/ Connections/ LAN Settings**



Proxy Automatic Configuration (PAC) Netscape Settings

- **Edit/Preferences**



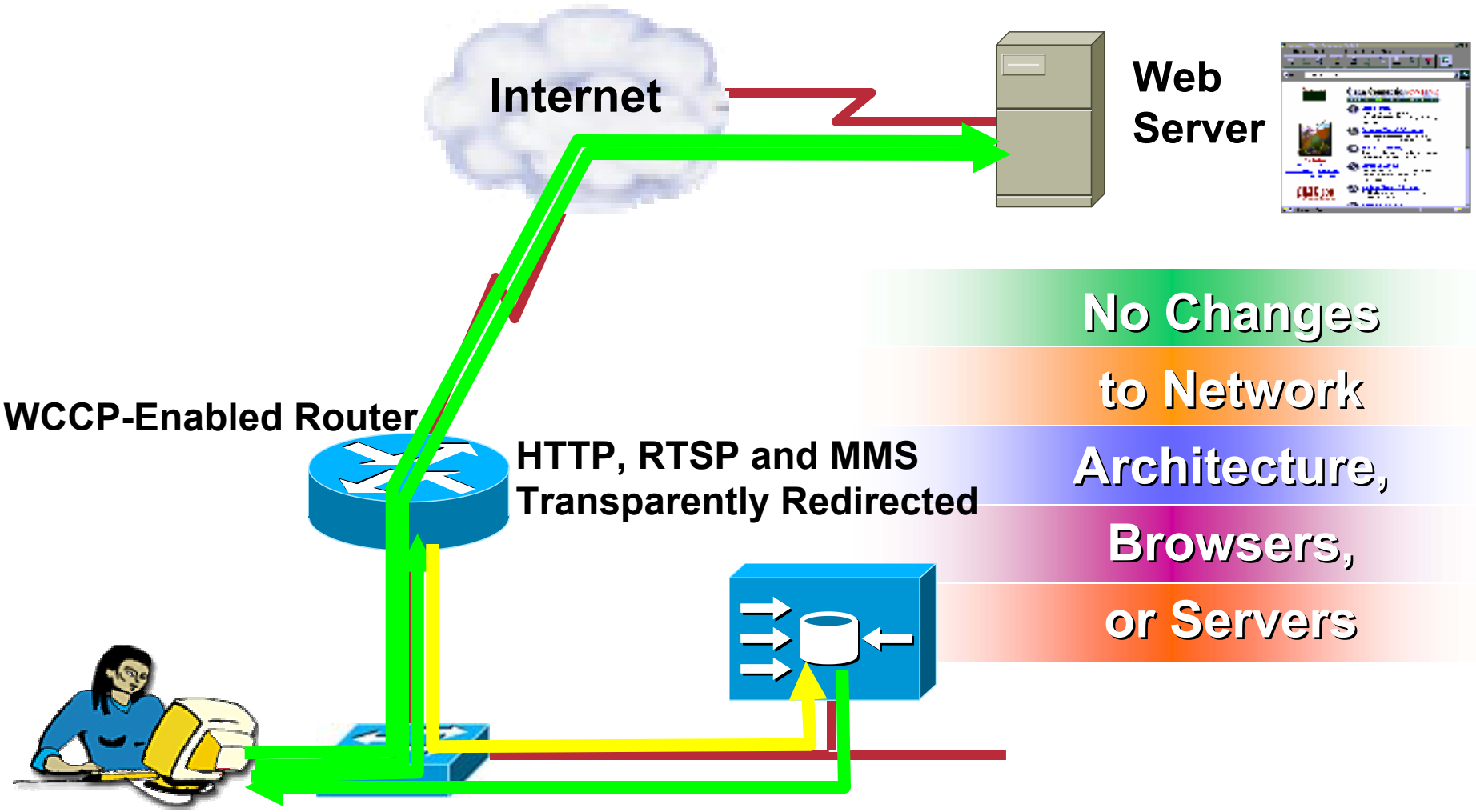
Proxy Automatic Configuration (PAC) Example


```
// proxy.pac for Company
// http://server.company.com/proxy.pac

function FindProxyForURL(url, host)
   {
          if (isPlainHostName(host)||
           shExpMatch(host, "*.company.com")||
           shExpMatch(host, "192.168.*.*")||
           shExpMatch(host, "172.16.*.*")||
           shExpMatch(host, "10.*.*.*"))
               return "DIRECT";
       else
       {
              return "PROXY proxy1.company.com:8080; PROXY
  proxy2.company.com:8080; PROXY proxy3.company.com:8080";
       }

   }
```

Exceptions No Proxy

Ordered Proxy List Returned

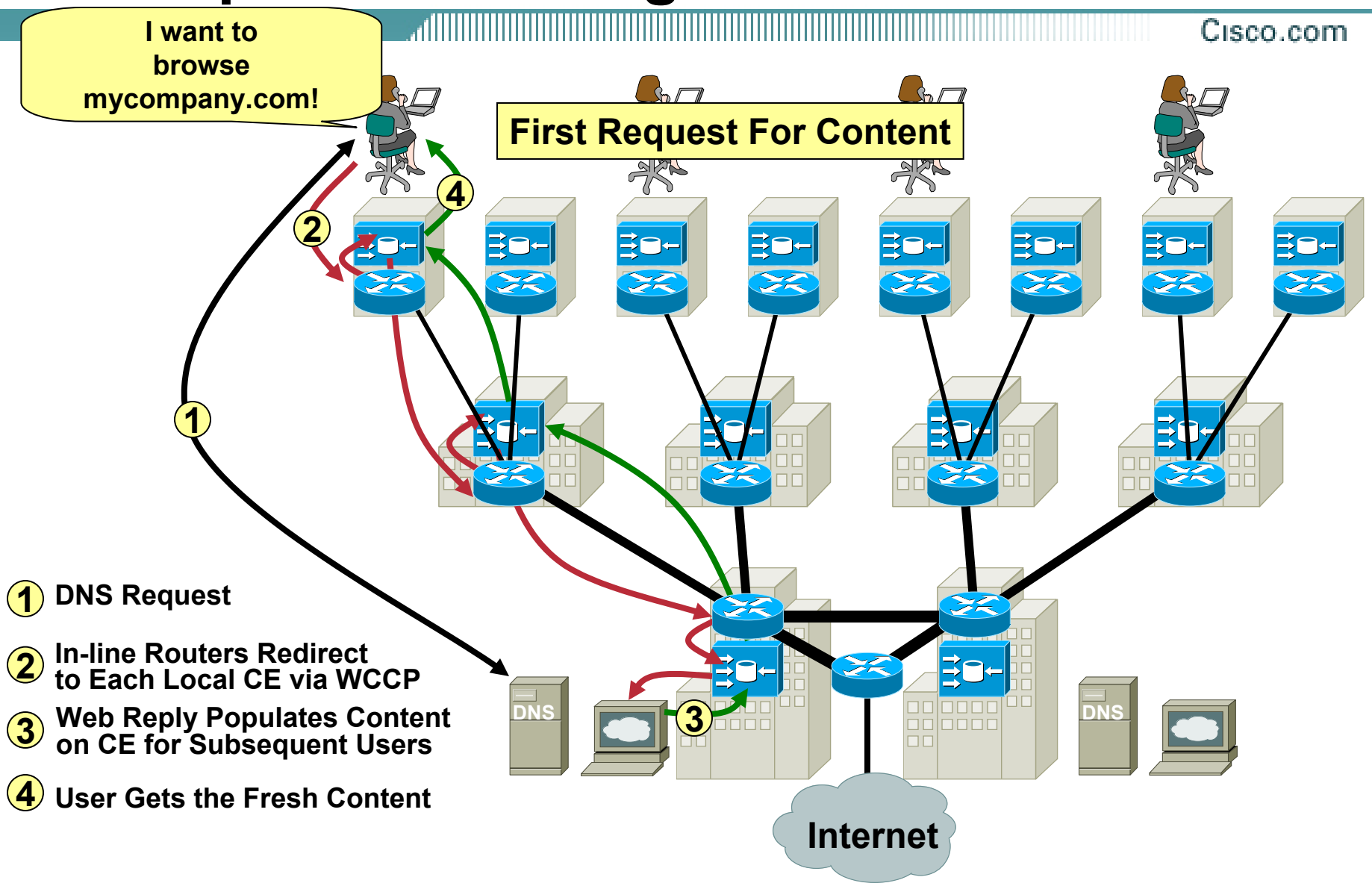
What is a Transparent Web Cache?



WCCP Introduction

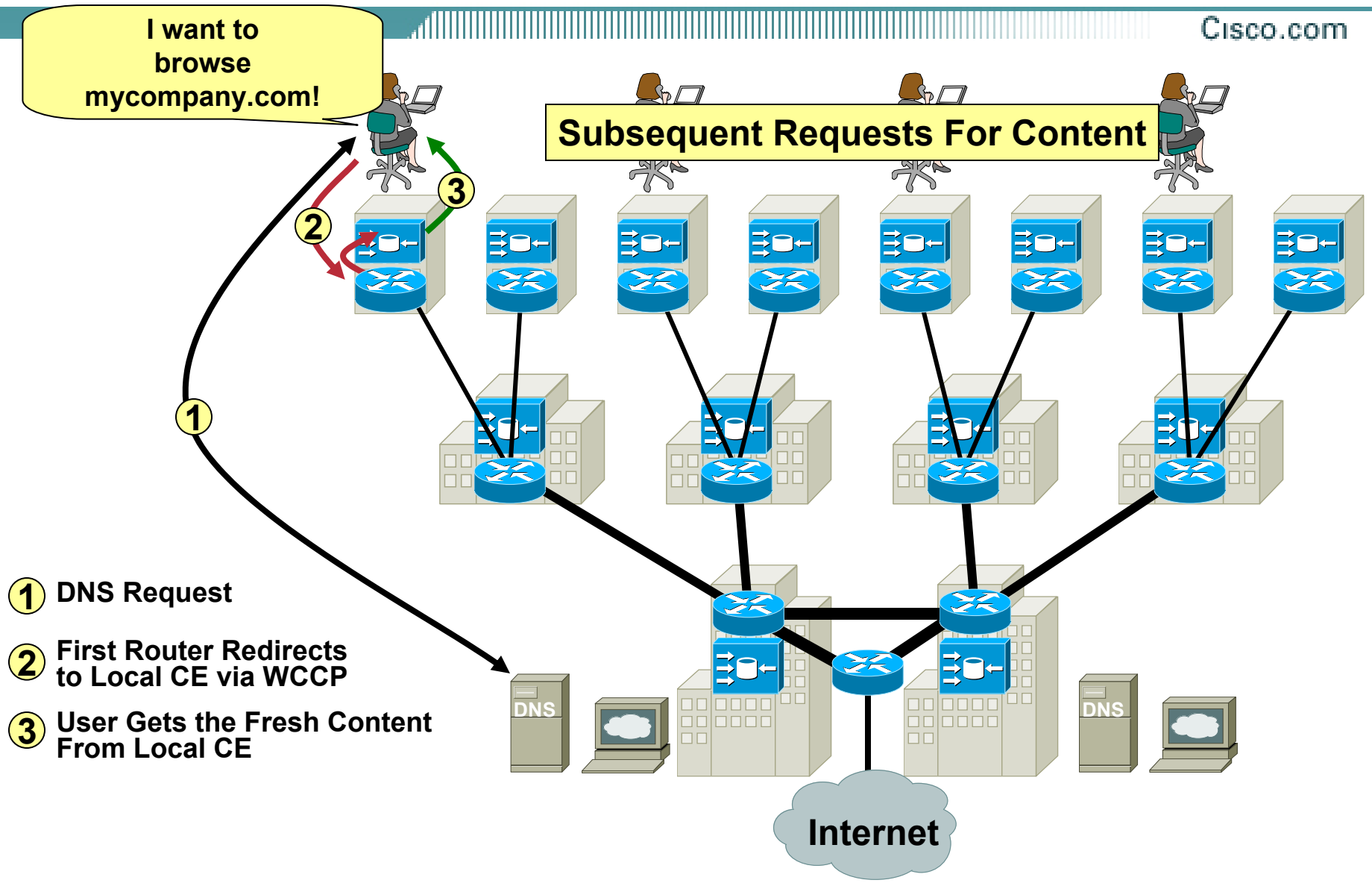
- Application Request Routing Technology introduced in 1997
- Integration with Cisco routers
- Intercepts application requests and directs them to local application server on a TCP/UDP port
- Redirects traffic flows (to CEs) in real-time
- Features
  - Load-balancing
  - Scaling
  - Fault tolerance
  - Service-assurance (failsafe)
  - Transparency
  - Bypass option

Transparent Caching with WCCP



1. DNS Request
2. In-line Routers Redirect to Each Local CE via WCCP
3. Web Reply Populates Content on CE for Subsequent Users
4. User Gets the Fresh Content

Transparent Caching with WCCP (Cont'd)



1. DNS Request
2. First Router Redirects to Local CE via WCCP
3. User Gets the Fresh Content From Local CE

WCCP Versions

- WCCPv1 spec released as an IETF Internet-Draft

  draft-forster-wrec-wccp-v1-00.rtf

- WCCPv2 spec released as an IETF Internet-Draft

  draft-wilson-wrec-wccp-v2-00.rtf

- WCCPv2 is licensed

WCCP Overview

- Communication protocol between router and cache on UDP port 2048, GRE encapsulated
- Router and CE communicate on well known service number between 0 and 100 (similar to port)
- CE transmits keep-alive every 10 seconds with 30 second hold-down
- WCCP router tells “lead” CE that a CE is down and to reassign the IP address buckets
- No return HTTP data is transmitted in WCCP

WCCP
Specific Implementations

- WCCPv1—the original
- WCCPv2 (first round—Cisco IOS® 12.0(3)T) Output Feature and CEF
- WCCPv2 (second round—Cisco IOS 12.0(11)S) Input Feature and dCEF
- WCCPv2 Layer 2 Redirection on Catalyst® 6000 series—Cisco IOS 12.1(2)E

WCCP Version 2

- Transparent caching
- Authentication bypass*
- MD5 authentication support*
- Multi-home router support*
- Overload bypass*
- Reverse-Proxy support*

* Requires Cisco IOS Release 12.0(3)T or Later

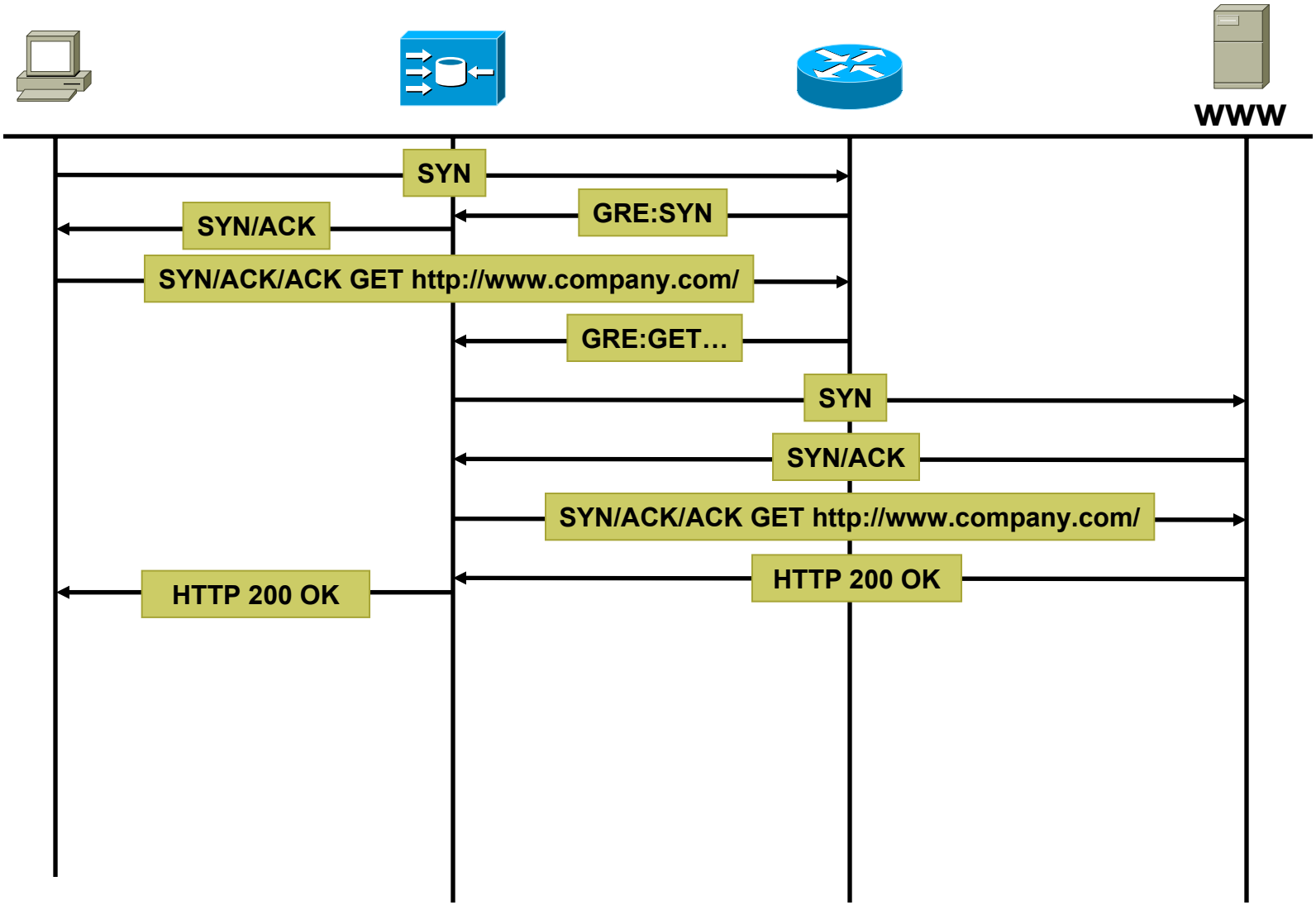
WCCP
Version 2 Enhancements

- Announced late 1998
- Integrated into Cisco IOS 12.0(3)T
- WCCPv2 supports any protocol/port
- Lead CE instructs router what to intercept and how to load-balance it
- Supports flows being re-inserted back into original traffic path
- Supports up to 32 routers and 32 caches in the same “service” (WCCPv1 supports only 1 router)

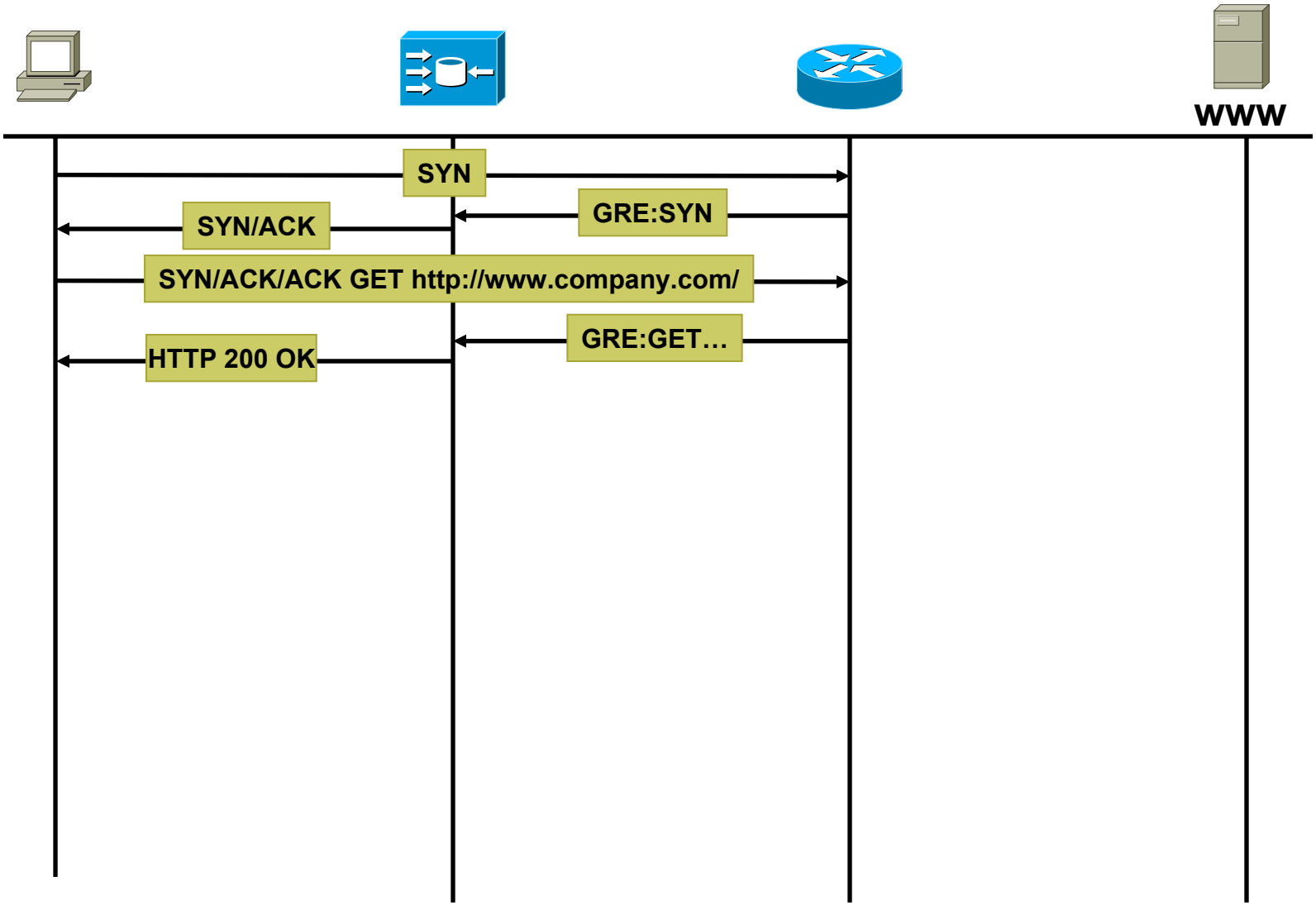
WCCP
Version 2 Enhancements (Cont.)

- WCCPv2 enables “Advanced Transparency” with negotiated hash and forward methods
- MD5 Authentication of Service Cluster
- 12.0(4)T—CEF Switched
- 12.0(5)T—version can be selected between WCCPv1 and WCCPv2
- 12.1(3)T—WCCP Redirection on Inbound Interfaces

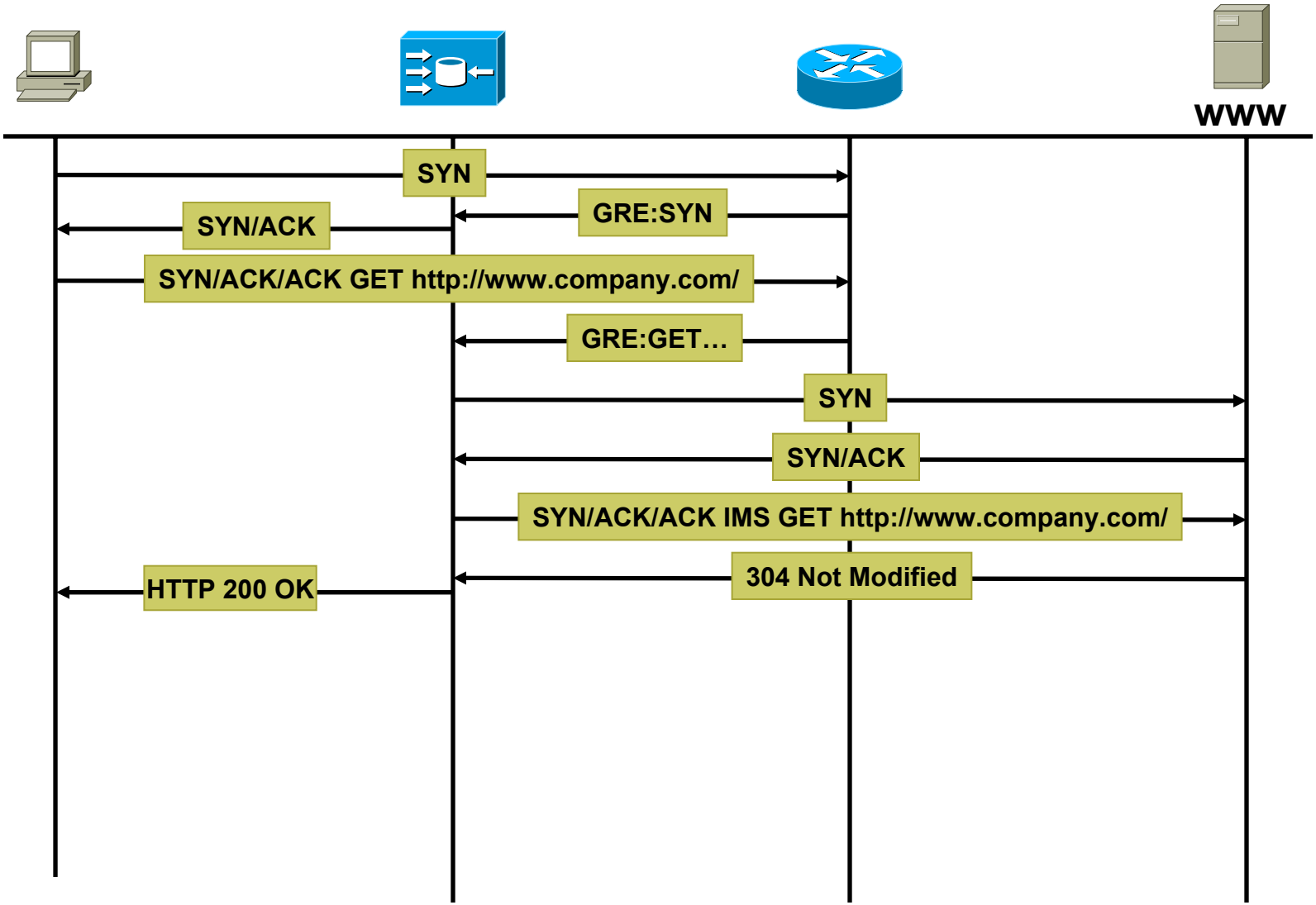
WCCP
HTTP Object Miss



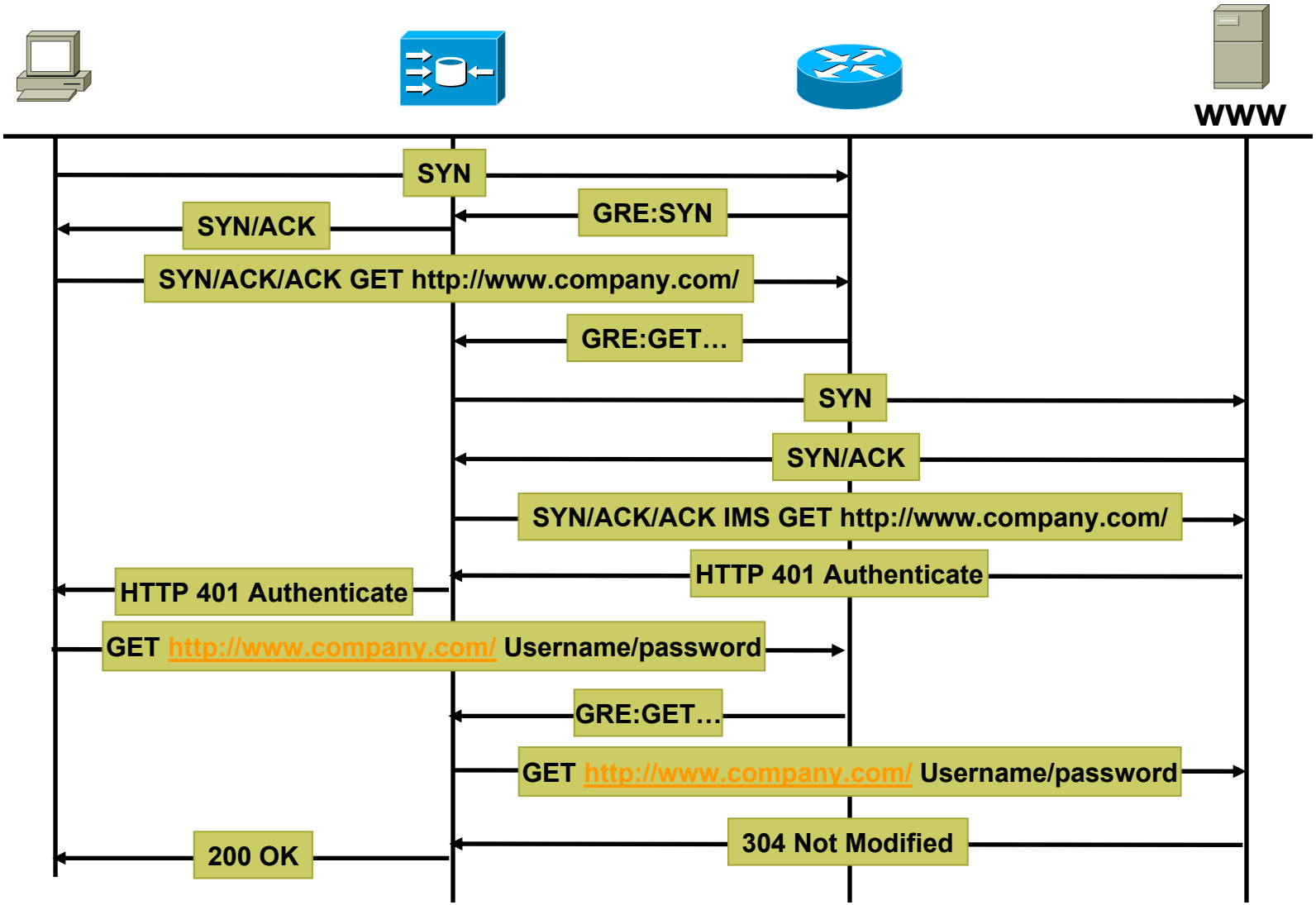
WCCP
HTTP Object Hit



WCCP
HTTP Object TCP_REFRESH_HIT



WCCP
HTTP Object Requiring Authentication



WCCP Services

IOS—ip wccp	CE—wccp
ip wccp 53	DNS UDP (port 53)*
ip wccp 70	wccp https (port 443)*
ip wccp 80	wccp rtsp (port 554)
ip wccp 81/82	wccp wmt (mmst/mmsu port 1755)
ip wccp web-cache	wccp web-cache (http port 80)
ip wccp 90-97	service-number (up to 8 ports each)
ip wccp 98	custom-web-cache (any single port)
ip wccp 99	reverse-proxy on port 80

Service Number Used by CE to Register Interesting Protocol/Ports
IOS CLI uses service number
CE CLI uses service name

WCCP
Router Configuration

- **Global**
  - **ip wccp web-cache password cisco**
  - **ip wccp 80 password cisco**
  - **ip wccp 81 password cisco**
  - **ip wccp 82 password cisco**
  - **ip wccp 98 password cisco**
- **Interface Ethernet/Serial**
  - **ip wccp web-cache redirect in/out**
  - **ip wccp 80 redirect in/out**
  - **ip wccp 81 redirect in/out**
  - **ip wccp 82 redirect in/out**
  - **ip wccp 98 redirect in/out**

WCCP
Router View


```
internet-rtr#show ip wccp web-cache
Global WCCP information:
    Router information:
        Router Identifier:                  172.16.1.254
        Protocol Version:                   2.0

    Service Identifier: web-cache
        Number of Cache Engines:            1
        Number of routers:                  1
        Total Packets Redirected:           547
        Redirect access-list:               -none-
        Total Packets Denied Redirect:      0
        Total Packets Unassigned:           0
        Group access-list:                  -none-
        Total Messages Denied to Group:     0
        Total Authentication failures:      0
```

WCCP
CE Configuration

Cisco.com

```
core-ce(config)#wccp ?
  custom-web-cache      Custom web caching service
  flow-redirect         Redirect moved flows
  home-router           WCCP Version 1 Home Router Ip address
  media-cache           Media caching service
  port-list             Port list for use in WCCP services
  reverse-proxy         Reverse Proxy web caching service
  router-list           Router List for use in WCCP services
  service-number        WCCPv2 service number
  shutdown              Wccp Shutdown parameters
  slow-start            accept load in slow-start mode
  version               WCCP Version Number
  web-cache             Standard web caching service
  wmt                   Windows media caching service
core-ce(config)#wccp
```

WCCP
CE Configuration


```
wccp router-list 1 172.16.1.254

wccp web-cache router-list-num 1 password
  cisco

wccp media-cache router-list-num 1 password
  cisco

wccp wmt router-list-num 1 password cisco

wccp custom-web-cache router-list-num 1 port
  8080 password cisco

wccp version 2

For L2 redirection on the Catalyst 6500

wccp web-cache router-list-num 1 password
  cisco l2-redirect
```

WCCP
CE View


```
ce#sho wccp gre
Transparent GRE packets received:           28401
Transparent non-GRE packets received:       72243
Transparent non-GRE packets passed through: 72243
Total packets accepted:                     27886
Invalid packets received:                   0
Packets received with invalid service:      0
Packets received on a disabled service:     0
Packets received too small:                 0
Packets dropped due to zero TTL:            0
Packets dropped due to bad buckets:         0
Packets dropped due to no redirect address: 0
Connections bypassed due to load:           0
Packets sent back to router:                515
Packets sent to another CE:                 0
GRE fragments redirected:                   0
Packets failed GRE encapsulation:           0
Packets dropped due to invalid fwd method:  0
Packets dropped due to insufficient memory: 0
Packets received with client IP addresses:  0
```

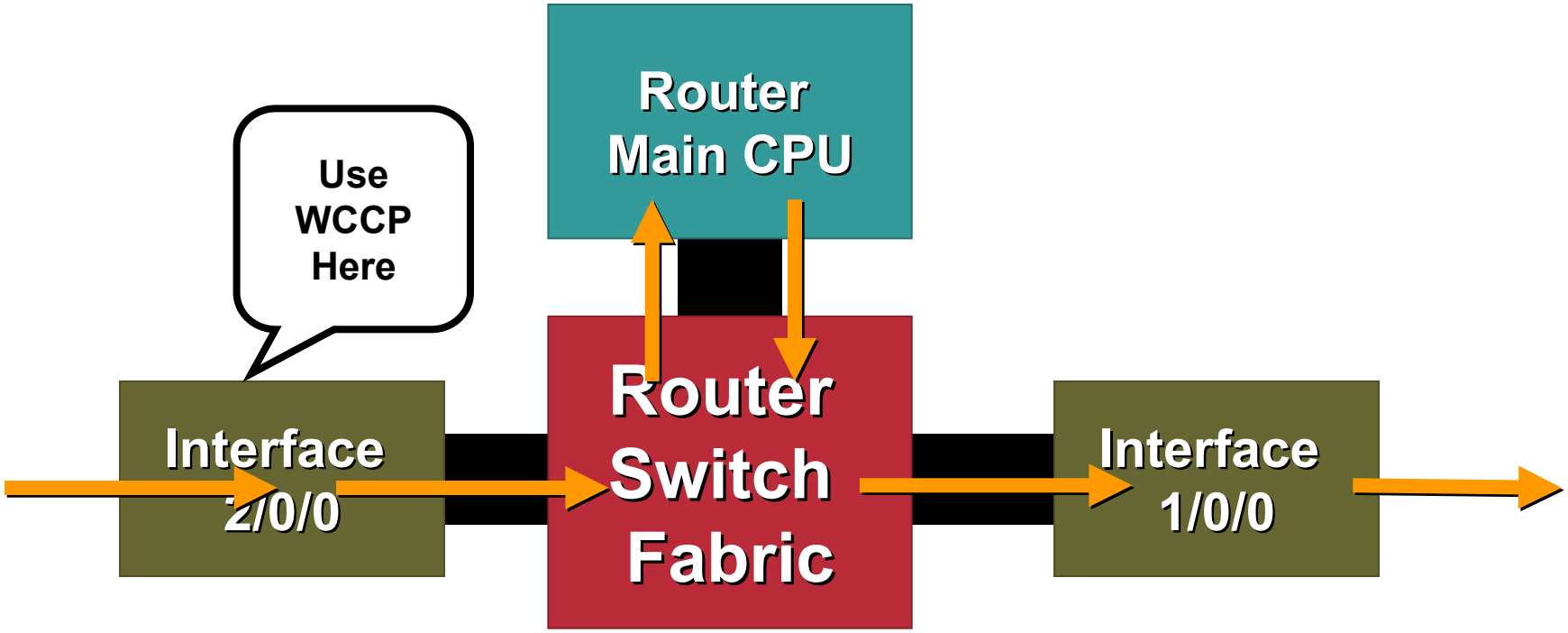
WCCP Switching Paths

- CEF, dCEF, Fast and Process switching
- WCCP will not cause the switching level to be decreased to “next slowest” level (but other features may)
- Use CEF on all platforms (except 75xx)
- WCCPv2 in CEF on Cisco IOS 12.0T, 12.1 mainline, 12.1T, 12.2, 12.2T
- Use dCEF (Distributed Cisco Express Forwarding) on 75xx routers
- WCCP in dCEF on Cisco IOS 12.XS only

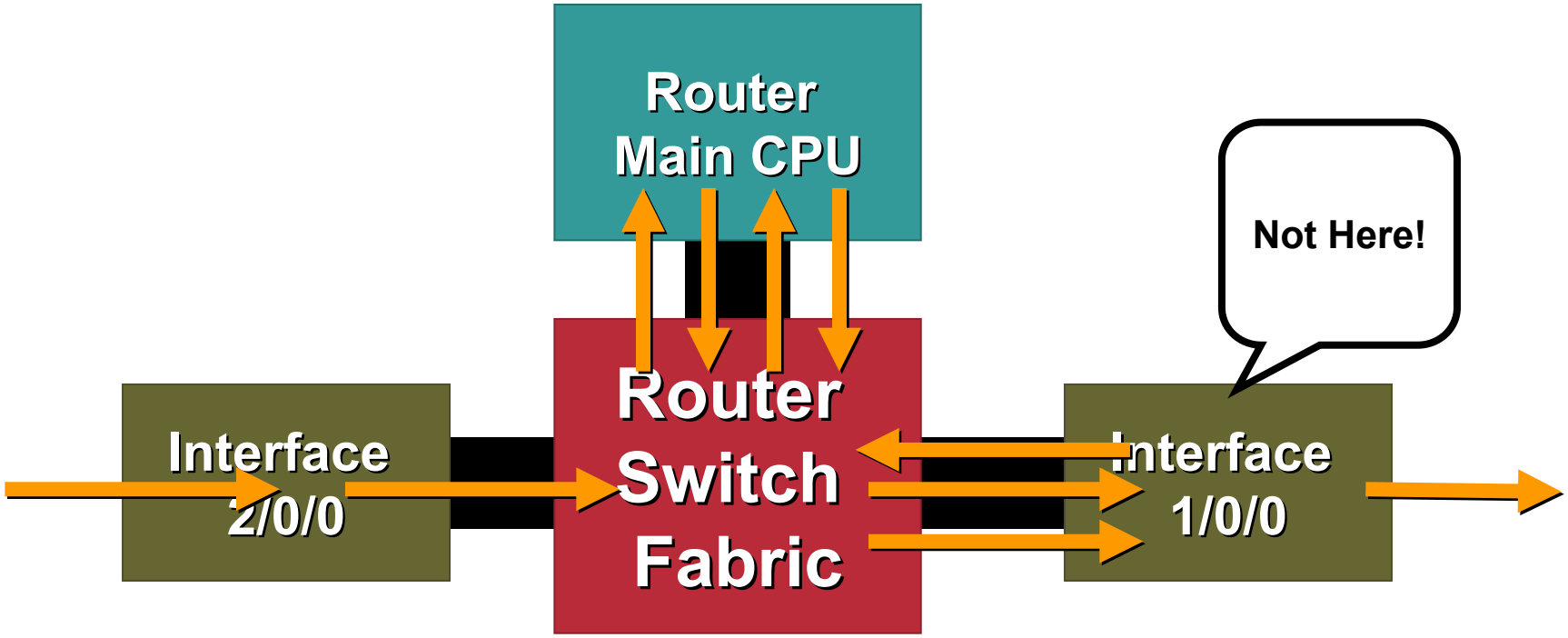
WCCP
Ingress vs. Egress Interception

- WCCP can intercept on input-interface into router or output-interface out of router
- Input-based WCCP has less CPU impact—packet doesn't need to be switched "twice"
- Router supports explicit inclusion/exclusion from intercept based on input interface

WCCP
Switching: Ingress Interception



WCCP
Switching: Egress Interception



WCCP
GRE Redirect vs. L2 Rewrite

- **Generic Router Encapsulation (GRE) Redirect**
  - **GRE allows cache to be non-local**
  - **Not performed in hardware**
- **Layer 2 Rewrite**
  - **L2-redirect must be local**
  - **L2-redirect preferred for performance**

WCCP
Cisco IOS and Platform Support

- **Cisco IOS 11.1 and 11.2**
  - **WCCP version 1 introduced in IOS 11.1(14)CA on Cisco 7200 and 7500**
  - **WCCP version 1 ported from IOS 11.1(17)CA to 11.1(17)CC**
  - **Other platforms supported on IOS 11.2(13)P**
  - **WCCP Redirect list added in 11.1(18)CA and 11.2(12.4)P**
- **Cisco IOS 12.0**
  - **Support for WCCPv1**

WCCP
Cisco IOS and Platform Support (Cont.)

- **Cisco IOS 12.0T**
  - **12.0(1)T and 12.0(2)T only supports WCCPv1**
  - **12.0(3)T and 12.0(4)T only supports WCCPv2**
  - **12.0(5)T and above support both WCCPv1 and WCCPv2**
- **Cisco IOS 12.0S**
  - **Support for WCCPv1**
  - **Support for WCCPv2 in 12.0(11)S**
  - **CEF Distributed GRE used by Distributed WCCP in IOS 12.0(11)S**
  - **WCCPv2 input feature in IOS 12.0(11)S**
  - **WCCP BGP Policy propagation in IOS 12.0(11)S**

WCCP
IOS and Platform Support (Cont.)

- **Cisco IOS 12.1**

  Support for WCCPv1 and WCCPv2

- **Cisco IOS 12.1T**

  WCCPv2 Redirection on Inbound Interfaces in Cisco IOS 12.1(3)T

  This feature is available as well on Cisco IOS 12.0(11)S

- **Unsupported platforms**

  Cisco 700, 800* series

  Catalyst 8500, 2948G-L3/4908G-L3, 3550XL, 4500* series**

*Future support
**port 80 intercept only with EMI version

WCCP
Catalyst 6500

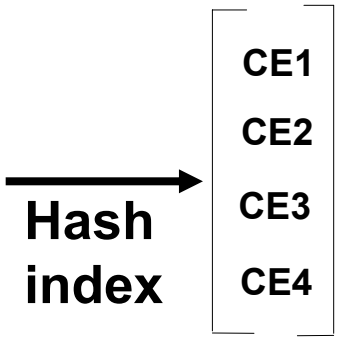
- **Switch integration and Layer 2 Redirection**
  - **Catalyst 6500 + PFC is the first implementation**
- **New WCCP assignment mechanism**
  - **Masking scheme for Layer 2 Redirection**
- **Different modes on Catalyst 6500 series**
  - **Basic on Supervisor I**
  - **Optimized on Supervisor I (Basic on Sup.II)**
  - **Hardware on Supervisor II**

WCCP Assignment Methods

- Per-service
- Hashing Scheme
- Masking Scheme (WCCP v2 Enhanced)

HASHING

XOR (IP_DA
IP_SA
port_DA
port_SA)



MASKING

IP_DA	IP_SA	L4_proto	port_DA	port_SA	
0…011	0…...0	1……….1	1……….1	0……….0	
xxxx00	xxxx	TCP	80	xxxx	CE1
xxxx01	xxxx	TCP	80	xxxx	CE2
xxxx10	xxxx	TCP	80	xxxx	CE3
xxxx11	xxxx	TCP	80	xxxx	CE4

WCCP
Catalyst 6500

- **Supervisor 1**
  - GRE redirect
    - WCCP flows in MSFC software
    - Max performance <1 Gbps
  - L2 redirect
    - WCCP flows are h/w accelerated
    - Max performance ~4 Gbps
- **Supervisor 2**
  - GRE redirect—same as Sup1
  - L2-redirect + XOR method
    - Max performance~4 Gbps
  - L2-redirect + Hash Mask method
    - Line-rate at 30M PPS and 256 Gbps

WCCP Deployments

- Deploy across edge in preference to core
- Use ingress-based WCCP over egress-based
- Use L2-redirect in preference to GRE
- Use hardware-supported methods where possible
- Caching may mean less packets thru router
- Place caches on client side of network to minimize client-side packets thru router

WCCP Implementations

- Use WCCP passwords to avoid Denial Of Service attack
- Do not register CE with router HSRP
- Use “ip cef” with late WCCP IOS releases
- Use “no ip cef” with earlier WCCP IOS releases
- Use “no wccp slow-start enable” for faster recovery
- Use WCCP redirect lists for trials to limit client or server population

WCCP
Monitoring and Troubleshooting

- **Content Engine**

  “show wccp routers” for registration

  “show wccp gre” for packet counts

  debug wccp …

- **Router**

  show ip wccp # for packet counts and authentication failures

  debug ip wccp

Content Delivery

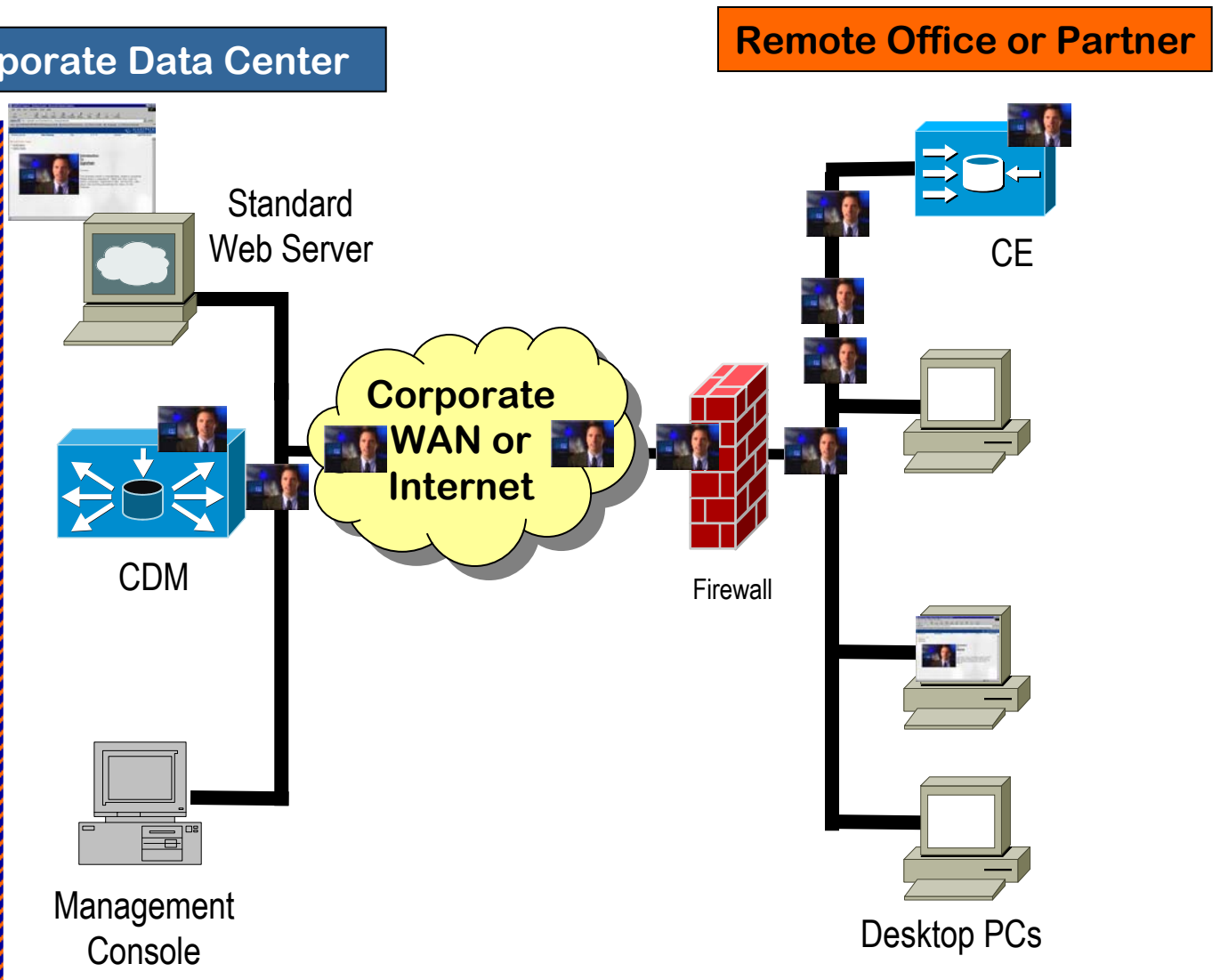
Corporate Communications Solution

- **What if you could extend the reach of video communications to all employees, partners, and stakeholders everywhere?**
  - **Do you see value in getting the same message to everyone everywhere anytime?**
  - **What if you could record all corporate communications and make it available for later viewing?**
  - **What if you could greatly reduce your travel budget?**
  - **What if anyone in your organization could watch any video conference from their desk?**

CDM and CE Setup

Set-up

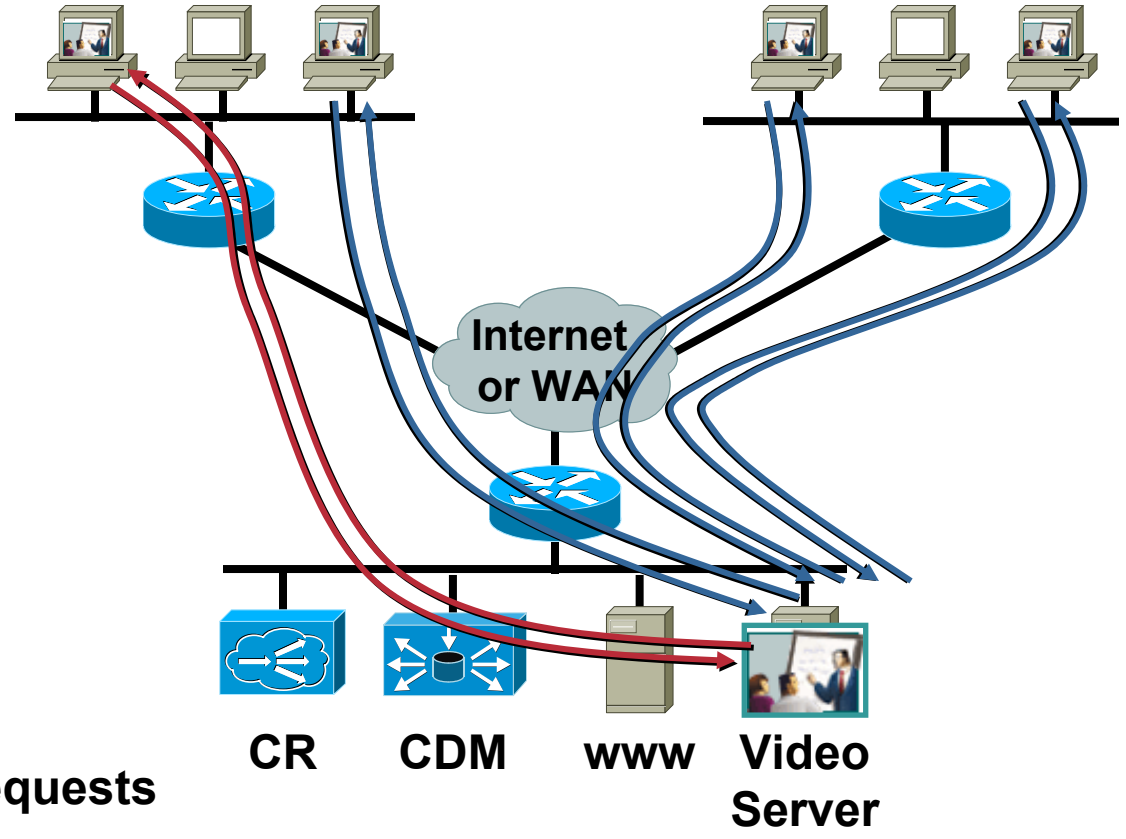
1. CDM Install
2. CE Install
3. CDM Channel Assignment
4. File Import
5. Copies from Web Server to closet CE
6. File Replication to all CEs



CDN File Replication

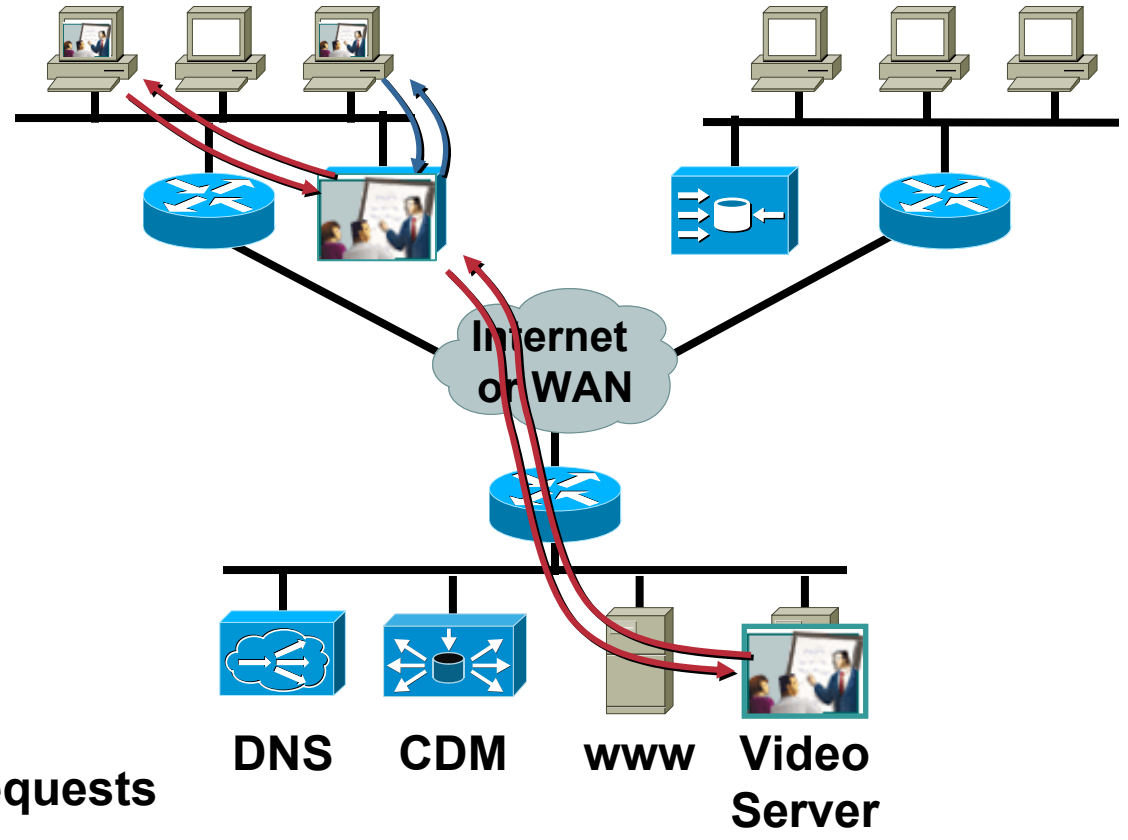
- Occurs from CDM to CE and CE to CE
- Efficient use of existing WAN and LAN architectures
- Fault-tolerant replication utilizing markers
  - File transfer disruptions resume at marker locations
  - Allows bandwidth settings to be set to zero for critical business times
  - Efficient data transfer for large files and/or small pipes
- Provides high level of fault tolerance compared to other methods such as FTP
- Optional replication with SSL

Video on Demand Without CEs



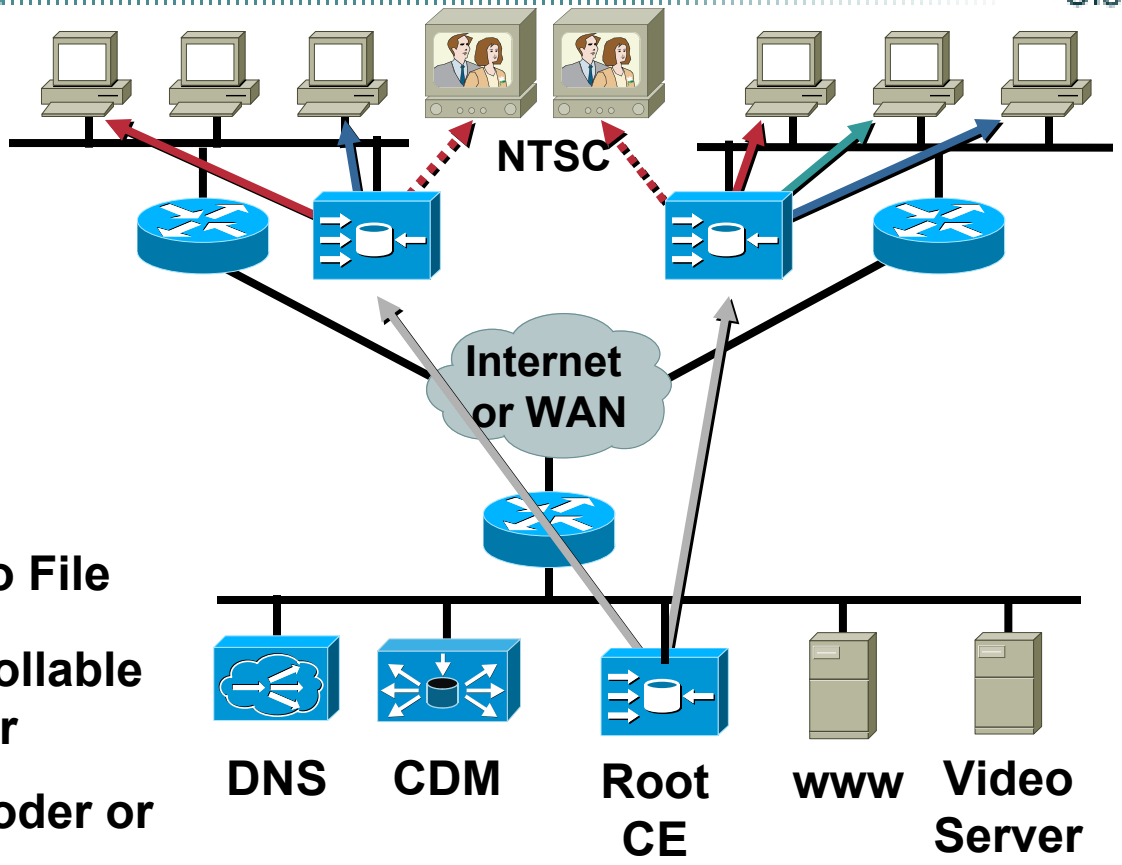
Separate Stream for Each Client across the WAN
Aggregate of All Clients Must Be Less than WAN Bandwidth

Video on Demand Pull Caching



Streamed Bandwidth Must Be Less than WAN Bandwidth
Unmanaged Intranet or Internet Sourced

Video on Demand Pre-Positioned



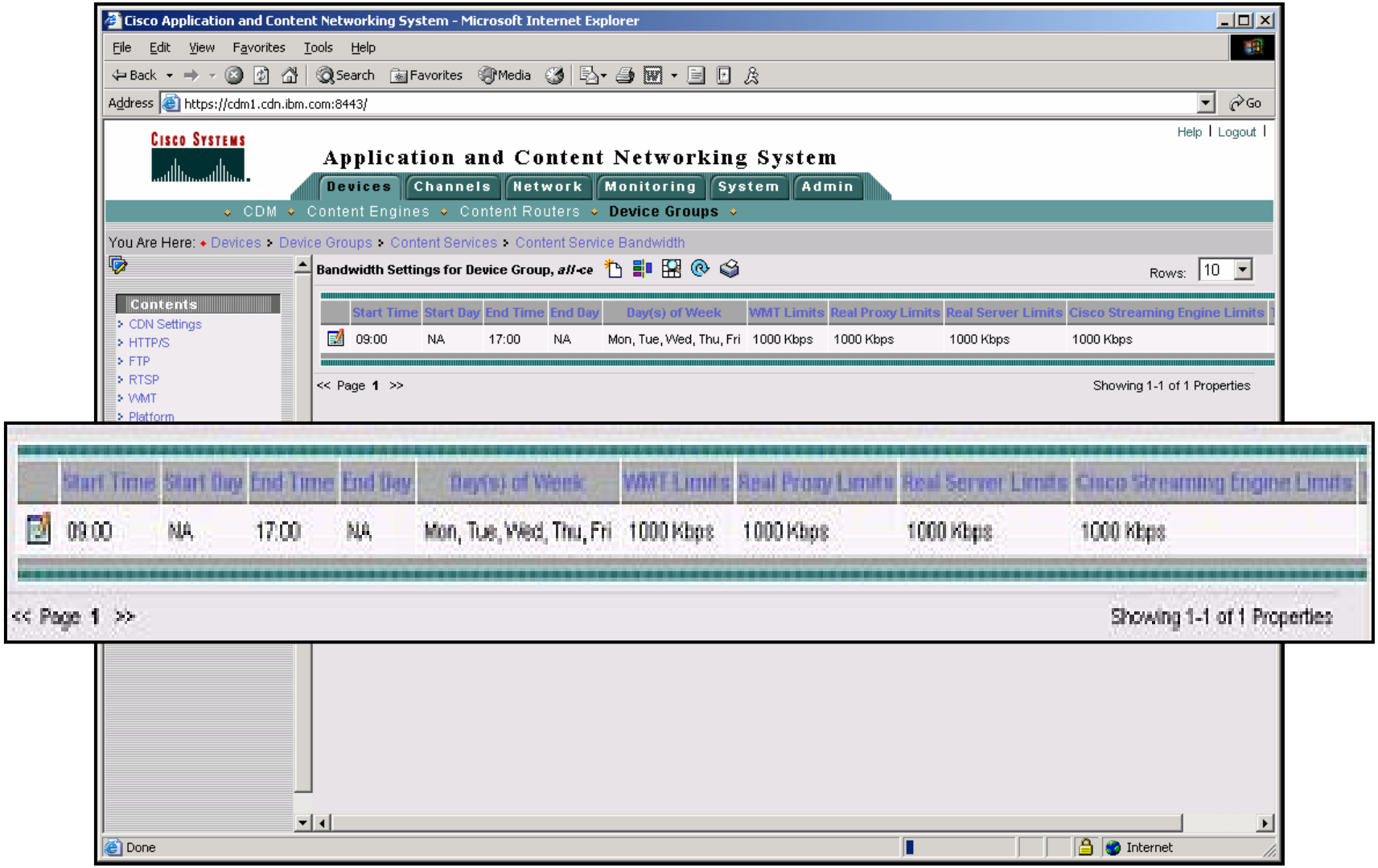
Distribute Video File

Separate Controllable Stream per User

NTSC/PAL Decoder or Set-Top-Box

Streamed Bandwidth May Be Greater than WAN Bandwidth Managed Intranet or Internet Sourced

Video
Playout Bandwidth Controls



Streaming

Any Streaming Format

HTTP On Demand Delivery:

- ASF and MPEG 1/2 files over HTTP
- IP/TV Broadcast Server can encode MPEG-1, 2 files and import into CDM
- No fast forward and rewind
- Pre-position with CDM

Live IP Multicast video: IETF standard

- Uses Cisco IOS on Cisco routers to allow one stream to serve multiple users.
- Scale to wide audience with low bandwidth usage

Video On Demand: RTSP/MMS Control

- Unicast (one stream/user).
- VCR-like controls (fast forward, rewind, pause)
- Native Real, ISO-compliant MPEG server, and Microsoft MMS for transport/control
- Pre-position with CDM

Live Real & WMT Stream Splitting:

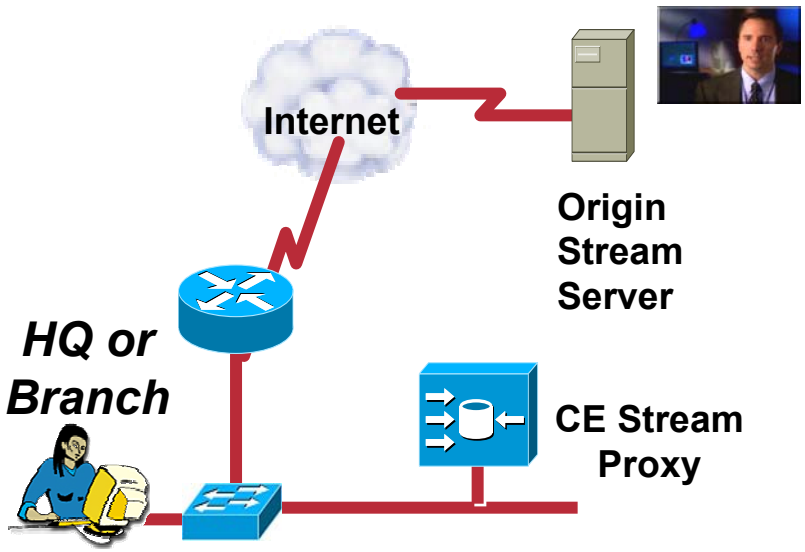
Allows live programs over non-multicast-enabled network

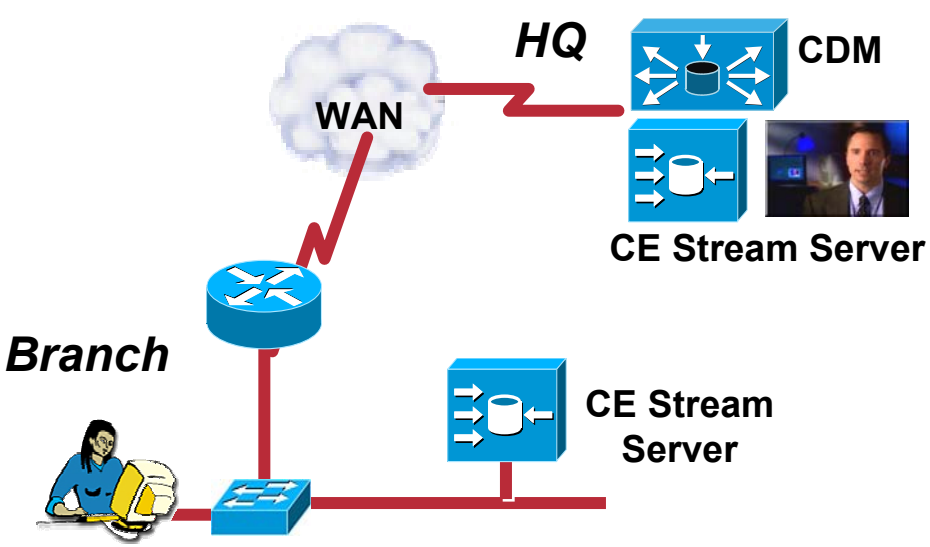
Unjcast from origin server to CE splitter, unicast or multicast to viewers

Multicast from origin server to CE splitter, unicast or multicast to viewers

Auto setup with tree structure

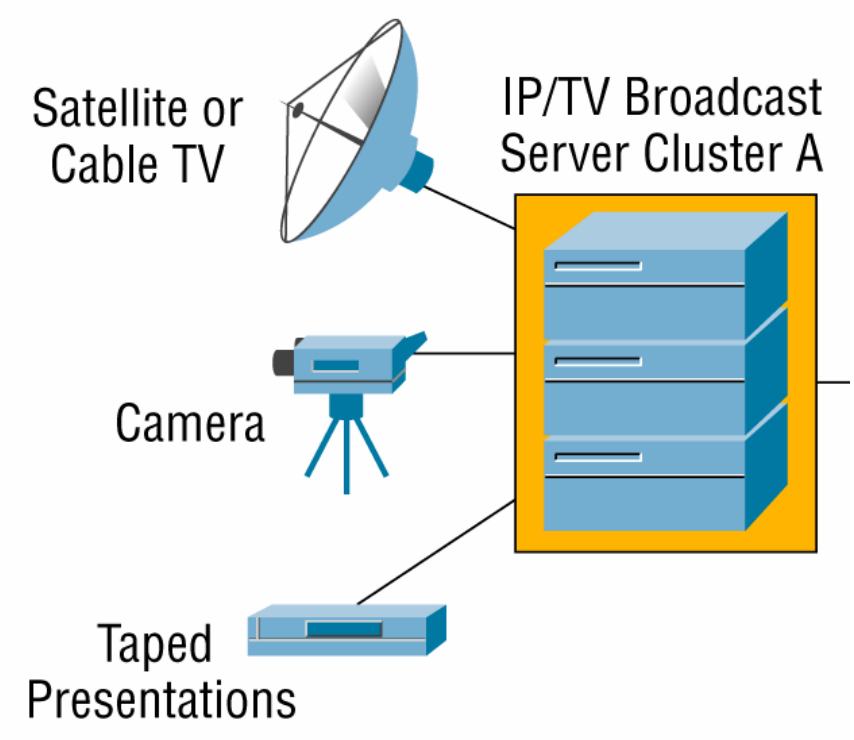
ACNS 4.2 Streaming Media Support: Internet Proxy and Intranet Content Serving





- **Stream Proxy Mode**
  - Caches and proxies content to reduce congestion to origin server
  - Proxy and WCCP redirection
  - Mainly used if content originates from an external source, such as the Internet
- **Stream Server Mode**
  - CE acts like origin server
  - Content pre-positioned through the CDM
  - Mainly used if the enterprise creates or controls its own content

Cisco IP/TV Broadcast Servers



- **Captures and broadcasts real-time and pre-recorded content**
- **Receives content from a variety of sources:**
  - **Cameras, satellite and cable feeds, DVDs**
  - **ASF, AVI, MPEG digital files**
- **Range of video formats:**
  - **MPEG-1, MPEG-2, MPEG-4, H.261**

Cisco IP/TV 3412 Control Server

- **Centrally manages entire IP/TV system**
- **Enables easy set-up of times and dates for initial and repeat showings**
- **Automatically generates program listing**
- **QoS support via resource reservation protocol (RSVP)**

Easy-to-use, Web-based administration tool

Cisco RealSystem V8 Proxy

- Acts As Proxy to Origin Server: Uses WCCP Re-direction
  - Origin Server Controls the Limits of Stream Licenses Served by Proxy CE (Splitting, Multicast or VOD)
- Not for Pre-positioning
- RealSystem RTP/RTSP Delivery
- Live-stream Pull Splitting: Initiated by Client Request
  - Origin Server Sends Live Stream by Unicast Over Non-multicast Network
  - Stream Splitter CE Then Unicasts or Multicasts to End Users
- IP Multicast:
  - Back-channel Multicast: Client Must Be Authenticated With Origin Server Prior to Multicast Delivery
- On Demand Streaming of Cached Content
- Certified by RealNetworks and RealSystem Powered

Cisco RealSystem V8 Server Subscriber

- **Content Pre-positioning:** Configured by Cisco CDM
- **Dynamic Capacity Allocation:** Ability for Multiple Subscriber CEs to Share Same License From One Publisher Server (Origin Server) As Stream Capacity Is Load Balanced Between Subscriber CEs
- **Server Reliability:** Network Outage Protection for Live Stream, Configurable Live Packet Buffer Window (Smooths Out Transmission Latency Variances)
- **Server to Server Multicast Delivery**
- **UDP/TCP/Multicast CE to Client Delivery**
- **Certified by RealNetworks and RealSystem Powered**
- To be supported in 4.2:
  - Server to Client Scalable Multicast (No Back-channel Authentication Required)
  - Quicktime plugin support
  - Push Splitting (Live Stream Is Pre-positioned for Instant Splitting to Clients)
  - Edge Archiving of Multicast Transmissions (Live Archiving), Encoder Failover Redundancy

Cisco WMT Proxy and Native WMT V4.0 Server

- **WMT Proxy :**
  - Transparent (WCCP & L4 switch) & Non-transparent (Manual) MMS & HTTP Proxy
  - Basic or NTLM User Authentication of Clients Against Origin Server, WMT DRM
- **WMT Server:** Content **Pre-positioned** From Cisco CDM
- Client Talks to CE Via **MMS Over UDP, MMS Over TCP or MMS over HTTP**
- **IP Multicast** Sourcing Over UDP
- **Live Stream Splitting**:
  - Multicast or Unicast Input to CE Splitter
  - Multicast or Unicast Output From CE to Connected Clients
- **VOD Streaming**
- Variable Bit-rate (VBR) Support: and stream thinning support
- Admission Control: Control BW
- Transaction Logging and Export: W3c-compliant Logs
- **First to be Certified to Be Compliant by Microsoft for both Proxy and Server**

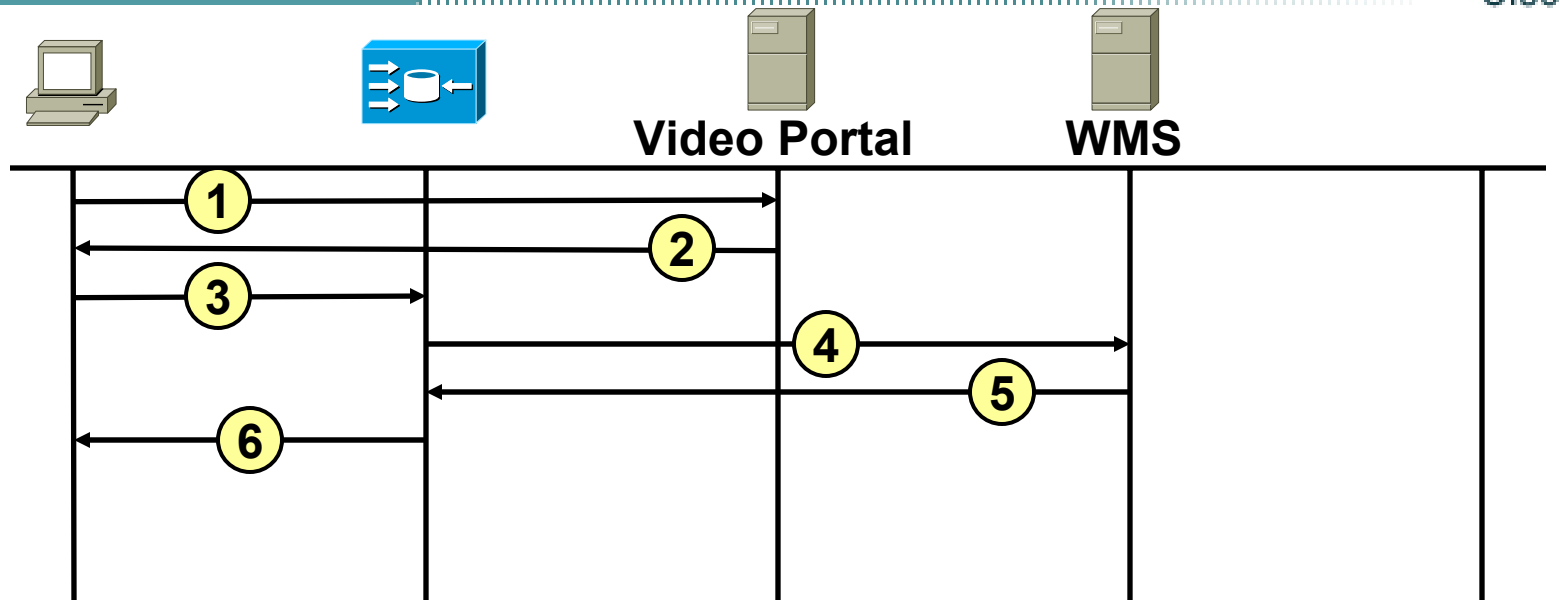
Windows Media CE Capabilities

- Proxy
- VoD Caching
- Live Splitting
  - Unicast-unicast
  - Unicast-multicast
  - Multicast-unicast
  - Mulitcast-multicast
- WCCP Transparency
- Logging
- Statistics (SNMP, API, CLI)

Windows Media Multimedia Media Server (MMS)

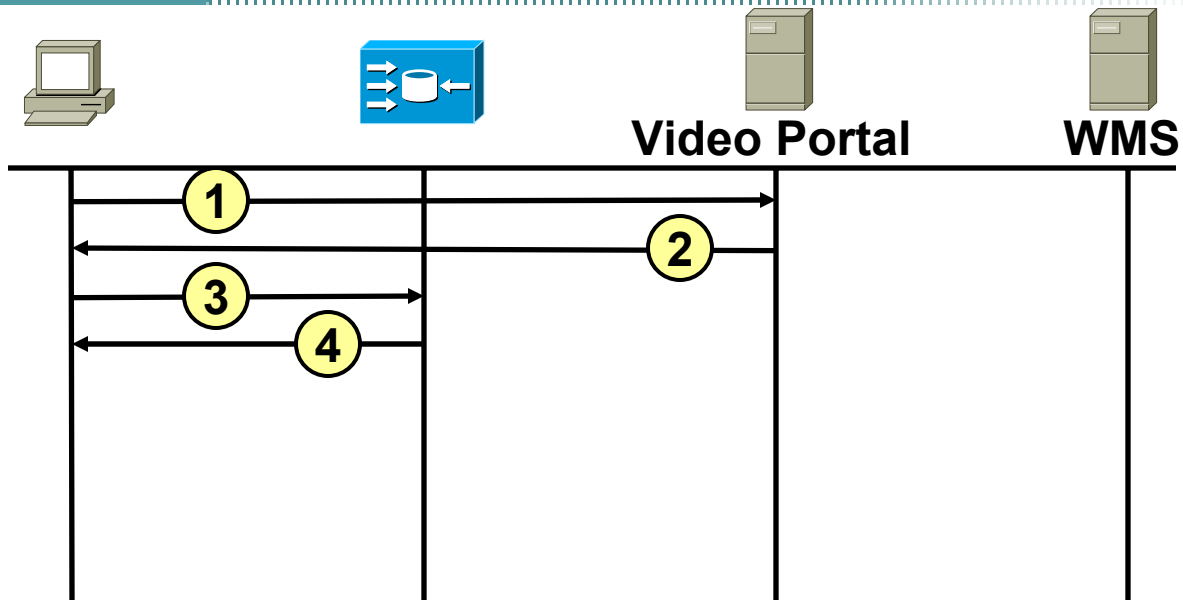
- MMS IP multicast
- MMS UDP (MMSU)
- MMS TCP (MMST)
- MMS over HTTP
- RTSP for WMS 9.0

Windows Media
First Request for VoD



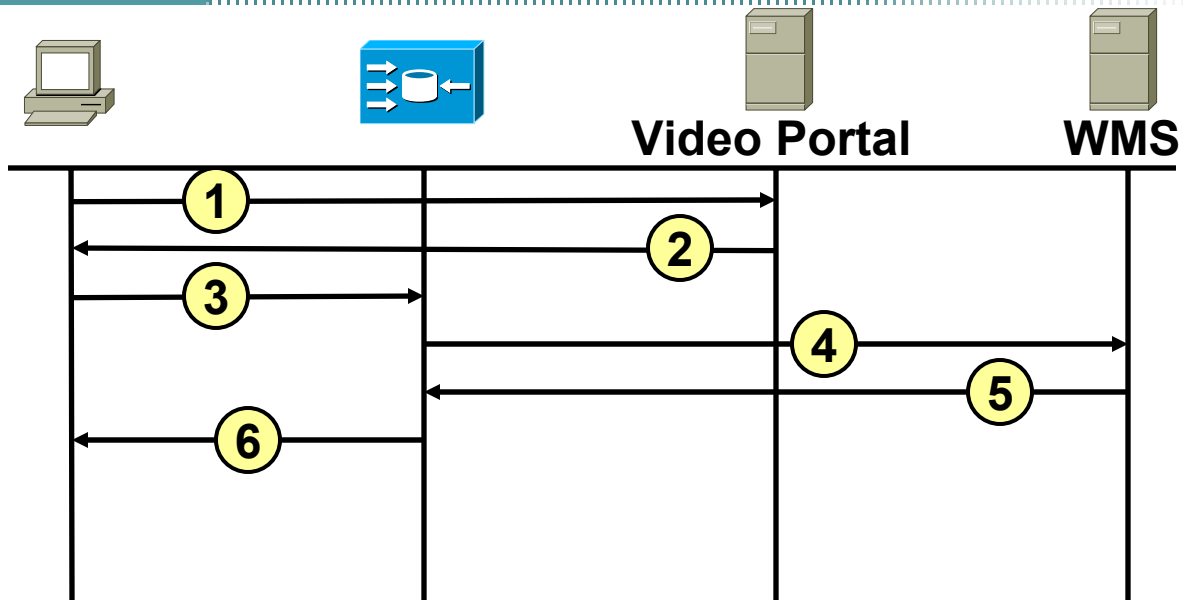
1. First client browser requests video.asx
2. Web server delivers video.asx
3. WMP makes mms://wms/video.asf
4. CE requests mms://wms/video.asf
5. WMS streams to CE
6. CE streams to WMP

Windows Media
Second Request for VoD



1. First client browser requests video.asx
2. Web server delivers video.asx
3. WMP makes mms://wms/video.asf
4. CE streams to WMP

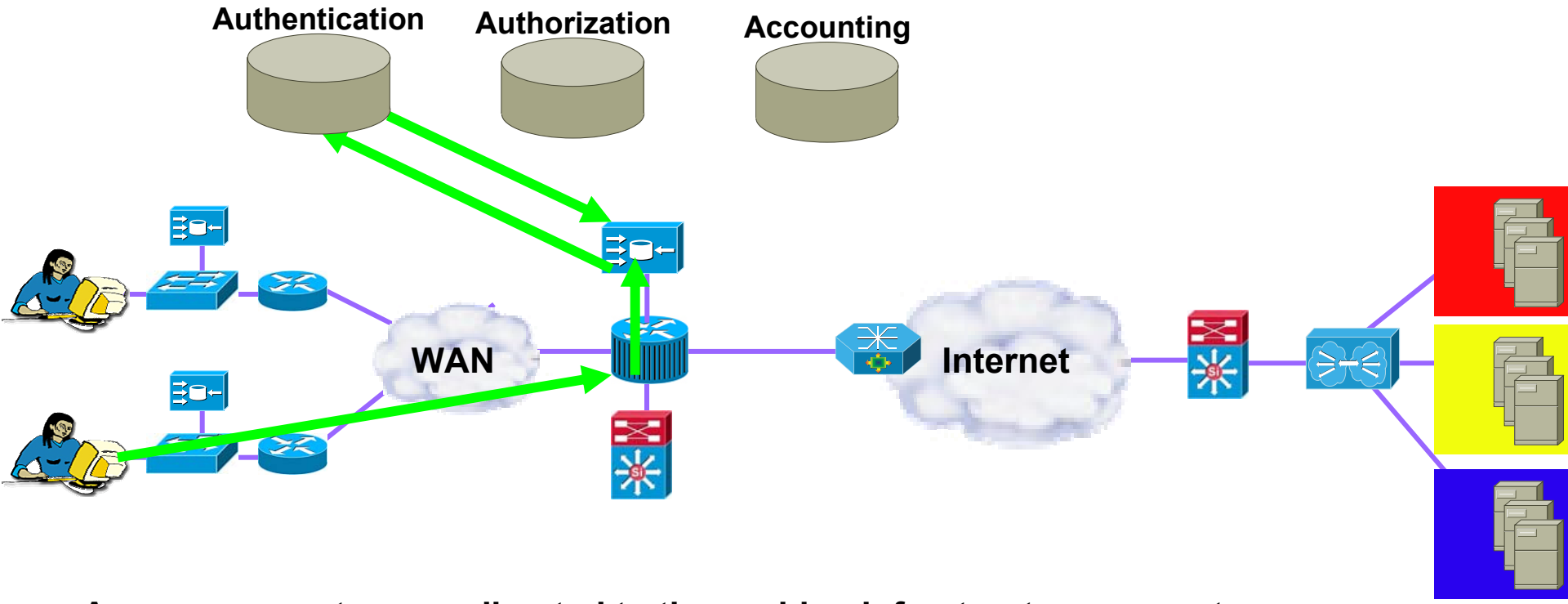
Windows Media
Live Unicast Stream Splitting



1. First client browser requests video.asx
2. Web server delivers video.asx
3. WMP makes mms://wms/video.asf
4. CE intercepts and requests mms://wms/video.asf
5. WMS streams to CE
6. CE streams to WMP

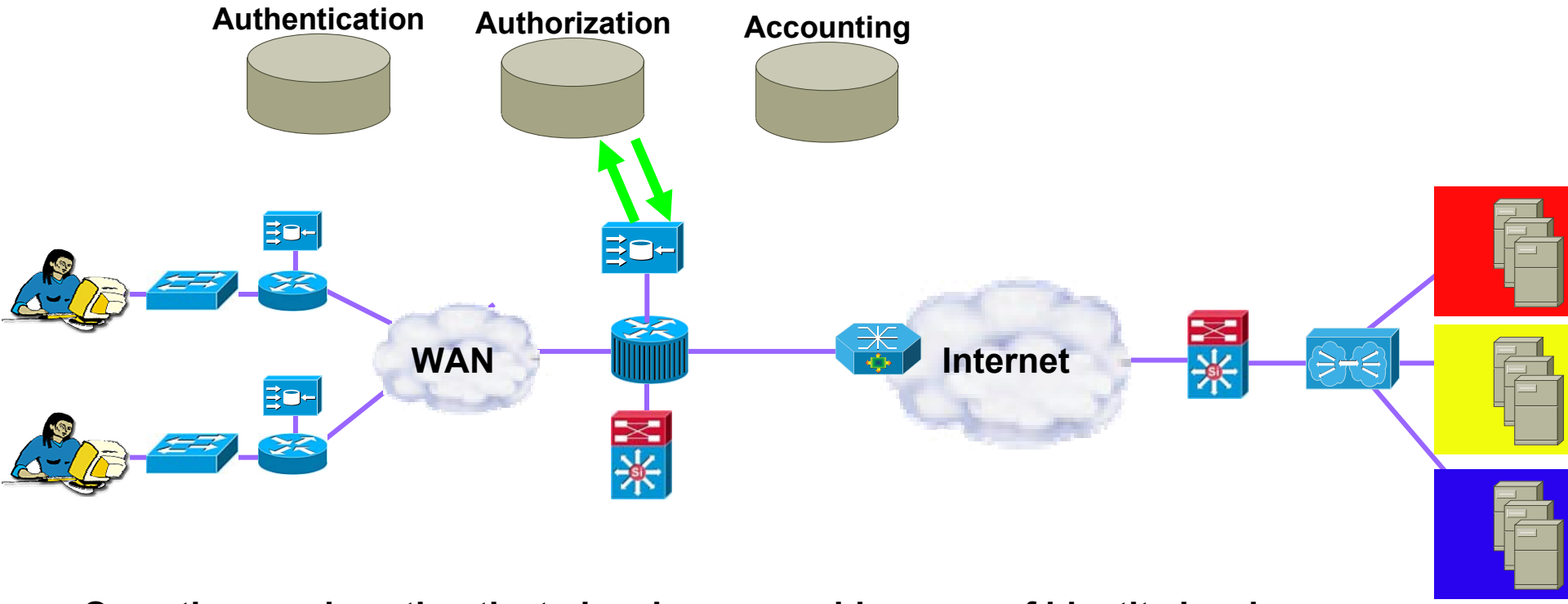
Security

Internet Management Authentication



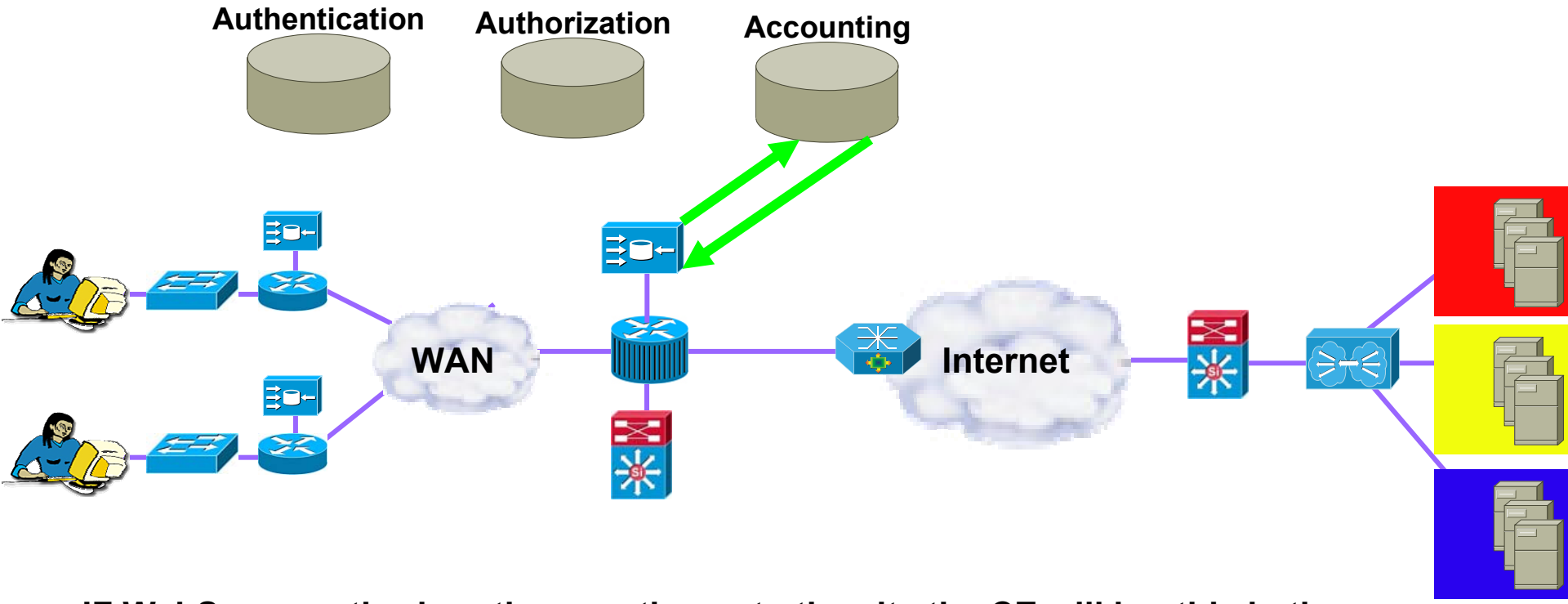
- As user requests are redirected to the caching infrastructure requests may need to be authorized for viewing certain content or material.
- User credentials can be acquired via two-ways.
- The CE can present an HTTP-AUTH message to the client
- The CE can read the NTLM credentials passed via an IE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

Internet Management Authorization



- 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, SmartFilter or N2H2 which is designed to provide user-level site authorization services.

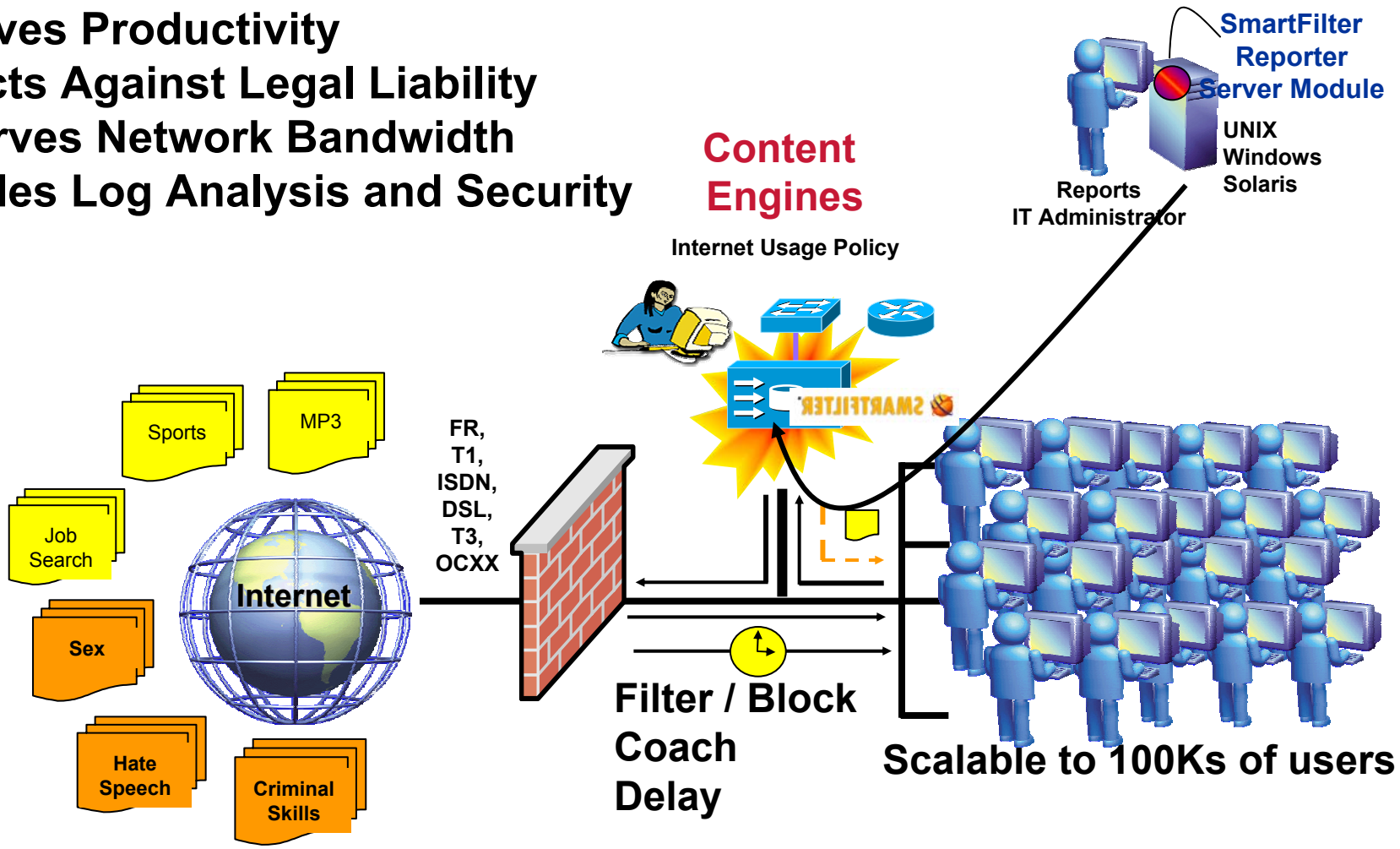
Internet Management Accounting



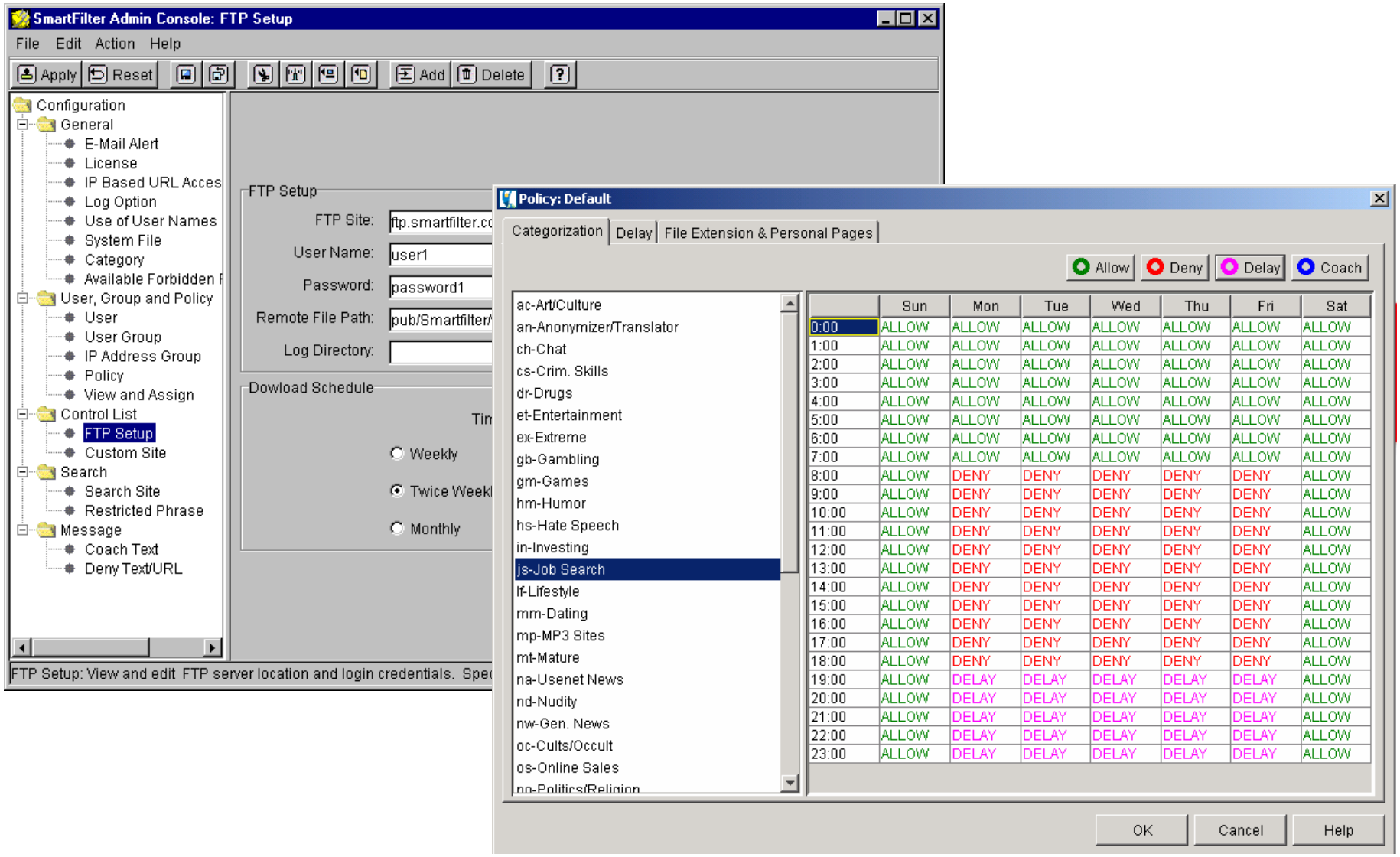
- IF WebSense authorizes the user the go to the site the CE will log this in the SQUID log format.
- The logs can be rolled up by date/time or by size.

SmartFilter Software Option and Cisco Content Engine

- Improves Productivity
- Protects Against Legal Liability
- Preserves Network Bandwidth
- Provides Log Analysis and Security



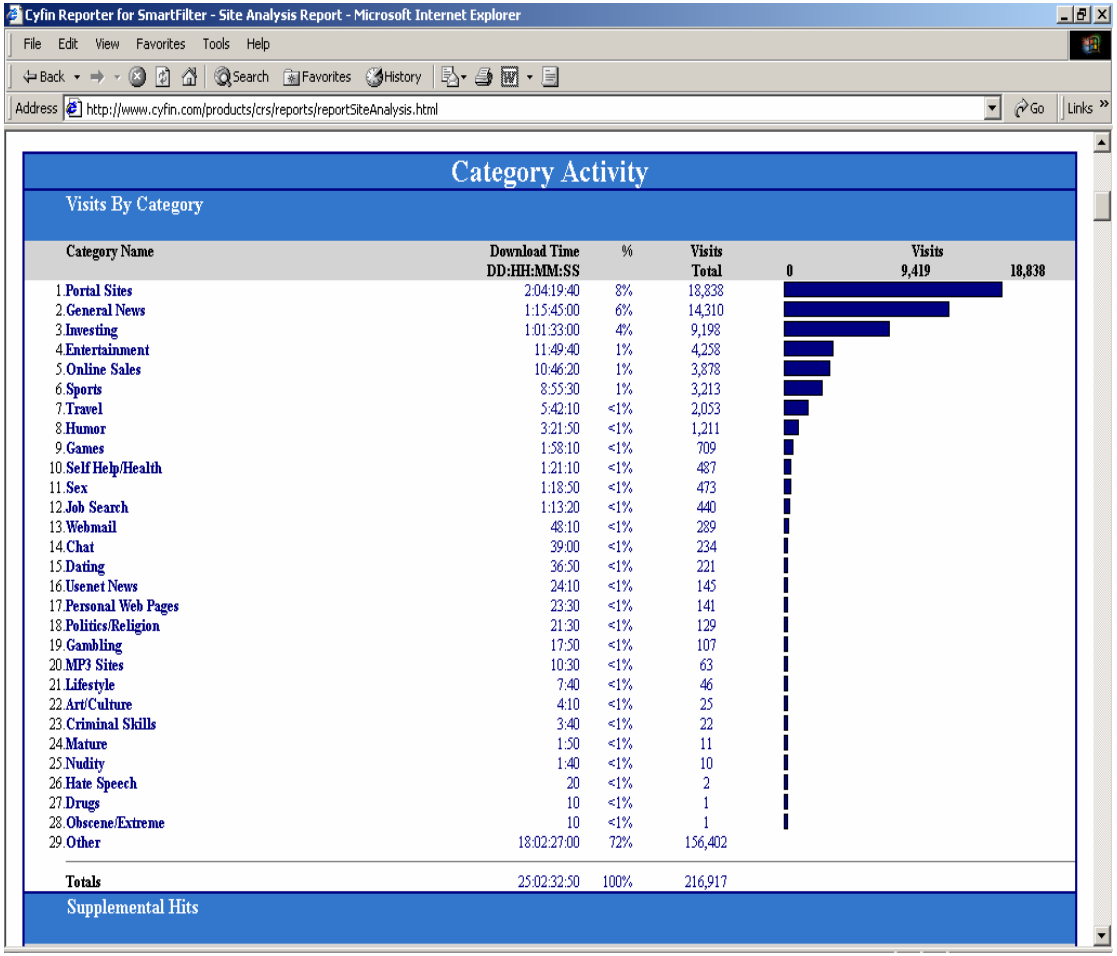
SmartFilter Control List and Policy Management



SmartFilter Reporting

Cisco.com

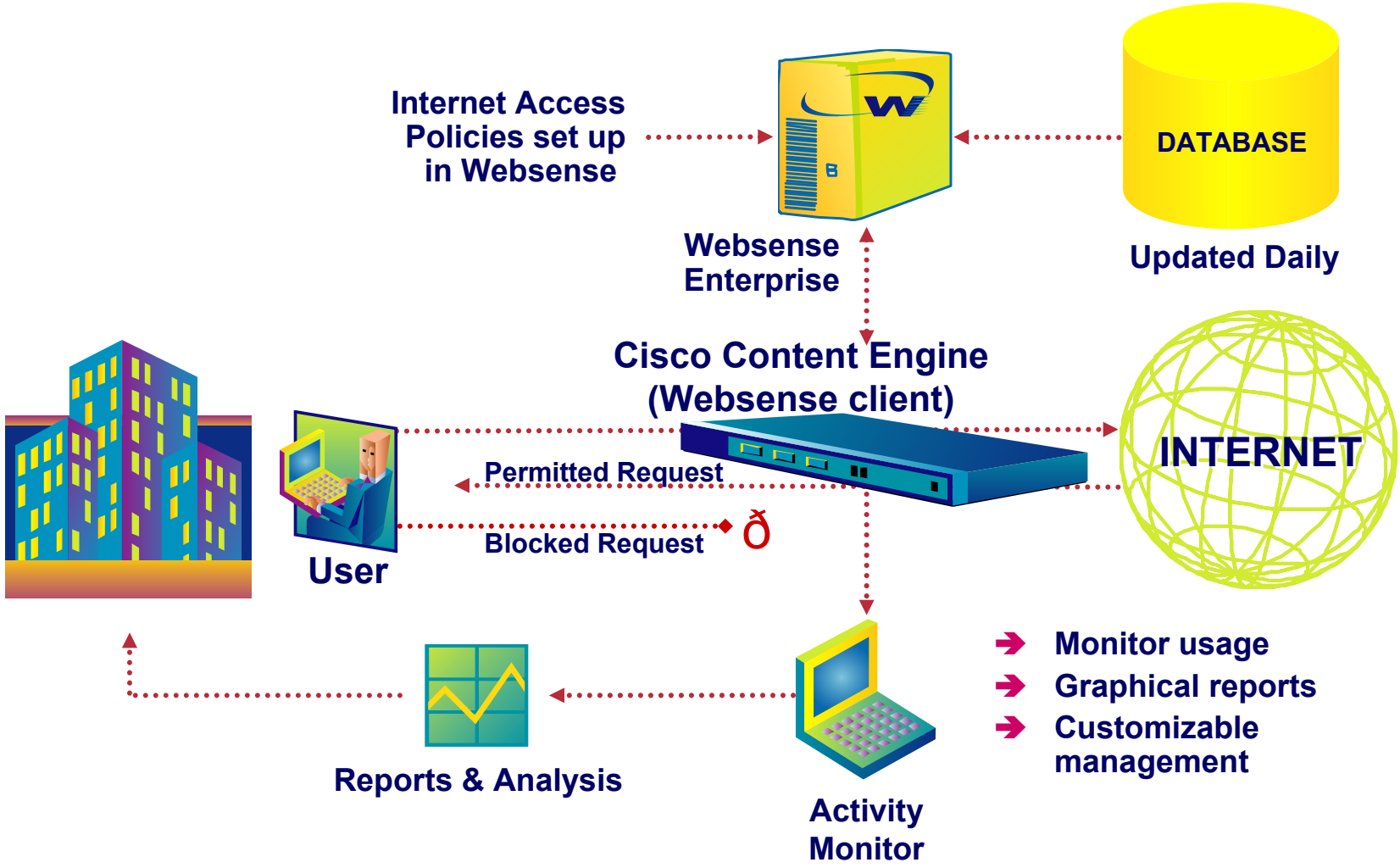
- Cyfin® Reporter performs detailed analysis on all Web-surfing activity and generates management-ready reports.
- Cyfin has a complete reporting system for executive level information, delivered on demand to the manager's browser.
- Helps managers keep a finger on the pulse of Internet usage in their organization, enhance their culture & improve productivity
- Satisfies the needs of IT Professionals and Management
- Cyfin Reporter is an industrial grade reporting tool.
- Fully integrated with SmartFilter



Websense Overview

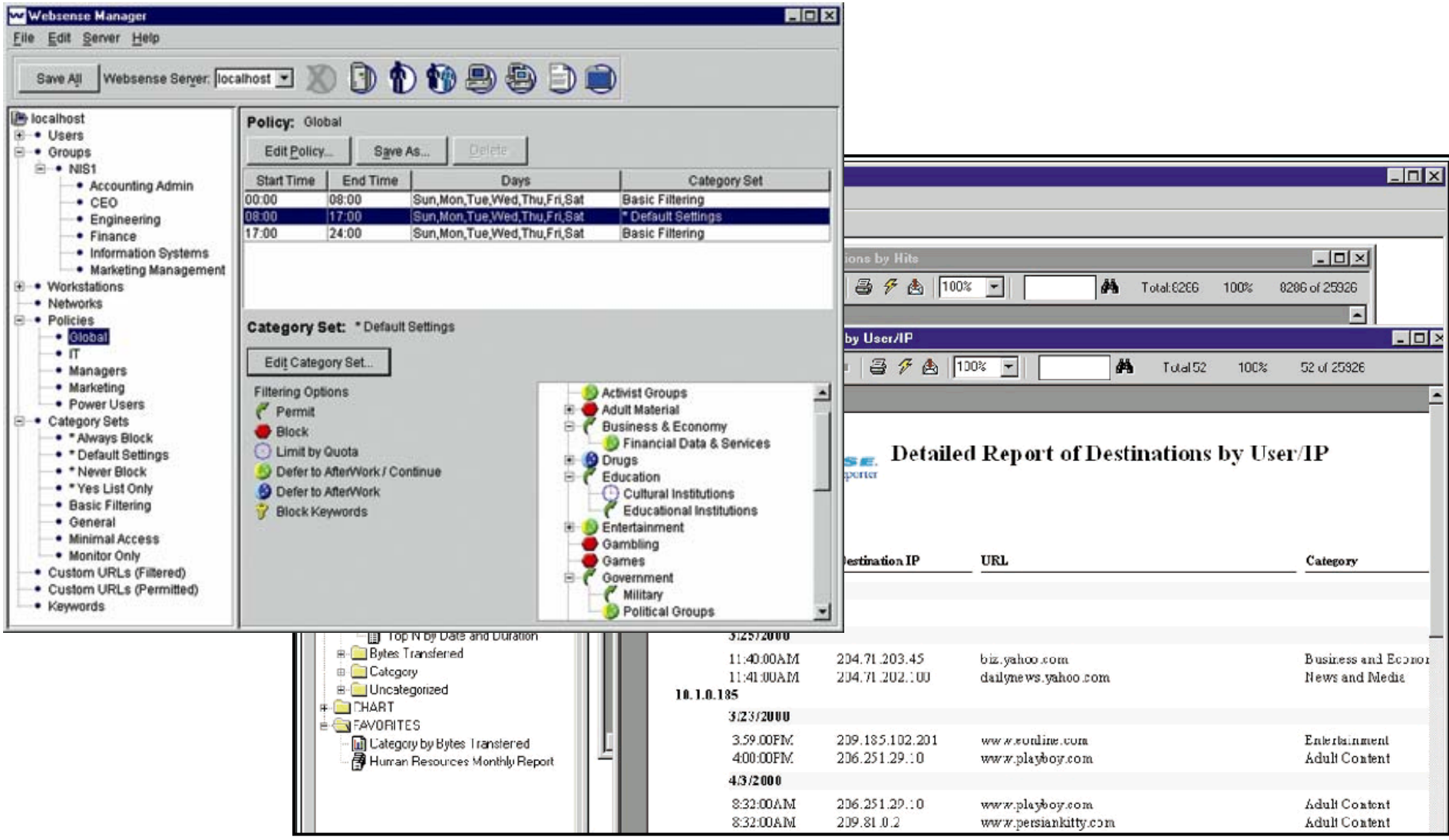
- Content Engine acts as a Websense V4.3 client
- Filters HTTP requests based on usage policies defined in Websense Enterprise server which is purchased from Websense
- Requests for cached objects are still challenged
- Comprehensive monitoring, reporting and management of Internet Access
- Master Database Driven: better categorization, no keyword “overblocking”, automatic daily updates
- Intelligent Content Categorization: 3.1 million+ sites representing 600 million+ pages and 75+ categories
- Contact Websense SolutionCenter at www.websense.com/solutioncenter/cisco, a site designed exclusively for Cisco employees and resellers.

Websense and CE: How It Works



Websense Administration and Reporting

Cisco.com



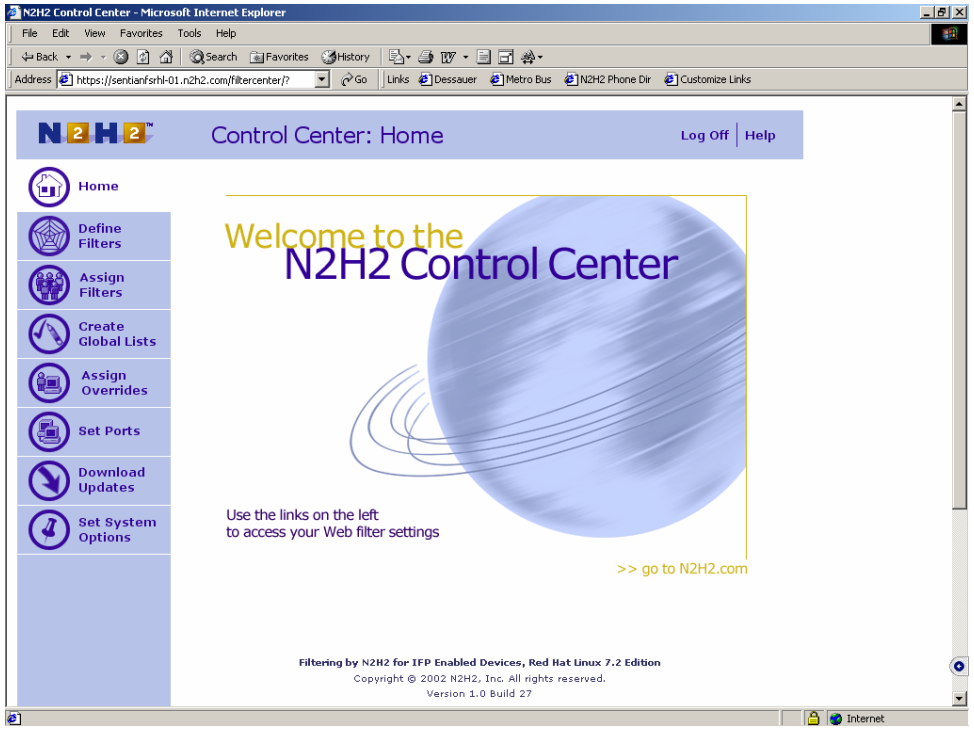
N2H2 Overview

- Popular with Education Market
- N2H2 Internet Filtering Protocol (IFP) V2.0 client is integrated in Cisco CE
- Separate N2H2 Sentian FS Server must be purchased from N2H2
- Filtering by N2H2 is sold and marketed as an annual software subscription, based on Enterprise, Public and Education market sectors, and the number of Internet-accessible workstations
- Contact N2H2 Direct Sales representatives at 800-971-2622

N2H2 Sentian FS Server

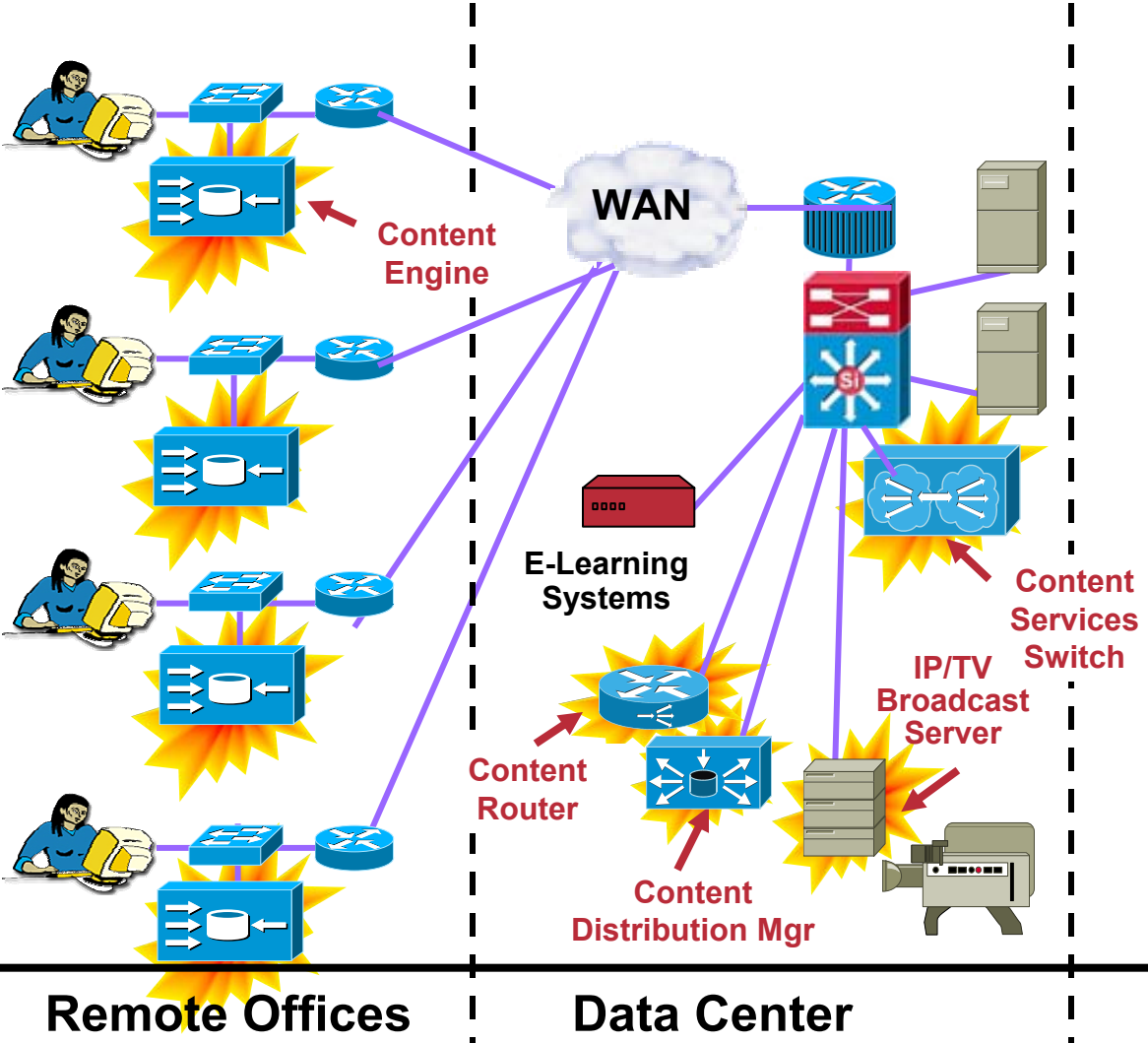
Cisco.com

- Ease of installation & integration
- Flexible, customizable Filters by user and user groups
- Time of day filtering
- Customizable categories
- Internet usage reporting



E-Learning & Corporate Communications Content Delivery Network

Cisco.com



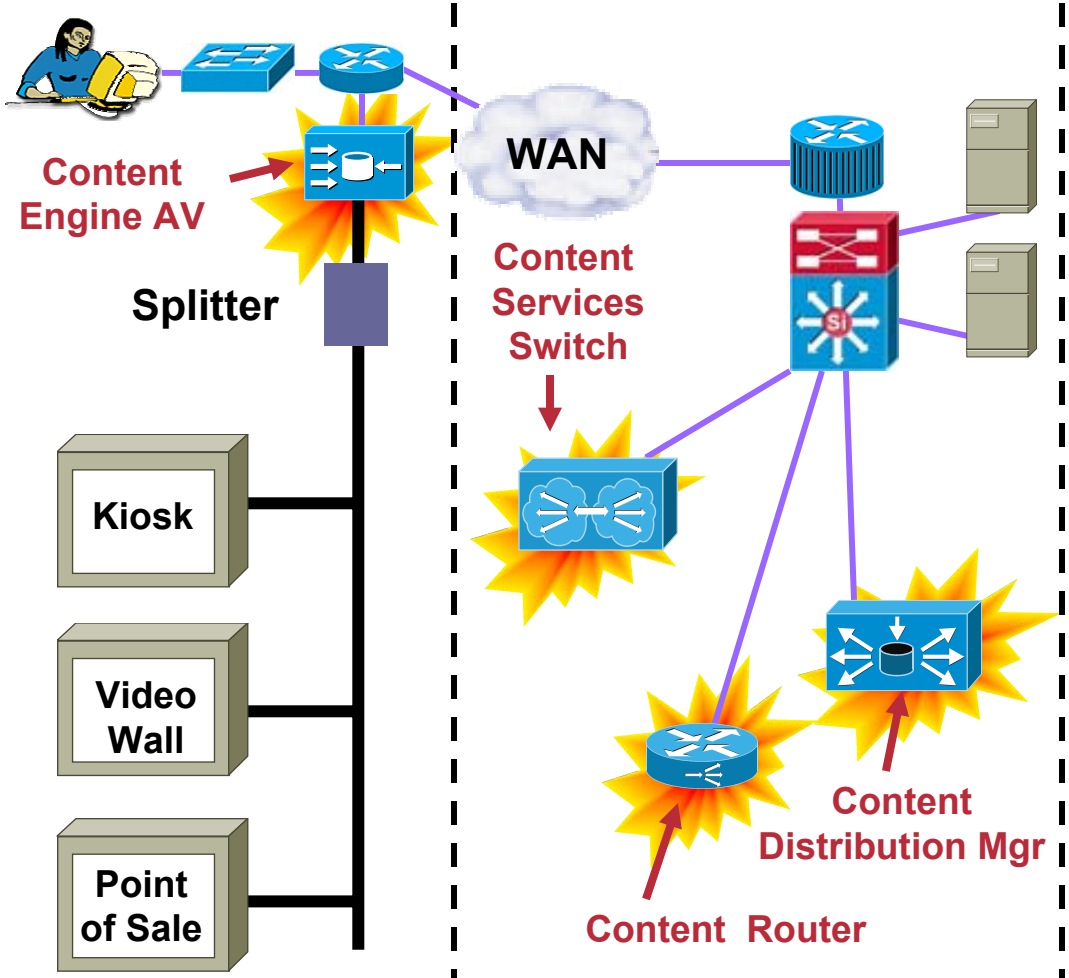
Benefits:

- 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

Point-of-Sale Content Delivery Network



Benefits:

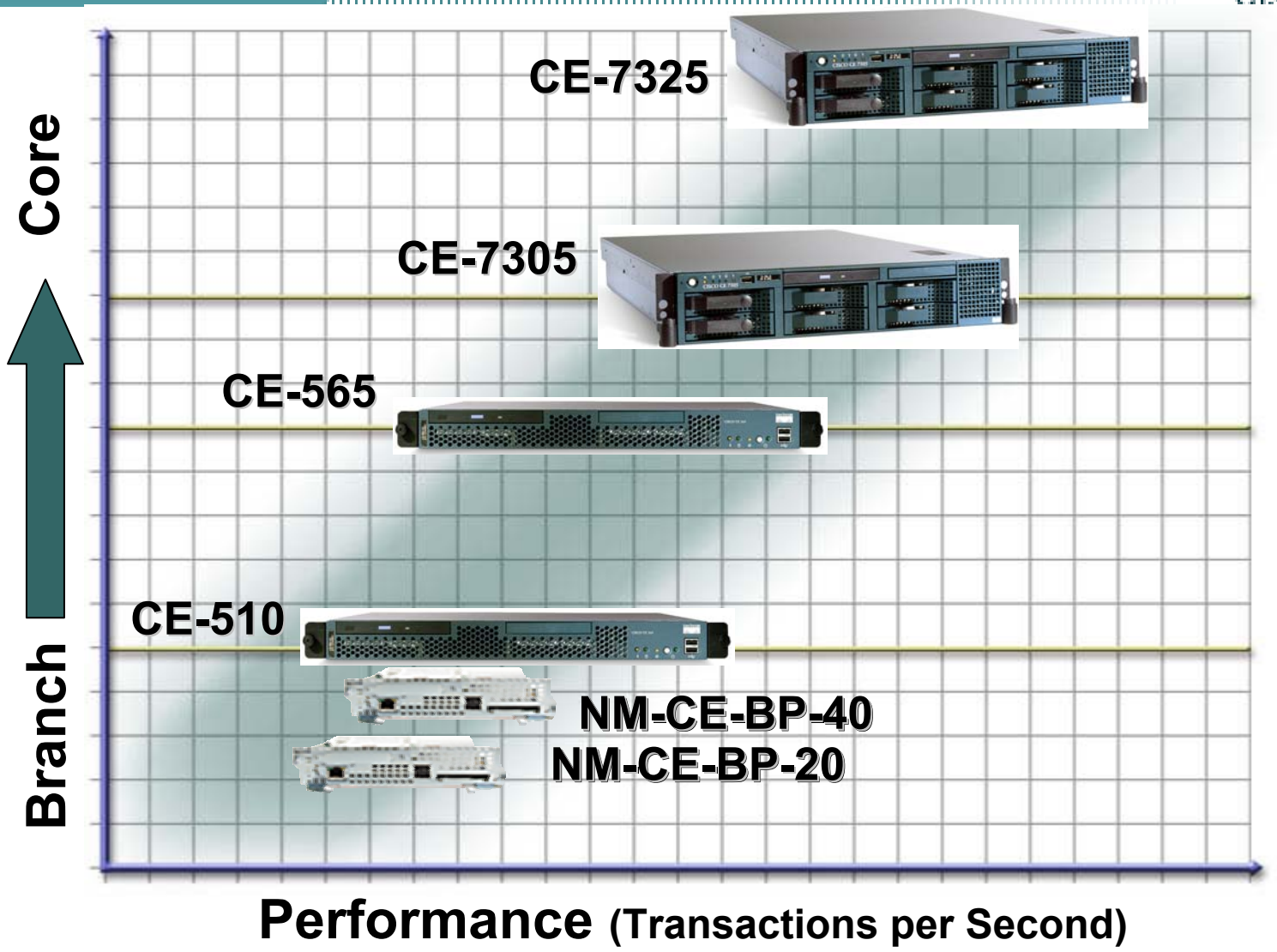
- Fast, efficient delivery of tailored promotional content to stores /branches/kiosks
- Central content control
- Includes e-learning, caching benefits

Products:

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

Deployment Considerations

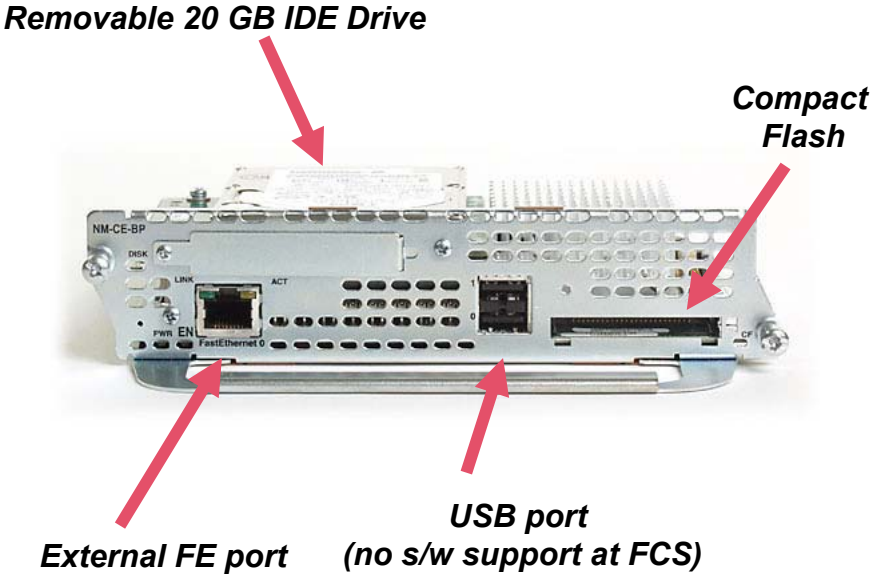
Caching / Content Delivery Portfolio
Flexible Price/Performance Options

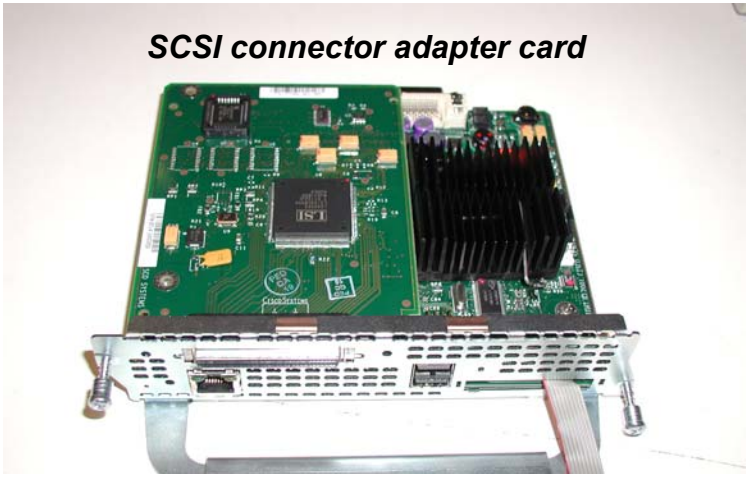


Deployment Guidelines: Network Module vs. Appliance

CE Appliance	CE Network Module
• No initial IOS upgrade • Can be used with any router • CE-AV option available (as part of initial CE purchase) • Variety of price/performance appliances for branch, data center, campus environments	• Lower total cost of ownership: price point, consolidated maintenance support • No increase in physical footprint • No additional power supplies/cables, redundant power from router platform • Interoperable with stand alone Content Engine Appliances and Content Distribution Manager

CE-NM-BP Network Deployment

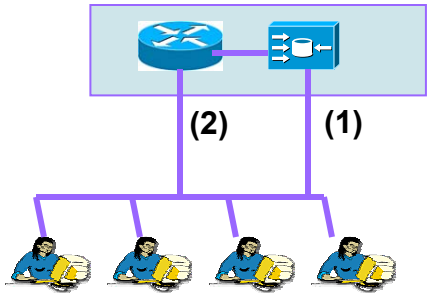




PRIMARY BRANCH OFFICE TOPOLOGIES:

1. **CE NM is directly connected to a LAN by an Ethernet switch or hub through the NM's external FE**

   CE NM gets IP address from the branch office LAN IP subnet space, typically configured statically using IOS CLI on the console port.



2. **CE NM is directly connected to an Ethernet interface on the router using the NM's internal FE interface**

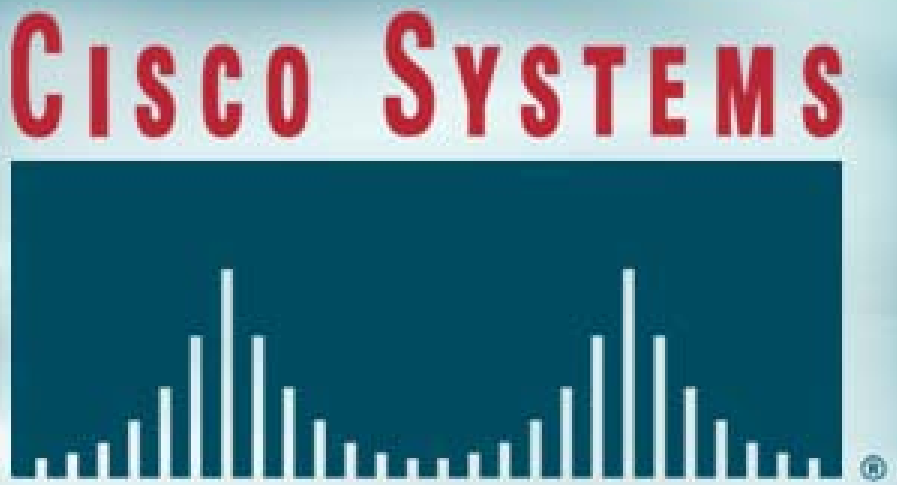
   Ethernet interface gets address from an IP subnet separate from the branch office LAN subnet. All caching and streaming traffic flows through the router and is limited by router performance

3. **2 Subnets – both internal/external are configured**
4. **Use IP unnumbered to save IP address space**

Flexible Storage Solutions

- Direct Attached SCSI Arrays
  - SA-14, SA-7: 3RU Storage Array with 14x36GB or 7x36 GB HD
- SAN Solutions with Fiber Channel Interfaces
  - Direct Attached
  - Switched

Questions?


CISCO SYSTEMS