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

- **E-Commerce**
  - Increase revenues & customer base
  - Self services, decreased costs, knowledge transfer

- **E-Learning**
  - Reduced training costs, improved communications, increased competitive edge
  - Empowered partners, improved time-to-market & intellectual capital

- **Customer Care**
  - High productivity, better resource management

- **Workforce Optimization**
  - Self services, decreased costs, knowledge transfer

- **Supply Chain**
  - Increase revenues & customer base
  - High productivity, better resource management

Net Impact of …
- Availability, Security, Scalability
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%)
“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:

Enterprise

Enterprise Edge

WAN

Internet DMZ

Intranet RPC

Service Provider

Internet

SP Edge

Extranet

Extranet RPC

Shared RPC
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 Software: ACNS

Application and Content Networking Software

<table>
<thead>
<tr>
<th>HTTP Server Proxy</th>
<th>WMT Server Proxy</th>
<th>Real Server Proxy</th>
<th>Cisco Stream Server</th>
<th>Cisco Stream Splitter 5.1</th>
<th>DNS Proxy Cache</th>
<th>CIFS Server</th>
<th>FTP Server Proxy 5.1</th>
<th>TFTP Server 5.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Storage</td>
<td>Pull HTTP Storage</td>
<td>Pre-positioned Web and Video Storage</td>
<td></td>
<td>Pull Video Storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal (SCSI, IDE) and External (SCSI, FC, iSCSI*, NFS*, CIFS*) Storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CEs at HQ and Network Edge
Add a CDM, Creates a CDN

- Content Acceleration
- E-Communications
- E-Learning
- Content Filtering
- File Distribution

- Same content services as branch, plus: Point of sale for promotional delivery

- Retail Store/Branch

Network Edge  Headquarters/Data Center
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?

DNS Resolve proxy.company.com

SYN proxy.company.com:8080

SYN/ACK

SYN/ACK/ACK

proxy.company.com:8080
GET index.htm HTTP/1.0
Host: www.company.com

DNS Resolve www.company.com

SYN

SYN/ACK

SYN/ACK/ACK

GET index.htm HTTP/1.0
Host: www.company.com/

200 OK

Store Retrieved File with Reply Headers

200 OK
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";
    }
}
What is a Transparent Web Cache?

No Changes to Network Architecture, Browsers, or Servers

HTTP, RTSP and MMS Transparently Redirected

WCCP-Enabled Router
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
I want to browse mycompany.com!

First Request For Content

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

Subsequent Requests For Content

I want to browse mycompany.com!
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

SYN
SYN/ACK
SYN/ACK/ACK GET http://www.company.com/
GRE:SYN
GRE:GET...

SYN
SYN/ACK
SYN/ACK/ACK GET http://www.company.com/

HTTP 200 OK
HTTP 200 OK
WCCP
HTTP Object Hit

SYN

SYN/ACK

GRE:SYN

SYN/ACK/ACK GET http://www.company.com/

HTTP 200 OK

GRE:GET...
WCCP
HTTP Object TCP_REFRESH_HIT

- SYN
- SYN/ACK
- SYN/ACK/ACK GET http://www.company.com/
- GRE:GET...
- SYN
- SYN/ACK
- SYN/ACK/ACK IMS GET http://www.company.com/
- HTTP 200 OK
- 304 Not Modified
**WCCP**

**HTTP Object Requiring Authentication**

---

**Diagram:**

- **SYN**
- **SYN/ACK**
- **SYN/ACK/ACK GET http://www.company.com/**
- **GRE:SYN**
- **GRE:GET…**
- **SYN**
- **SYN/ACK**
- **SYN/ACK/ACK IMS GET http://www.company.com/**
- **HTTP 401 Authenticate**
- **GET http://www.company.com/ Username/password**
- **GRE:GET…**
- **GET http://www.company.com/ Username/password**
- **200 OK**
- **304 Not Modified**

---

© 2002, Cisco Systems, Inc. All rights reserved.
## WCCP Services

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

**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
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

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 12-redirect
ce#show 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
Use WCCP Here
WCCP
Switching: Egress Interception

Router
Main CPU

Interface
1/0/0

Not Here!

Interface
2/0/0

Switch
Fabric

Interface
1/0/0
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
  *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

<table>
<thead>
<tr>
<th>XOR (IP_DA IP_SA port_DA port_SA)</th>
<th>Hash index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CE1</td>
</tr>
<tr>
<td></td>
<td>CE2</td>
</tr>
<tr>
<td></td>
<td>CE3</td>
</tr>
<tr>
<td></td>
<td>CE4</td>
</tr>
</tbody>
</table>

### MASKING

<table>
<thead>
<tr>
<th>IP_DA IP_SA L4_proto port_DA port_SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...011 0...0 1.........1 1.........1 0.........0</td>
</tr>
<tr>
<td>xxxx00 xxxx TCP  80 xxxx CE1</td>
</tr>
<tr>
<td>xxxx01 xxxx TCP  80 xxxx CE2</td>
</tr>
<tr>
<td>xxxx10 xxxx TCP  80 xxxx CE3</td>
</tr>
<tr>
<td>xxxx11 xxxx TCP  80 xxxx CE4</td>
</tr>
</tbody>
</table>

© 2002, Cisco Systems, Inc. All rights reserved.
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

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

<table>
<thead>
<tr>
<th>Start Time</th>
<th>Start Day</th>
<th>End Time</th>
<th>End Day</th>
<th>Day(s) of Week</th>
<th>WMT Limits</th>
<th>Real Proxy Limits</th>
<th>Real Server Limits</th>
<th>Cisco Streaming Engine Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Mon, Tue, Wed, Thu, Fri</td>
<td>1000 Kbps</td>
<td>1000 Kbps</td>
<td>1000 Kbps</td>
<td>1000 Kbps</td>
</tr>
</tbody>
</table>

© 2002, Cisco Systems, Inc. All rights reserved.
Streaming
## Any Streaming Format

<table>
<thead>
<tr>
<th>HTTP On Demand Delivery:</th>
<th>Live IP Multicast video: IETF standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>• ASF and MPEG 1/2 files over HTTP</td>
<td>• Uses Cisco IOS on Cisco routers to allow one stream to serve multiple users.</td>
</tr>
<tr>
<td>• IP/TV Broadcast Server can encode MPEG-1, 2 files and import into CDM</td>
<td>• Scale to wide audience with low bandwidth usage</td>
</tr>
<tr>
<td>• No fast forward and rewind</td>
<td></td>
</tr>
<tr>
<td>• Pre-position with CDM</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Video On Demand: RTSP/MMS Control</th>
<th>Live Real &amp; WMT Stream Splitting:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Unicast (one stream/user).</td>
<td>Allows live programs over non-multicast-enabled network</td>
</tr>
<tr>
<td>• VCR-like controls (fast forward, rewind, pause)</td>
<td>Unicast from origin server to CE splitter, unicast or multicast to viewers</td>
</tr>
<tr>
<td>• Native Real, ISO-compliant MPEG server, and Microsoft MMS for transport/control</td>
<td>Multicast from origin server to CE splitter, unicast or multicast to viewers</td>
</tr>
<tr>
<td>• Pre-position with CDM</td>
<td>Auto setup with tree structure</td>
</tr>
</tbody>
</table>
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
  - Multicast-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
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.
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.
IF WebSense authorizes the user to 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

Content Engines
Internet Usage Policy

Filter / Block
Coach Delay
Scalable to 100Ks of users

SmartFilter Reporter
Server Module
Reports
IT Administrator

UNIX
Windows
Solaris

Internet

FR, T1, ISDN, DSL, T3, OCXX

Sports
MP3
Job Search
Sex
Hate Speech
Criminal Skills

© 2002, Cisco Systems, Inc. All rights reserved.
SmartFilter Control List and Policy Management
### SmartFilter Reporting

- 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

#### Category Activity

<table>
<thead>
<tr>
<th>Category Name</th>
<th>Downloads Total</th>
<th>%</th>
<th>Visits Total</th>
<th>%</th>
<th>Visits Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Portal Sites</td>
<td>20,949.46</td>
<td>20%</td>
<td>7,415.24</td>
<td>7%</td>
<td>13,034.00</td>
</tr>
<tr>
<td>2. General News</td>
<td>11,545.60</td>
<td>10%</td>
<td>4,910.00</td>
<td>5%</td>
<td>9,310.00</td>
</tr>
<tr>
<td>3. Inventing</td>
<td>1,012,120.00</td>
<td>10%</td>
<td>41,000.00</td>
<td>4%</td>
<td>39,999.98</td>
</tr>
<tr>
<td>4. Entertainment</td>
<td>11,408.25</td>
<td>2%</td>
<td>4,237.19</td>
<td>2%</td>
<td>13,480.67</td>
</tr>
<tr>
<td>5. Online Sales</td>
<td>10,600.00</td>
<td>1%</td>
<td>2,031.20</td>
<td>1%</td>
<td>8,568.80</td>
</tr>
<tr>
<td>6. Sports</td>
<td>8,730.00</td>
<td>1%</td>
<td>3,000.00</td>
<td>1%</td>
<td>7,730.00</td>
</tr>
<tr>
<td>7. Travel</td>
<td>5,420.00</td>
<td>1%</td>
<td>2,000.00</td>
<td>1%</td>
<td>5,420.00</td>
</tr>
<tr>
<td>8. Finance</td>
<td>3,310.00</td>
<td>1%</td>
<td>1,111.11</td>
<td>1%</td>
<td>3,310.00</td>
</tr>
<tr>
<td>9. Games</td>
<td>1,330.00</td>
<td>1%</td>
<td>499.99</td>
<td>1%</td>
<td>1,330.00</td>
</tr>
<tr>
<td>10. Help/Health</td>
<td>1,210.00</td>
<td>1%</td>
<td>499.99</td>
<td>1%</td>
<td>1,210.00</td>
</tr>
<tr>
<td>11. Sex</td>
<td>1,100.00</td>
<td>1%</td>
<td>499.99</td>
<td>1%</td>
<td>1,100.00</td>
</tr>
<tr>
<td>12. Job Search</td>
<td>1,120.00</td>
<td>1%</td>
<td>499.99</td>
<td>1%</td>
<td>1,120.00</td>
</tr>
<tr>
<td>13. WebMail</td>
<td>910.00</td>
<td>1%</td>
<td>299.99</td>
<td>1%</td>
<td>910.00</td>
</tr>
<tr>
<td>14. Chat</td>
<td>390.00</td>
<td>1%</td>
<td>111.11</td>
<td>1%</td>
<td>390.00</td>
</tr>
<tr>
<td>15. Dating</td>
<td>360.00</td>
<td>1%</td>
<td>111.11</td>
<td>1%</td>
<td>360.00</td>
</tr>
<tr>
<td>16. Erotic News</td>
<td>1,440.00</td>
<td>1%</td>
<td>499.99</td>
<td>1%</td>
<td>1,440.00</td>
</tr>
<tr>
<td>17. Personal Web Pages</td>
<td>2,340.00</td>
<td>1%</td>
<td>140.00</td>
<td>1%</td>
<td>2,340.00</td>
</tr>
<tr>
<td>18. Political/Religion</td>
<td>210.00</td>
<td>1%</td>
<td>70.00</td>
<td>1%</td>
<td>210.00</td>
</tr>
<tr>
<td>19. Gambling</td>
<td>1,750.00</td>
<td>1%</td>
<td>599.99</td>
<td>1%</td>
<td>1,750.00</td>
</tr>
<tr>
<td>20. NDS Sites</td>
<td>1,000.00</td>
<td>1%</td>
<td>333.33</td>
<td>1%</td>
<td>1,000.00</td>
</tr>
<tr>
<td>21. Lifestyle</td>
<td>740.00</td>
<td>1%</td>
<td>244.44</td>
<td>1%</td>
<td>740.00</td>
</tr>
<tr>
<td>22. Art/Culture</td>
<td>410.00</td>
<td>1%</td>
<td>136.67</td>
<td>1%</td>
<td>410.00</td>
</tr>
<tr>
<td>23. Criminal Skills</td>
<td>341.00</td>
<td>1%</td>
<td>113.33</td>
<td>1%</td>
<td>341.00</td>
</tr>
<tr>
<td>24. Music</td>
<td>1,200.00</td>
<td>1%</td>
<td>109.09</td>
<td>1%</td>
<td>1,200.00</td>
</tr>
<tr>
<td>25. Reality</td>
<td>1,400.00</td>
<td>1%</td>
<td>400.00</td>
<td>1%</td>
<td>1,400.00</td>
</tr>
<tr>
<td>26. Hate Speech</td>
<td>20.00</td>
<td>1%</td>
<td>7.00</td>
<td>1%</td>
<td>20.00</td>
</tr>
<tr>
<td>27. Drugs</td>
<td>10.00</td>
<td>1%</td>
<td>3.33</td>
<td>1%</td>
<td>10.00</td>
</tr>
<tr>
<td>28. Gun/Weapon</td>
<td>10.00</td>
<td>1%</td>
<td>3.33</td>
<td>1%</td>
<td>10.00</td>
</tr>
<tr>
<td>29. Other</td>
<td>19,027,000.00</td>
<td>2%</td>
<td>6,293,974</td>
<td>7%</td>
<td>19,027,000.00</td>
</tr>
</tbody>
</table>

**Supplemental Hits**

- Total: 26,025,900
- 26,025,900
- 216,817
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

Internet Access Policies set up in Websense

Websense Enterprise

Updated Daily

DATABASE

Cisco Content Engine (Websense client)

INTERNET

User

Permitted Request

Blocked Request

Reports & Analysis

Activity Monitor

Monitor usage
Graphical reports
Customizable management

© 2002, Cisco Systems, Inc. All rights reserved.
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

- 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

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

Performance (Transactions per Second)

Core

Branch

CE-7325

CE-7305

CE-565

CE-510

NM-CE-BP-40

NM-CE-BP-20
## Deployment Guidelines:
### Network Module vs. Appliance

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

Removable 20 GB IDE Drive

Compact Flash

External FE port
(no s/w support at FCS)

USB port

SCSI connector adapter card

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?