Cisco Wide Area Application Services (WAAS) v4.1

Technical Overview

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Agenda

- Enterprise Application Delivery Challenges
- Introducing Cisco Wide Area Application Services
- Cisco WAAS Product Architecture
- Application Specific Acceleration
- Data Replication Acceleration
- Network-embedded virtualization
- Remote Access Optimization with WAAS Mobile
- Management and WAE Platforms
- Application Performance Solution Process
- WAAS Installation steps
- Summary
- Q&A
I/T’s Application Delivery Problem

- Increasingly distributed workforce drives need for distribution of I/T resources to remote locations
  - Enable productivity
  - Drive revenue and profits

- Data protection, availability, compliance, and management drives need for consolidation
  - Fewer devices to manage
  - Fewer points to protect
The WAN Is A Barrier To Consolidation

- Applications perform well in LAN:
  - High bandwidth
  - Low latency
  - Reliability

- Applications perform poorly in WAN:
  - Already congested
  - Low bandwidth
  - Latency
  - Packet Loss

Round Trip Time (RTT) ~ 0mS

Round Trip Time (RTT) ~ many many milliseconds
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Cisco WAAS
Comprehensive WAN Optimization Solution

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

Remote Office → Optimized Connections → Mobile
Remote Office → Optimized Connections → Internet
Remote Office → Optimized Connections → Data Center
Remote Office → Optimized Connections → Backup Data Center
## Application Performance Improvements

<table>
<thead>
<tr>
<th>Category</th>
<th>Applications</th>
<th>2X</th>
<th>5X</th>
<th>10X</th>
<th>25X</th>
<th>50X</th>
<th>100X+</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>File Sharing</strong></td>
<td>CIFS, NFS</td>
<td>2-20X</td>
<td>Avg</td>
<td></td>
<td></td>
<td></td>
<td>&gt;100X</td>
</tr>
<tr>
<td><strong>Email</strong></td>
<td>Microsoft Exchange, Lotus Notes, Internet Mail</td>
<td>2-5X</td>
<td>Avg</td>
<td>20X</td>
<td>Peak</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Web and Collaboration</strong></td>
<td>HTTP, WebDAV, FTP, Microsoft Sharepoint</td>
<td>2-10X</td>
<td>Avg</td>
<td></td>
<td></td>
<td></td>
<td>100X</td>
</tr>
<tr>
<td><strong>Software Distribution</strong></td>
<td>Microsoft SMS, Altiris, HP Radia</td>
<td>2-20X</td>
<td>Avg</td>
<td></td>
<td></td>
<td></td>
<td>&gt;100X</td>
</tr>
<tr>
<td><strong>Enterprise Applications</strong></td>
<td>Microsoft SQL, Oracle, SAP, Lotus Notes</td>
<td>2-5X</td>
<td>Avg</td>
<td>20X</td>
<td>Peak</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Backup Applications</strong></td>
<td>Microsoft NTBackup, Legato, NetBackup, NetApp</td>
<td>2-10X</td>
<td>Avg</td>
<td></td>
<td>50X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Data Replication</strong></td>
<td>EMC SRDF/A, EMC IP Replicator, NetApp, SnapMirror, Data Domain, Double-Take, Veritas Vol Replicator</td>
<td>2-10X</td>
<td>Avg</td>
<td></td>
<td>50X</td>
<td></td>
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</tr>
</tbody>
</table>
Seamless and Transparent Integration

- Compliance with critical network services
- Industry’s only holistic and secure optimization, visibility, and control solution
- Quality of Service (QoS)
  - Classification, NBAR, marking
  - Policing, shaping, queuing, WRED
  - LFI, header compression
- Network Management
  - NAM, PVM, NetFlow
  - NetQoS, IP SLA
- Security
  - IOS Firewall, IDS, IPS, ACL, VPN
- Optimized Routing
  - Network Path Affinity (NPA)
  - Optimized Edge Routing, PBR

Cisco Integrated Services Router
- Quality of Service (QoS)
- Network Analysis/NetFlow
- IOS Firewall
- Intrusion Prevention
- Optimized Edge Routing
- Policy Based Routing
- IP Service Level Agreements
- VPN

Cisco Wide Area Application Services
- Application Optimizers
- Advanced Compression
- Transport Optimization

WAN

APP DATA

SrcIP 1.1.1.1
DstIP 2.2.2.2
SrcPrt 1434
DstPort 80
optimized

SrcIP 1.1.1.1
DstIP 2.2.2.2
SrcPrt 1434
DstPort 80

SrcIP 1.1.1.1
DstIP 2.2.2.2
SrcPrt 1434
DstPort 80
APP DATA
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Cisco WAAS Product Architecture

Platform Management and Services

- CIFS AO
- MAPI AO
- HTTP AO
- SSL AO
- Video AO
- NFS AO
- WoW
- Virtual Blade #2
- Virtual Blade #3

Configuration Management System (CMS)

Cisco WAAS Operating System

- Policy Engine
- Filter-Bypass
- Egress Method
- Directed Mode
- Auto-Discovery

Disk Storage (Cache, VB storage etc.)

Ethernet Network I/O

TCP Proxy with Scheduler Optimizer (SO)
- DRE
- LZ
- TFO

Embedded virtualization
TCP Performance Challenges

- Bandwidth Starvation for Short-Lived Connections
- Inability to Use Available Bandwidth
- Inefficient Response to Packet Loss/Congestion

Diagram:
- cwnd vs. Time (RTT)
- Slow Start
- Congestion Avoidance
- TCP
Cisco TFO Provides Significant Throughput Improvements over Standard TCP Implementations

- Bandwidth Scalability Leverage Available WAN Capacity
- Better Performance in High Packet Loss Networks

Packet loss

Cisco WAAS TFO

Short Slow Start Yields Better Bandwidth Utilization

Standard TCP

Bandwidth Utilization

Time (RTT)
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 can achieve higher throughput automatically without compromising on fairness
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
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
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
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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**

![Diagram of Application-Specific Acceleration](image-url)
Benefits for Web-Based Application Users:
- Optimizing latency and bandwidth limited HTTP and HTTPS (SSL) applications
- Easily integrates with several digital certificate infrastructures

WAAS advantages:
- SSL Security Trust Model maintained - Server private keys remain within datacenter
- Accelerates widest range of enterprise SSL traffic including those that requires client authentication, real-time certificate revocation checks, and HTTP proxy

Encrypted SharePoint document download 1.5Mbps WAN (80 msec)

WAAS 4.1 is 4x faster than WAAS 4.0
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

![Diagram of HTTP Request and Response]

Click for More Details
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
The Need for CIFS Acceleration

- In this example of a 2MB Word document open, over 1000 messages are exchanged.
- With a 40ms RTT WAN, this equates to more than 52 seconds of wait time before the document is usable.
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
End-To-End HTTP Performance and Availability

- The top Web based enterprise application vendors are Oracle, SAP and Microsoft
  - Cisco offers WAN application delivery solutions developed and/or tested in partnership with leading application vendors

- [www.cisco.com/go/optimizemyapp](http://www.cisco.com/go/optimizemyapp)
The Need for SSL Acceleration

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

SSL Handshake

“session key” derived

Encrypted Data Exchange
Live Video Streaming for Windows Media Environment

1. Uncompressed Video
2. Click on published URL to get live stream
3. Opens Windows Media Player
4. Windows Media RTSP unicast streams

Bottleneck

- Redundant streams issued for the same source!
- Overloaded streaming servers
Live Video Streaming with WAAS

Edge stream splitting

**BRANCH OFFICE**

1. **Click on published URL to get live stream**

2. **Opens Windows Media Player**

3. **Only one stream per remote site**

**DATA CENTER**

1. **Uncompressed Video**

2. **List of scheduled live streaming events**

**WAAS**

- auto-detect RTSP connections (no configuration required)

**Microsoft Windows Media Server (WMS)**

**Web Portal**

**Encoder**

**BRANCH OFFICE**

Note: Separate WAAS license for Windows Media Live Streaming required per contract w/Microsoft
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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

Replication time takes several hours

Replication throughput is only 20Mbps

WAN link speed is 45Mbps
Combined Power of TCP Optimization and Advanced Compression

LAN-Like Throughput

Bandwidth Savings Fewer Roundtrips

No WAAS

WAAS enabled with Replication Accelerator Mode
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 with storage vendors
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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
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
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The Cisco WAE Appliances are designed to address varying customer needs, from very small branch offices to massive data center deployments, and offer the highest single-device and clustered-device scalability in the industry.
Cisco WAAS Router Modules

- The Cisco Wide Area Application Services (WAAS) network modules provide integrated WAN optimization with Cisco Integrated Services Routers (ISR), enabling you to implement full feature WAN optimization while minimizing total cost of ownership.

- Can be clustered with WCCPv2, PBR, and is supported in ISR models 2811, 2821, 2851, 3825, and 3845.

Cisco Integrated Services Router (ISR) Series

Reduce Branch Footprint
Reduce Cost with Integrated Support
Single Box Solution for Voice, Security, Wan Opt
Cisco Wide Area Virtualization Engine (WAVE) appliances extend the Cisco WAN optimization appliance portfolio to provide the industry's only branch-office appliance family that incorporates comprehensive WAN optimization, embedded virtualization for local hosting, and branch-office video delivery.
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