Cisco WAAS
Wide Area Application Services

Technical Overview & Important Features

Maciej Bocian
Architecture Sales Manager
Data Center and Virtualization, Central Europe
mbocian@cisco.com
Agenda

- Cisco WAE Platforms
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- Data Replication Acceleration
- Network-embedded virtualization
- Management
- Q&A
Cisco WAAS
Comprehensive WAN Optimization Solution

- Accelerates applications over the WAN
- Delivers video to the branch
- Provides local hosting of branch IT services
WAAS Product Line Overview

Location & Size*

Data Center & Campus Platforms

Branch Office & Mobile User Platforms

List Price w Enterprise License

* Indicative sizing only. Please refer to WAAS sizing guidelines to size specific to customer requirements.

* NME-302 - offers TCP Optimization & Compression only. It does not support Enterprise License Features.
Cisco WAAS Router Modules

- Provides the lowest CapEx and OpEx; integrates within the ISR; addresses 80 percent of remote branch offices.
- Single-processor system; can be clustered with WCCPv2, PBR, and is supported in ISR models 2811, 2821, 2851, 3825, and 3845.

- Model NME-WAE-302:
  - 512 MB of RAM, 80 GB of disk
  - Up to 4 Mb/s WAN connections and up to 250 optimized TCP connections

- Model NME-WAE-502:
  - 1 GB of RAM, 120 GB of disk
  - Up to 4 Mb/s WAN connections and up to 500 optimized TCP connections

- Model NME-WAE-522:
  - 2 GB of RAM, 160 GB of disk
  - Up to 8 Mb/s WAN connections and up to 800 optimized TCP connections
WAAS on ISR G2

WAAS edge deployment for small to medium offices

Integration with ISR G2

Application Acceleration validated with application vendors

WAN Optimization

Enable Server Consolidation

NME-WAE-502

Supported on 2911, 2921, 2951 and 3900 with Network Module Adapter
WAAS 4.1.5 or later
Available at ISR G2 FCS

Value Proposition on 502
Investment protection for current 502 customers
Available for immediate deployment
Proof of Concept for ISR G2 and WAAS
Cisco WAAS Appliance Family

- **WAE-512 Appliance**:
  
  Single-processor system with 250 GB of RAID-1-protected SATA2 disk capacity and optional disk encryption.

  1 GB memory configuration supports 8 Mb/s WAN connections and 750 optimized TCP connections.

  2 GB memory configuration supports 20 Mb/s WAN connections and 1500 optimized TCP connections.

- **WAE-612 Appliance**:
  
  Dual-core processor system with 300 GB of RAID-1-protected and hot-swappable SATA2 disk capacity and optional disk encryption.

  2 GB memory configuration supports 45 Mb/s WAN connections and 2000 optimized TCP connections.

  4 GB memory configuration supports 90 Mb/s WAN connections and 6000 optimized TCP connections.
Cisco WAAS Virtualization Appliance

- WAE-674 Appliance:
  - Support for WAAS and Up to 3 Additional Virtual Blades
  - SCSI drives with RAID-5 & Hot Swap
  - Option to add redundant power & cooling
  - 300-GB for Virtual Blade
  - 300-GB Usable Disk for DRE, CIFS, etc.
  - Base memory 4 GB, option to upgrade to 8 GB of Memory
  - Hardware Assist for Enterprise Class Virtual Blades
Cisco WAAS Data Center Appliances

- **WAE-7341 Appliance:**
  - Quad-core processor, 12 GB of RAM
  - Up to 310 Mb/s WAN connections and 12,000 optimized TCP connections
  - Up to 900 GB RAID-5 protected and hot-swappable SAS disk capacity with optional disk encryption

- **WAE-7371 Appliance:**
  - Dual quad-core processors, 24 GB of RAM
  - Up to 1 Gb/s WAN connections and 50,000 optimized TCP connections
  - Up to 1.5 TB RAID-5 protected and hot-swappable SAS disk capacity with optional disk encryption

WAE-7341
Enterprise Data Center Appliance

WAE-7371
Enterprise Data Center Appliance
Introducing Cisco WAAS Mobile

- WAAS Appliances & NMs accelerate the WAN
- WAAS Mobile Software accelerates mobile VPN Connections
# Cisco WAAS Licensing

<table>
<thead>
<tr>
<th>License</th>
<th>Description</th>
<th>Use</th>
</tr>
</thead>
</table>
| Transport | Includes WAN optimization features only:  
- Data Redundancy Elimination  
- Persistent Session-Based LZ Compression  
- Transport Flow Optimization  
Includes Cisco IOS-like command-line interface and Cisco WAE Device Manager GUI | Used for deployments where applications need to be optimized but protocol latency does not need to be mitigated (non-server-consolidation environments). Provides optimizations for all TCP-based applications, but no CIFS protocol acceleration (latency mitigation/caching), file server disconnected mode, or print. |
| Enterprise | Includes all the features of Transport license and:  
- Application Acceleration: CIFS, HTTP, SSL, NFS, MAPI  
- Disk encryption  
- NetQos FlowAgent integration  
Enables a WAE to act as Central Manager for Cisco WAAS deployments:  
- Includes Central Manager GUI  
- Order two for active or standby deployments | Used for deployments where applications need to be optimized and file servers are being consolidated. Provides optimizations for all TCP-based applications and protocol acceleration for CIFS, HTTP, SSL, NFS, MAPI. Required for each deployment of Cisco WAAS. Deployments without Central Manager are not supported under any circumstance. |
| Video     | Enables the Live Video Streaming Acceleration Add on to the Enterprise License                                                                                                                                 | Used for deployments where video streaming enhancements are required                                                                                                                                 |
| Virtual Blade | Enables the Virtual Blade features Add on to the Enterprise License                                                                                                                                                                                                  | Used for deployments where a server may be required for print services and directory services                                                                                                                                                           |
Agenda

- Cisco WAE Platforms
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- Data Replication Acceleration
- Network-embedded virtualization
- Management
- Q&A
Cisco WAAS Product Architecture

Platform Management and Services
- CIFS AO
- MAPI AO
- HTTP AO
- SSL AO
- Video AO
- NFS AO
- TCP Proxy with Scheduler Optimizer (SO)
  - DRE, LZ, TFO
- Embedded virtualization

Cisco WAAS Operating System
- Policy Engine, Filter-Bypass, Egress Method, Directed Mode, Auto-Discovery

Disk Storage (Cache, VB storage etc.)

Configuration Management System (CMS)
- WoW
- Virtual Blade #2
- Virtual Blade #3

Ethernet Network I/O
Advanced Compression

- **Data Redundancy Elimination (DRE):**
  - Application-agnostic compression
  - Up to 100:1 compression

- **Persistent LZ Compression:**
  - Session-based compression
  - Up to an additional 10:1 compression even after DRE
TCP Flow Optimization (TFO)

- Improves application throughput
- Improves existing WAN bandwidth utilization
- Shield end-nodes from unruly WAN conditions
  - Bandwidth scalability - help certain applications ‘fill-the-pipe’
  - Connection fairness - ensure bandwidth is allocated fairly amongst flows
  - Loss mitigation - selective acknowledgement and retransmission
  - Slow-start mitigation - improve connection setup time
- TCP Proxy architecture provides LAN-like TCP behavior and provides higher levels of compression than per-packet compression
- TFO provides adaptive buffering to help ensure that connections requiring additional memory to achieve higher throughput
Application-Specific Acceleration

- **Application and Protocol Awareness**
  Minimize chatter through protocol proxy-caching, read-ahead, write-behind, and other optimization
  Safe caching preserves coherency, integrity while improving performance and saving WAN bandwidth
  Scheduled File preposition enables intelligent distribution of large objects to improve performance

- **Intelligent Server Offload**
  Caching and optimizations minimize workload on accelerated servers enabling consolidation along with centralization

- **WAAS Application Accelerators**
  CIFS, NFS, MAPI, Video, HTTP, SSL Windows printing

- **Licensed developed and validated with application vendors**
WAAS Overview
Session and Transport Layer Optimization

Host A
- Application
- Presentation
- Session
- Transport
- Network
- Data Link
- Physical

Host B
- Application
- Presentation
- Session
- Transport
- Network
- Data Link
- Physical

WAE 1
- Application Optimizer (AO)
  - TFO
  - Network
  - Data Link
  - Physical

WAE 2
- Application Optimizer (AO)
  - TFO
  - Network
  - Data Link
  - Physical

Origin
Optimized
WAN
Simple Transparent In-path Deployment

- **Simple Plug-and-Play Deployment**
  - Physical in-path deployment between switch and router or firewall requires no network changes
  - Mechanical fail-to-wire upon hardware, software, or power failure

- **Scalability and High Availability**
  - Two two-port fail-to-wire groups provides support for redundant network paths and asymmetric routing
  - Serial in-path clustering with load-sharing and fail-over

- **Seamless Transparent Integration**
  - Transparency and automatic discovery
  - 802.1q VLAN trunking support
  - Supported on all WAE appliance models
Network-Integrated Off-path Interception

- Transparent integration and automatic discovery regardless of interception method

- WCCPv2 Interception
  
  Active/active clustering supports up to 32 WAEs and 32 routers with automatic load-balancing, load redistribution, fail-over, and fail-through operation

  Near-linear scalability and performance improvement when adding devices

- Policy-Based Routing Interception
  
  Routing of flows to be optimized through a Cisco WAE as a next-hop router

  Active/passive clustering provides high availability and failover using IP SLAs as a tracking mechanism
Scalable Data Center Integration

- **Application Control Engine (ACE)**
  - Appliance and Catalyst 6500 series module provide industry-leading scalability and performance for the most demanding data center networks
  - Supports from 1Gbps to 64Gbps of aggregate throughput and up to 4M concurrent TCP connections
  - Cluster management for hundreds of WAE devices provides industry’s most scalable and high-performance WAN optimization solution

- **Asymmetric Optimization**
  - Host of asymmetric optimizations that complement WAAS and provide single-ended performance and scalability improvements
  - Includes intelligent compression, latency reduction for HTTP applications, SSL offload, and TCP connection re-use
Cisco WAAS Auto-Discovery

- Cisco WAAS devices automatically discover one another and negotiate optimization capabilities
- Eliminates the need for complex overlay networks with tunnels that could double management effort and break control, security, and monitoring systems
Secure WAN Optimization

- Security technologies have gone mainstream in today’s branch office:
  - Represent a significant investment and priority.
  - Must not be compromised by emerging WAN acceleration technology.

- Cisco WAAS has unique capabilities to provide secure WAN optimization at the branch:
  - Firewall interoperability
  - Disk encryption
  - Role Based Access Control (RBAC):
  - PCI compliance
  - Common Criteria certification
Cisco WAAS: Security Integration

Firewall recognition of the TCP options used in WAAS autodiscovery:
- Permits the initial sequence number shift for the connection
- Maintains the Layer 4 state on the optimized path

WAAS interoperability with leading Cisco security platforms:
- IOS Firewall 12.4(11)T2
- FWSM 3.2.1
- ASA/PIX release 7.2.3
IOS Firewall

- Independent IOS Firewall:

  IOS Firewall 12.4(11)T2 incorporates an enhancement to observe WAAS TCP sessions:
  - Identifies TCP options used in autodiscovery.
  - After successful completion of autodiscovery it permits the initial sequence number shift for the connection without compromising stateful inspection.

  Solution applies to both inline and WCCP interception WAAS appliance deployments.

  Full Stateful Firewall for optimized traffic.
Cisco WAAS: Firewall Integration

Cisco WAAS provides autodiscovery utilizing TCP options:

- Firewalls might scrub TCP options used for autodiscovery

Cisco WAAS sequence number shift used to distinguish between optimized and nonoptimized flows:

- Firewalls see the sequence number shift and drop the session

Cisco Firewalls can be made WAAS aware which avoids these problems

Cisco WAAS Directed mode supports 3\textsuperscript{rd} party firewalls that do not support the auto discovery process.
Cisco WAE Disk Encryption

- Cisco WAE Disk Encryption
  - Optional feature applied against data partitions within the WAE to mitigate concern of data theft due to stolen drives or physically compromised WAE devices
  - Keys fetched from CM upon boot and stored in memory only, WAE will pass-through if keys are unavailable
  - Keys synchronized amongst Central Managers to ensure high availability

- Standards-Based Strong Encryption
  - Follows FIPS 140-2 level 2 specification with certification to follow
  - 256-bit Advanced Encryption Standard (AES) cipher, which is the standard for US Government data protection and the strongest commercially-available encryption
  - Cisco WAAS is ‘In Evaluation’ with Common Criteria certification

![Diagram of Cisco WAE Disk Encryption]
Common Criteria

Common Criteria is an international standard (ISO 15408) for security features in a product:

In the United States, federal government agencies prefer products that are Common Criteria “Certified” or “In-evaluation.”

Common Criteria is a part of a U.S. government initiative between the National Institute of Standards and Technology (NIST) and the National Security Agency (NSA).

Cisco WAAS is the first WAN acceleration product certified under Common Criteria:

Certification is under EAL4 (level of certification).
Cisco WAAS is the first product to be certified.
URL: http://www.niap-ccevs.org/cc-scheme/in_evaluation.cfm
Agenda

- Cisco WAE Platforms
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- Data Replication Acceleration
- Network-embedded virtualization
- Management
- Q&A
CIFS Application Optimizer

Problem
CIFS is a "chatty" protocol and when used in an environment with high latency, packet loss, and bandwidth constraints such as a WAN, file server access over the WAN is significantly diminished.

Solution
- File and Metadata caching
- Read-ahead
- Message pipelining
- Scheduled preposition to pre-populate
- Transparent integration
- Dedicated CIFS cache (SMS distribution point, user home area)

Benefits
- Enable consolidation of distributed file and print resources into the data center without compromising performance.
- Offload of Data Center Servers
Windows Printing Application Optimizer

Problem

Windows Print protocol uses MS-RPC which is very “chatty”
As a result, Windows Print over WAN degrades exponentially as latency increases.

Solution

- Based on licensed Microsoft Print Protocols
- Optimized access to print queue status and printer settings
- Bi-directional Acceleration
- Printer and Queue meta-data caching
- Async write
- DRE hints for enhanced payload compression
- MS-RPC message optimization
- RPC command fragments are handled asynchronously
- Delayed close of printer handles (OPEN requests local)

Benefits

- Users print at near-LAN speeds
- No need for Network IT group to manage Branch Print
- No configuration on WAAS – just turn it on!
- Enable scalable centralized Windows Print services
- Fully Transparent to Windows AD Management
- Easy server migration from branch to datacenter
NFSv3 Application Optimizer

Problem
- In UNIX environments Network File System (NFS) protocol is being used for large file exchange such as software builds, CAD applications and large directory access
- NFSv3 is a “chatty” RPC protocol
- Clients cannot efficiently operate on high-latency/high-bandwidth WANs

Solution
- Read-Ahead
- Asynchronous write
- DRE hints
- Meta-data caching

Benefits
- Can fill high-bandwidth links regardless of latency
- Transparent to client and server. No configuration required.
- Tested for compliance with IBM AIX, Linux and Solaris clients + Leading NAS vendors!
HTTP Application Optimizer

Problem
- Slow page load on Interactive Web applications
- Browsers serially open and close connections to fetch small objects (e.g., graphics)
- Latency in a connection open/close could be higher than object transmit time.

Solution
- Fast Connection Reuse - Optimized connections on the WAN remain active for a short period of time to be reused should additional data between the client-server pair need to be exchanged
- Proxy Connect to SSL Servers – Each HTTP request is being inspected and forwarded to the HTTP or SSL AO or general optimization

Benefits
- This eliminates the latency caused by establishing multiple connections between clients and servers
- Tuned to offset connection “bursts”
  - Bounded session and idle timeouts
- Transparency is maintained
  - Only same pair of client and server requests are reused
- Compliments and preserves http application pipelining
The Need for SSL Acceleration

- WAAS optimization benefits are maximized only when applied to decrypted payload

SSL Handshake

“session key” derived

Encrypted Data Exchange
Cisco WAAS SSL Optimization Solution

- Core WAE acts as a Trusted Intermediary Node for SSL requests by client
- Private Key and Server Certificate are stored on the Core WAE device
- Core WAE participates in SSL Handshake to derive “session key”
- Distributes the “session key” securely in-band to the Edge WAE over the established connection between the Edge WAE and Core WAE
Cisco WAAS SSL – Benefits Summary

- **Trust Model maintained in Data Center = Better Security**
  
  Server private keys stored securely only on Core WAE; never pushed out to branch.

  Edge and Core WAE communicate securely with each other, after verifying each-other’s identity.

- **Widest Range of SSL Acceleration**
  
  Online security check of certificates against enterprise and root authorities (OCSP)

  Supports Client Authentication and validation.

  Supports high-security mode (DHE key exchange) - default in some popular browser & server combinations.

- **Flexible Deployment**
  
  PKI integration - Import Original Server Certificate and Private Keys signed by CA

  Use Wildcard Certificates signed by CA

  Use Enterprise CA signed Certificate – derive session key without original server private key.

- **Ease of Operation = Lower Opex**
  
  SSL Service policy required only on the Core WAE

  Scalable service configuration using Wildcard certificates.
## Cisco WAAS SSL differentiators

<table>
<thead>
<tr>
<th>Feature</th>
<th>What is this feature about?</th>
<th>Why is this important?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Certificate Status Protocol (OCSP)</td>
<td>Real-time check whether SSL certificates are valid and/or revoked</td>
<td>▪ Real-time certificate checks are effective only if all devices that intercept SSL traffic have OCSP support. SSL devices that don’t support OCSP becomes the weak link from the security perspective</td>
</tr>
<tr>
<td>Client Authentication</td>
<td>Server authenticates client based on client certificates. WAAS SSL an optimize traffic using client certificates</td>
<td>▪ Provides user-id level identity control</td>
</tr>
<tr>
<td>▪ Common in Federal, Defense, and foreign financial firms.</td>
<td></td>
<td>▪ Most enterprise and large commercial customers use URL filtering &amp; explicit proxy</td>
</tr>
<tr>
<td>Explicit HTTP(S) Proxy</td>
<td>WAAS can optimization connections that upgrades from clear text to a crypto-SSL during connection set-up</td>
<td>▪ Default option for some popular browsers and servers (Apache/Firefox)</td>
</tr>
<tr>
<td>Diffie-Hellman (DHE) Key Exchange Method</td>
<td>Higher Security Key Exchange Method</td>
<td>▪ This simplifies deployment compared to the manual setup of trust relationships required on competitive products</td>
</tr>
<tr>
<td>Simplified Group based Trust configuration</td>
<td>Automated trust relationship negotiation between WAAS devices using device group</td>
<td>▪</td>
</tr>
</tbody>
</table>
MAPI Application Optimizer

Problem

- MAPI is using MS-RPC which is a chatty request-response protocol.
- MAPI exchanges many interactive control messages, perform meta-data operations and large object transfers.
- MAPI traffic is negotiated using MS Port Mapper (port 135) and is using dynamic ports.
- Data encoding is negotiated by client/server. Outlook 2000 obfuscates data, Outlook 2003 and 2007 compress data (LZ) or obfuscate if uncompressible.

Solution

- Full application support - Developed in conjunction with Microsoft
- Asynchronous Writes
- Read Ahead
- Messages Decompression
- DRE hints
- EndPoint Mapper - Listens to client communication with PortMapper server and creates dynamic ATP entry for negotiated port.

Benefits

- Reduced send and receive time and improves response time of interactive control operations – very important for Outlook 2000 users.
- Cleans up the outbox faster – important for cached mode users.
- Faster downloads of OAB, while significantly reducing BW consumption as this is a redundant transfer across user population.
- Optimizes native Outlook 2007 operations (Note: requires encryption to be disabled on server).
- Transparent, automatic optimization. Simple enable/disable control, no requirement for modification of MAPI ports as Riverbed does. Integrated with EPM adapter for classification.
- No reverse engineering (MSFT licensing) - Full protocol compliance with the different protocol versions –
- No security hole of keeping sessions open even after users have logged out.

Video Application Optimizer

- **Windows Media Stream Splitting** - Each new client request (over LAN) will reuse existing incoming stream (over WAN) for the same stream URL.

- **Data-reduction and optimization for non-WMT/RTSP video** – WAN optimization and bandwidth reduction for other video formats including video over HTTP, Flash, QuickTime, RealVideo, and any other video protocol that uses TCP as a transport.

- **Video-on-demand caching** – Cisco WAAS CIFS acceleration can be used in conjunction with prepositioning to provide a powerful VoD-delivery architecture for enterprise e-Learning, training, and video message archival and playback.

- **Intelligent video server offload** – Cisco WAAS video delivery services minimize the burden placed on the origin video server by intelligently.

- **RTSP/TCP rollover** - Client requests over RTSP/UDP automatically rolled over to RTSP/TCP.
VoD Streaming in Microsoft Environment – Windows Media, CIFS Servers and Active Directory

1. Open Web page
2. Click on VoD (Video.asx)
3. ... opens Windows Media Player
4. Play Video .wma file

*ASX Windows Media file points to *.WMA video file

<ASX Version = "3.0">
<Title>My Video</Title>
<Entry>
  <Title>Video Title</Title>
  <Ref href = "file://\ServerName\Path\Filename.wmv"/>
</Entry>
</ASX>

Windows File server

\CIFS_server\Directory\Video.wmv
VoD Streaming in a Microsoft Environment –

1. Open Web page
2. Click on VoD (Video.asx)
3. ... opens Windows Media Player
4. Play Video .wma file locally

*ASX Windows Media file points to *.WMA video file

<ASX Version = "3.0">
<Tag>My Video</Tag>
<Entry>
<Tag>Video Title</Tag>
<Ref href = "file://\ServerName\Path\Filename.wmv"/>
</Entry>
</ASX>

Windows File server

\CIFS_server\Directory\Video.wmv
Live Video Streaming for Windows Media Environment

2. Click on published URL to get live stream

3. Opens Windows Media Player

4. Windows Media RTSP unicast streams

1. Uncompressed Video

Web Portal
List of scheduled live streaming events

Encoder

Microsoft Windows Media Server (WMS)

WAN

Bottleneck

→ Redundant streams issued for the same source!

→ Overloaded streaming servers
Live Video Streaming with WAAS
Edge stream splitting

1. Uncompressed Video

2. Click on published URL to get live stream

3. Opens Windows Media Player

Note: Separate WAAS license for Windows Media Live Streaming required per contract w/Microsoft
Cisco DMS & WAAS to enable Video Applications in the Branch

- **Video to Branch Desktop**
  - Live streaming and Video-on-Demand (VoD)
  - DMS in Data Center, WAAS 4.1 in Branch

- **Video to Branch Digital Signage**
  - Cisco Digital Media Player (DMP) to pull video from WAAS (New DMP Feature)
  - WAAS can also deliver video to signage enabled Telepresence
Cisco WAAS and ASR-1000 WebEx Node optimize delivery of WebEx to branch users

**WAAS 4.1.3 optimizes WebEx Delivery to the Branch**
- Data redundancy elimination and compression
- Up to 80% Bandwidth Reduction
- Eliminates WAN Upgrades
- Increases number of WebEx users in Branch
- Fully transparent solution

**ASR-1000 WebEx Nodes optimize Internet Delivery**
- Only 1 stream per site
- 45-90% Bandwidth Savings
- Eliminates WAN Upgrades
- Offloads Firewall/Proxies due to reduced traffic
- Fully transparent solution

**WAAS Optimizations can also be delivered for other SaaS traffic in the enterprise**

**ASR-1000 WebEx Nodes (SPA Blades)**
Cisco is the only WAN Op vendor that offers validated solutions with the top 3 app vendors

<table>
<thead>
<tr>
<th>Application</th>
<th>Certification and Testing Activity</th>
</tr>
</thead>
</table>
| Oracle      | ▪ Joint Cisco-Oracle Enterprise Solutions Engineering Lab  
              ▪ Joint solution papers published |
| SAP         | ▪ Joint solution development and testing at SAP Labs  
              ▪ Joint solution papers under development  
              ▪ Joint technology development discussions |
| Microsoft   | ▪ Royalty-paying agreement for key Microsoft protocols – e.g. Microsoft Exchange, CIFS, Windows Media, MS-RPC  
              ▪ Joint testing of applications at Microsoft Labs  
              ▪ Joint escalation support agreement |
Cisco WAAS leads the market in solution development and testing with leading application vendors

<table>
<thead>
<tr>
<th>Application</th>
<th>Certification and Testing Activity</th>
</tr>
</thead>
</table>
| IBM         | ▪ Joint Cisco-IBM Enterprise Solutions Engineering Lab  
              ▪ Joint solution papers under development |
| EMC²        | ▪ Inclusion on Cisco-EMC products in each others product development test beds for file services  
              ▪ Joint solution development underway for SRDF  
              ▪ Joint escalation support agreement done |
| NetApp      | ▪ Joint solutions tested with published papers  
              ▪ Joint escalation support agreement done |
| vmware      | ▪ Strategic investment from Cisco with WAAS being one of the top 5 areas for joint solution development |
| Cisco       | ▪ IOS Regression Testing and Certification Labs  
              ▪ Cisco 28xx,38xx Branch Access Router Performance and Scale Testing labs  
              ▪ Cisco Voice & Security Solutions Labs  
              ▪ Cisco NSite, Safe Harbor/DCAP, PSIRT Labs |
Agenda

- Cisco WAE Platforms
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- Data Replication Acceleration
- Network-embedded virtualization
- Management
- Q&A
Data Backup and Restore and Replication

- Online Data Backup and Restore
  Backup is accessible directly over the WAN
  Reduces recovery time

- Data Replication
  Data is continuously synchronized across the network
  Enables rapid failover to remote datacenter for 24/7 data availability
  Reduces recovery time and improves recovery point
Data Replication Challenges

- Requires High Bandwidth Low Latency Links
- Inability of storage systems to fill WAN link due to latency/packet loss issues
- High cost of bandwidth for Data Replication
- Need to increase the distance of the disaster recovery site
Combined Power of TCP Optimization and Advanced Compression

LAN-Like Throughput

Bandwidth Savings Fewer Roundtrips

No WAAS

WAAS enabled with Replication Accelerator Mode
Replication Acceleration Mode Overview

WAEs in Replication Accelerator mode have
TFO tuned to **address TCP issues for high speed** WAN links
DRE tuned for **low latency processing** requirements for DC to DC Replication
Default policy in Replication Accelerator mode is tuned for Replication Applications
Cisco WAAS Data Center Appliances in Replication Accelerator Mode

- **WAE-7341 Appliance:**
  - Quad-core processor, 8GB of RAM
  - Up to 310Mbps WAN connections and 2500 optimized TCP connections (when in Replication Accelerator Mode)
  - Up to 900GB RAID-5 protected and hot-swappable SAS disk capacity with optional disk encryption
  - Fan Out - 4

- **WAE-7371 Appliance:**
  - Dual Quad-core processors, 24GB of RAM
  - Up to 1Gbps WAN connections and 5000 optimized TCP connections (when in Replication Accelerator Mode)
  - Up to 1.5TB RAID-5 protected and hot-swappable SAS disk capacity with optional disk encryption
  - Fan-Out - 9
Replication Accelerator Benefits

- Reduced cost of WAN bandwidth for Replication
- Shortening of the backup/replication windows
- Extension the distance of the disaster recovery site
- Integrates with the existing Data-Center Network
- Auto Discovery and Configuration drives ease of deployment
- Meets/exceeds the availability & reliability requirements for storage customers
- Validated solutions w storage vendors
Agenda

- Cisco WAE Platforms
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- Data Replication Acceleration
- Network-embedded virtualization
- Management
- Q&A
Virtualized App Delivery for Branch Office
Cisco WAAS 4.1 with Virtual Blade Technology

- Centralize what you can with WAAS
- Locally host services (e.g. Windows Server) on same WAAS device

Cisco WAAS Virtual Blade Technology
Providing Best Mix of Distributed and Centralized IT Services
Validated by Microsoft for Windows Services
Cisco WAAS Virtual Blade

- A virtual blade is the equivalent of having a generic PC built into the WAAS device.

- This generic PC has
  
  **Firmware:** BIOS and possible extensions.
  
  **Hardware:** one or more CPUs, memory, host bridge, VGA, one or more NICs, disk controller, disk, CD drive, serial port, etc.

- Software configuration of the virtual blade allows control on some of these items.
  
  How much memory, size of the disk, how many CPUs etc.
Cisco Wide Area Virtualization Engine (WAVE)

**WAVE 274**
- **HW:** All inclusive fixed config for easy ordering
  - 250GB, 3GB DRAM
  - 2 port inline
- **SW:** Enterprise License included
- **Options:** Virtual Blade, Live Video Streaming
- **Capacity:** up to 20 users, max 200 connections
- **Form:** Desktop
- **List Price:** $6,500

**WAVE 474**
- **HW:** All inclusive fixed config for easy ordering
  - 250GB, 3GB DRAM
  - 2 port inline
- **SW:** Enterprise License included
- **Options:** Virtual Blade, Live Video Streaming
- **Capacity:** up to 50 users, max 400 connections
- **Form:** Desktop
- **List Price:** $9,900

**WAVE 574**
- **Base HW config**
  - 500GB, 3GB DRAM
- **HW Upgrades:**
  - 500GB (RAID-1)
  - 3GB DRAM
  - 2 or 4 port inline
- **SW:** Enterprise License included
- **Options:** Virtual Blade, Live Video Streaming
- **Capacity:** up to 150 users
  - max 750 conn w 3GB, max 1300 conn w 6GB
- **Form:** 1RU rack server
- **List Price:** $12,500
Virtual Blade – Sample Flow
Allocate Resources and Deploy Image

- Allocate resources and start Virtual-Blade instance
  Easy & Simple - from WAAS CM or from CLI
- Centrally deploy server image over to WAE
  From CLI or WAAS CM, using FTP or HTTP
Virtual Blade – Sample Flow
Centrally Manage

- Remote access and management using Windows Management facilities

Example: Using Terminal Connection to Virtual Blade IP
Microsoft and Cisco Solution

Microsoft Windows Server 2008 Server Core

- Branch optimized IT services
  - Read-only Domain Controller
  - Print services
  - DNS/DHCP services

Cisco WAAS with Virtualization

- Complete WAN optimization + application acceleration
- Ability to host Windows services locally

Cisco WAAS with pre-packaged Windows Server 2008 services

- Jointly developed architecture
- Joint customer support
Cisco WAAS Virtual Blade (Cont.)

- Architecture jointly developed and validated by Microsoft and Cisco
- Joint support for solution from Cisco and Microsoft

Embedded systems virtualization architecture
- Native hardware performance for network services
- Optimized performance of virtualized Windows

Central Management
- Management of virtual blades using WAAS CM by network and server administrators
- WAAS CM minimizes operational dependencies by providing role-based management

Appliance experience
- Pre-installation option for Windows Server 2008
  - Eases migration to 2008
  - Small image foot-print reduces patching needs
Agenda

- Cisco WAE Platforms
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- Data Replication Acceleration
- Network-embedded virtualization
- Management
- Q&A
Scalable, Secure Central Management

- **Centralized Management**
  - Robust management, monitoring, and reporting for up to 2500 nodes
  - Device grouping for simplified rollout of configuration changes
  - Device and system alarms, as well as integration with SNMP and syslog

- **Secure Management Platform**
  - SSL-encrypted HTTP GUI and intra-device communication
  - Roles-based Access Control (RBAC) to isolate users to specific capabilities and domains of management
  - Integrated IOS-like CLI accessible via SSH (also telnet, serial)

- **High Availability Configurations**
  - Active/standby deployments with automatic failover, replication of Central Manager database, and encryption keys

- **SOA-ready Monitoring**
  - Standard XML Web Service (SOAP)
  - Integration with external reporting and monitoring portals
Configurable Comprehensive Reporting

- **Device Dashboard**
  Configurable list of reports to display on a device or device-group homepage

- **Customizable, schedulable reports**
  Device and system health, WAN optimization performance, application acceleration performance, and traffic statistics

- **Traffic Statistics**
  Optimized vs pass-through traffic mix including pass-through reason
  Application traffic mix over period of time (hr/day/wk/mo/custom)

- **Per-Connection Statistics**
  Connection monitoring shows near real-time view of optimized connections and details

- **Compression Statistics**
  Bandwidth savings per application over time (hr/day/wk/mo/custom)

- **Acceleration Statistics**
  Examine accelerated connections, open files, cached resources, cache hit ratio, and average throughput
Role-Based Access Control

Custom roles define the services that a user can manage in the WAAS network.

Domain configuration defines the device groups or WAEs that are accessible by the user.

Read-Only roles for viewing of pages and screens
Central Manager Home Page
New, Customizable, System Dashboard

- **Navigation Bar for Functionality Access**
- **System Wide Optimization Statistics**
- **Export the chart data to spreadsheet**
- **Increase chart space by hiding the navigation bar**
- **Network-wide notification capture and acknowledge**
Reporting Capabilities – Manage Reports

Can Create custom reports

Choose device/group

Schedule & Deliver via Email…

Can Schedule report generation
### Reporting Capability – Scheduled reports

#### View all the scheduled reports

<table>
<thead>
<tr>
<th>SLM</th>
<th>Report Name</th>
<th>Devices Selected</th>
<th>Scheduled Time</th>
<th>Completed Time</th>
<th>Frequency</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>shash_report</td>
<td>DC1-WAE1-alex, BR1-WAE-alex</td>
<td>Thu Feb 21 22:07:00 UTC 2008</td>
<td>Thu Feb 21 22:07:00 UTC 2008</td>
<td>Once</td>
<td>Completed</td>
</tr>
<tr>
<td>2</td>
<td>SYSTEM_DASHBOARD_TAB3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SYSTEM_PASSTHRU_REPORT</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>SYSTEM_PASSTHRU_REPORT</td>
<td>DC1-WAE1-alex, BR1-WAE-alex</td>
<td>Thu Feb 21 04:20:00 UTC 2008</td>
<td>-</td>
<td>Daily</td>
<td>In Progress</td>
</tr>
<tr>
<td>3.2</td>
<td>SYSTEM_PASSTHRU_REPORT</td>
<td>DC1-WAE1-alex, BR1-WAE-alex</td>
<td>Thu Feb 21 04:20:00 UTC 2008</td>
<td>Thu Feb 21 04:20:00 UTC 2008</td>
<td>Once</td>
<td>Completed</td>
</tr>
<tr>
<td>3.3</td>
<td>SYSTEM_PASSTHRU_REPORT</td>
<td>DC1-WAE1-alex, BR1-WAE-alex</td>
<td>Thu Feb 21 04:17:00 UTC 2008</td>
<td>Thu Feb 21 04:17:00 UTC 2008</td>
<td>Once</td>
<td>Completed</td>
</tr>
<tr>
<td>4</td>
<td>SYSTEM_TRAFSUMM_REPORT</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>