

Cisco Mid-Atlantic Users Group

WAN Optimization

October 19, 2010

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Agenda

- **Why Do You Need WAN Optimization?**
- **How Does Cisco WAAS Work?**
- **How Does WAAS Integrate With Your Network?**
 - **WAAS Appliances**
 - **Router-Integrated WAAS Solutions**
 - **vWAAS**
- **WAAS Management**
- **Conclusion/Questions**

Why Do You Need WAN Optimization?

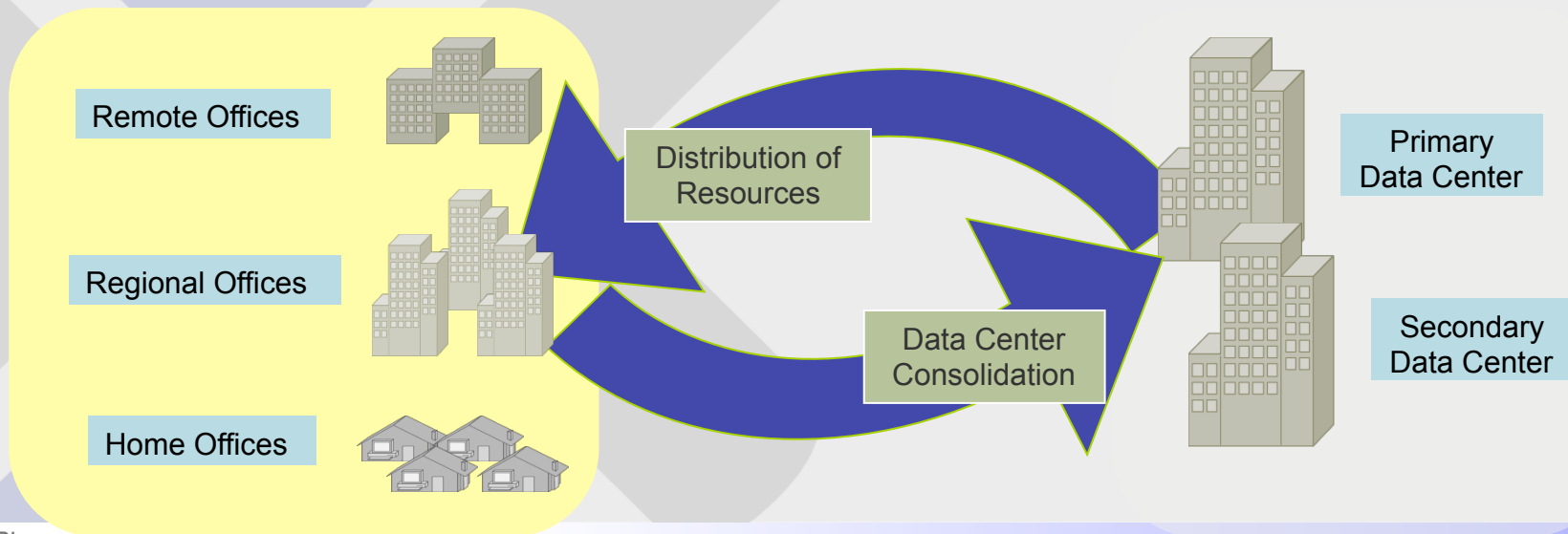
Application Delivery Problem

Scattered workforce requires distributed IT:

- Email, File, Print, Intranet
- Customer Relationship Management
- Enterprise Resource Planning

Cost control mandates centralized IT:

- Virtualization, CapEx & OpEx Control
- Service Agility
- Power, Cooling, Facilities

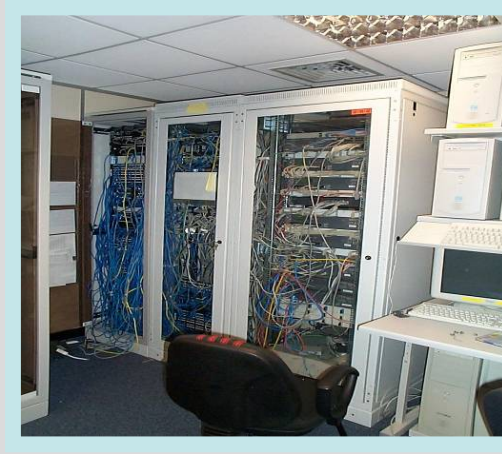


Branch Application Delivery Challenges

Application Performance



Branch Equipment Sprawl



- File
- Print
- Email
- Applications
- Backup
- Storage
- Networking

Data Protection & Compliance



HIPAA
GLBA
SOX
CA SB1386
PCI

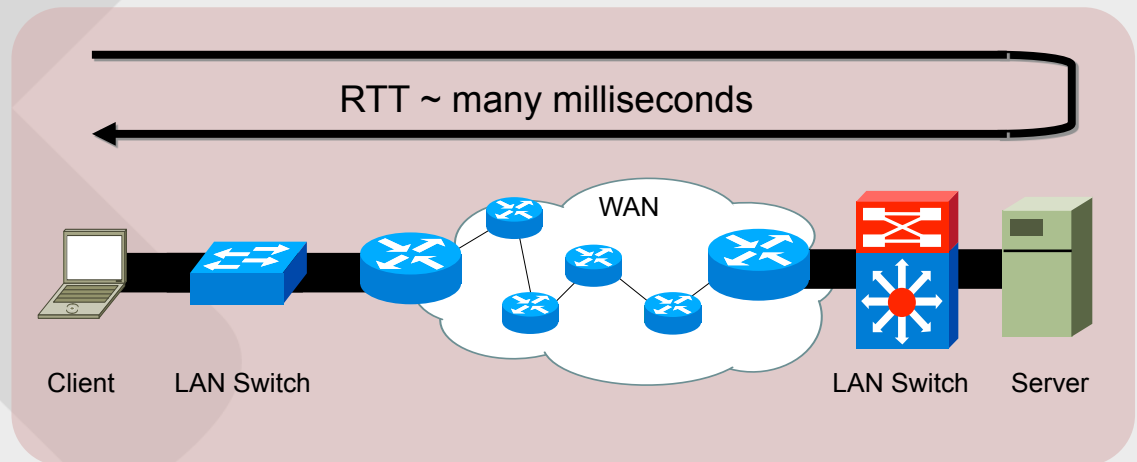
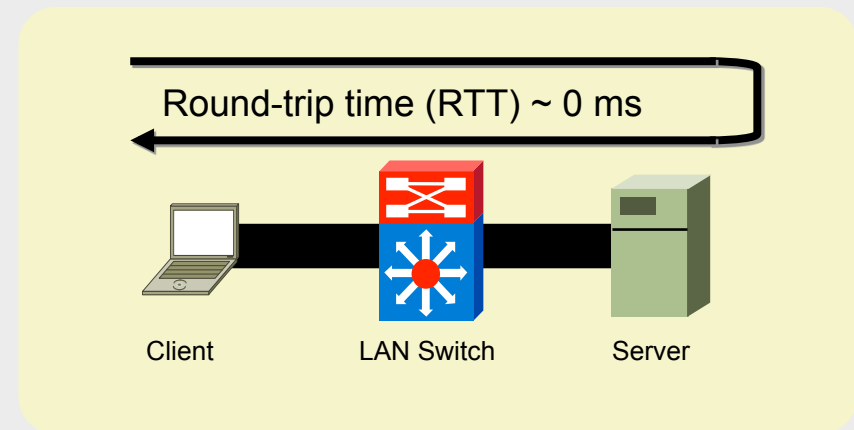


Poor Service Agility



The WAN Is a Barrier to Consolidation

- Few barriers to application performance in LANs:
 - High bandwidth
 - Low latency
 - Reliable connection
- WAN characteristics hinder performance and consolidation:
 - Congested
 - Low bandwidth
 - High latency
 - High packet loss
 - Unstable connection



Addressing the WAN Challenge

Source	Need	Technology
Latency	<ul style="list-style-type: none">Reduce number of network round trips caused by chatty application protocols	<ul style="list-style-type: none">Application accelerationProtocol optimization

Addressing the WAN Challenge (Cont.)

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Network Control	<ul style="list-style-type: none"> Align network resources with business priority and application requirements 	<ul style="list-style-type: none"> Quality of service Advanced routing
Network Visibility	<ul style="list-style-type: none"> Understand network utilization and application performance metrics React and respond to changes in network conditions 	<ul style="list-style-type: none"> NetFlow, RMON, monitoring tools IP SLA

How Does Cisco WAAS Work?

The Solution: Make WAN Perform Like LAN



TCP Flow
Optimization

Accelerates TCP performance over the WAN

Data Redundancy
Elimination

Redundant data does not need to transit the WAN – reduces overall bandwidth usage

Data Compression

LZ Compression to minimize amount of bandwidth used per TCP Connection

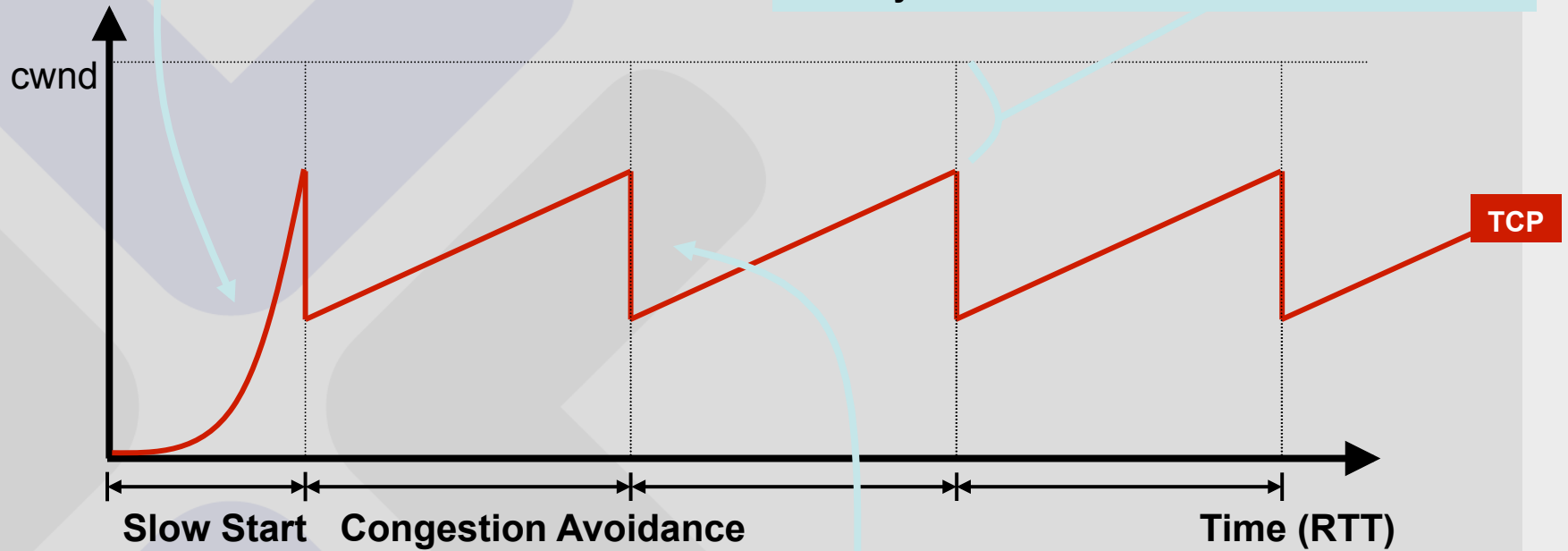
Application
Acceleration

Application specific accelerated features to minimize the impact of latency and bandwidth utilization for specific applications

TCP Performance Challenges

Bandwidth Starvation for Short-Lived Connections

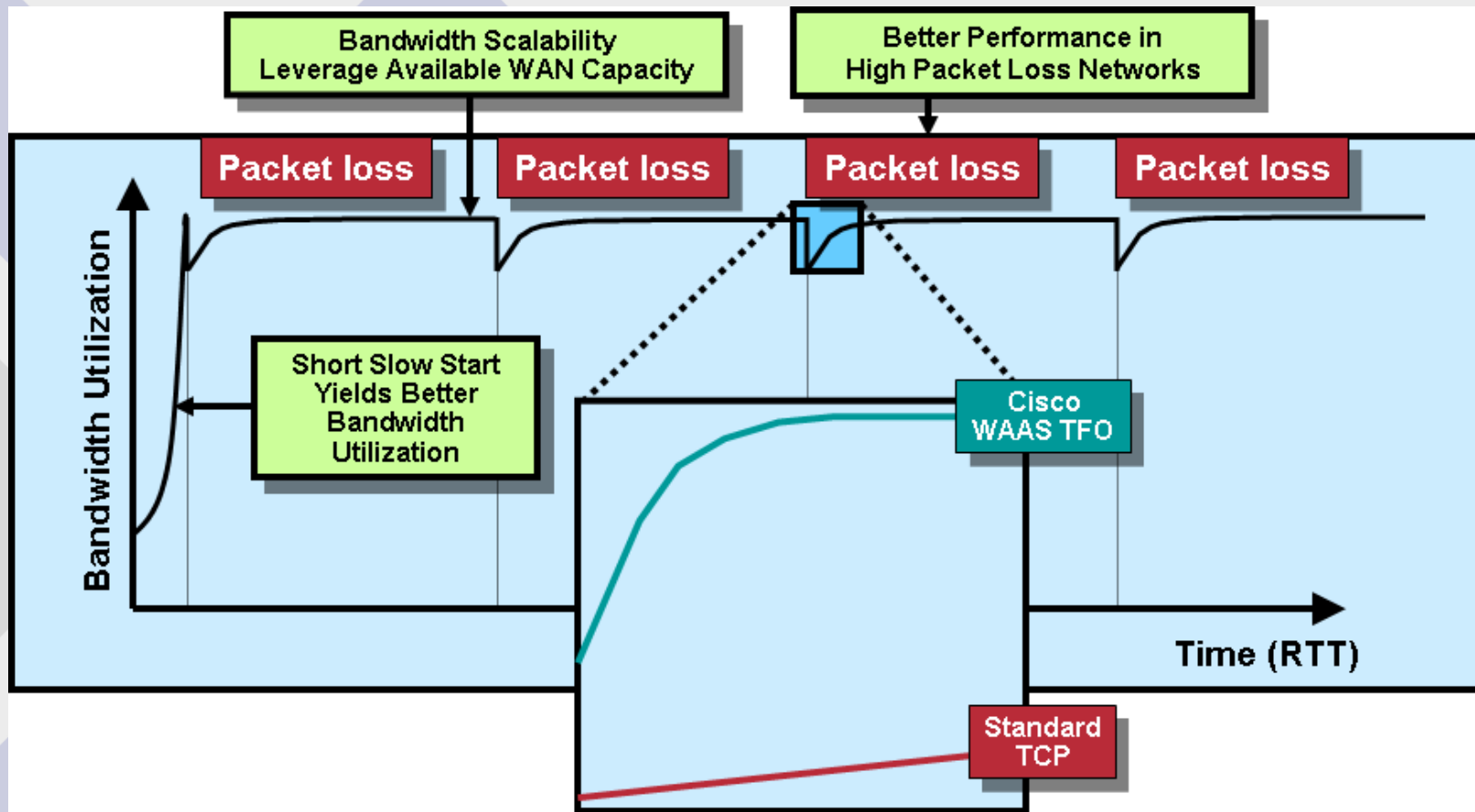
Inability to Use Available Bandwidth



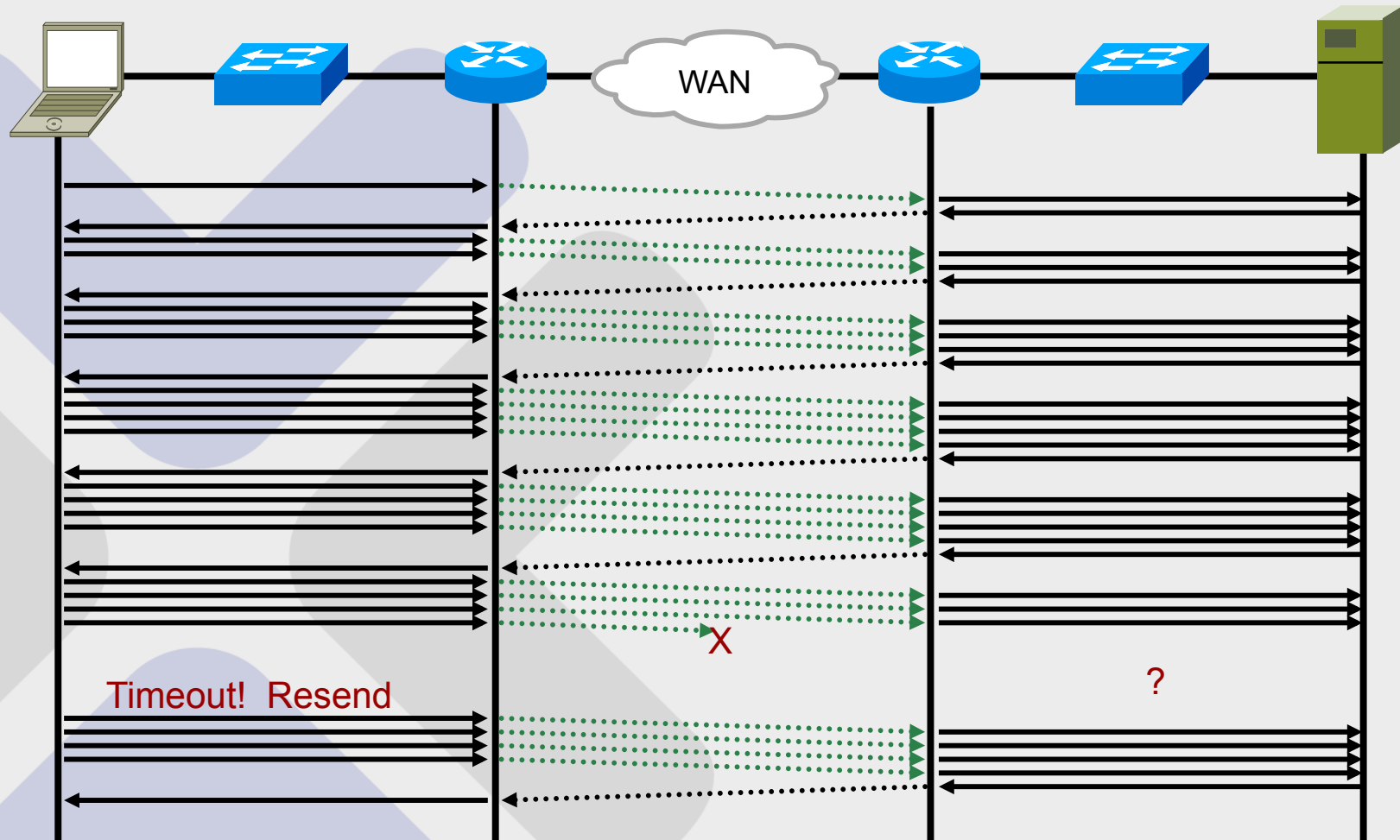
Inefficient Response to Packet Loss/
Congestion

WAAS TFO Solution

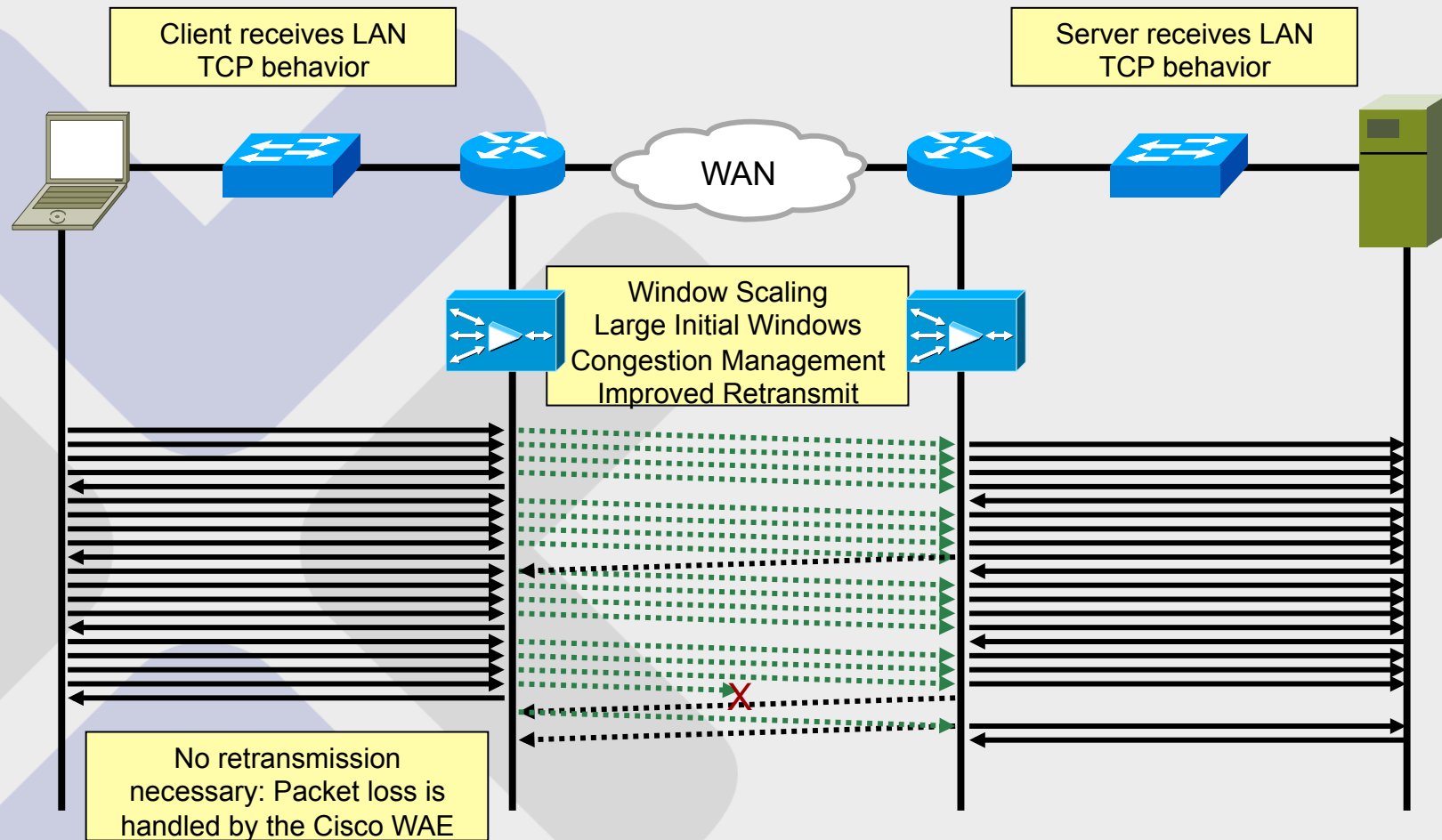
Cisco TFO Provides Significant Throughput Improvements over Standard TCP Implementations



Without TCP Proxy



TCP Proxy and TFO



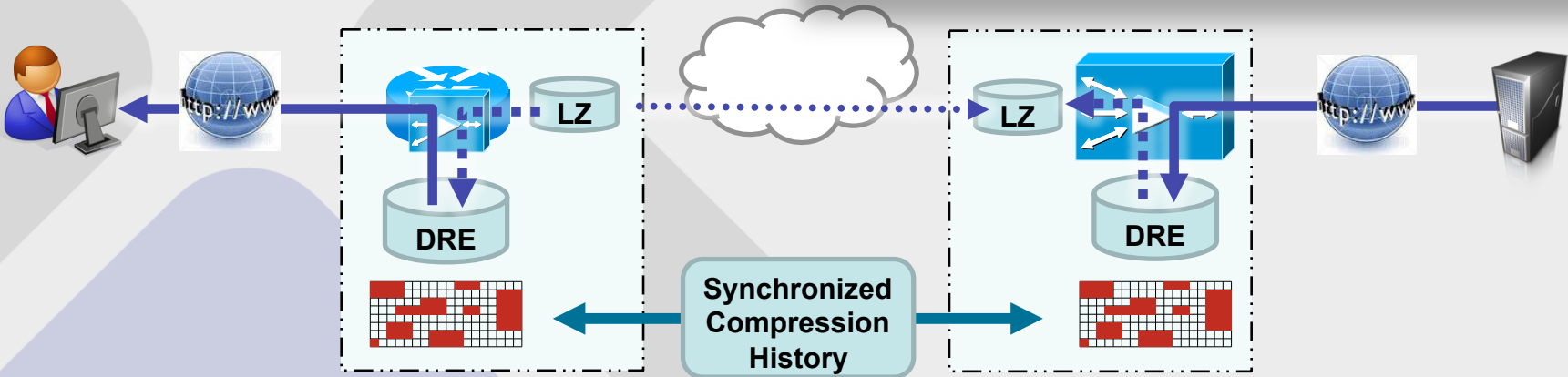
Advanced Compression

Solutions

- Data Redundancy Elimination (DRE)
- Persistent LZ compression

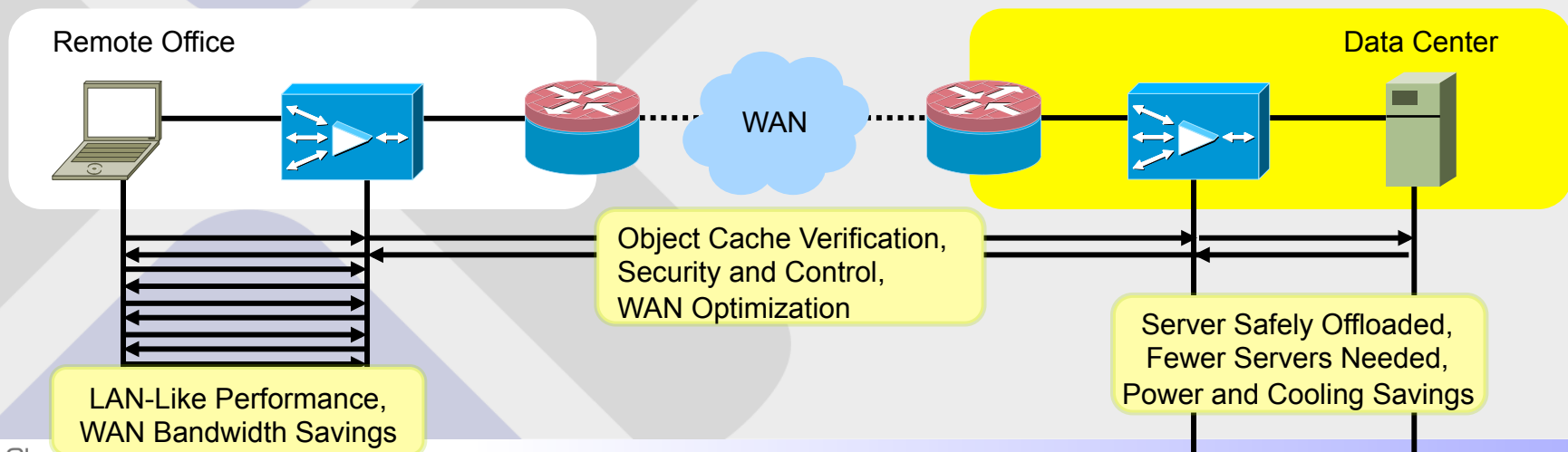
Benefits

- Application-agnostic compression
- Up to 100:1 compression
- Session-based compression
- Up to an additional 10:1 compression even after DRE



Application-Specific Acceleration

- Application and protocol awareness
 - Minimizes chatter, preserves coherency, and intelligently distributes large objects
- Intelligent server offload
 - Allows consolidation and centralization
- Cisco WAAS application accelerators:
 - CIFS (Windows File Services)
 - Windows printing
 - NFS
 - HTTP
 - Streaming video
 - MAPI
 - SSL



MAPI Application Optimizer

Solution

- Full application support
- Asynchronous Writes
- Read Ahead
- Messages Decompression
- DRE hints
- EndPoint Mapper

Challenge

- Uses MS-RPC - chatty protocol.
- Exchanges many interactive control messages
- MAPI traffic is negotiated using MS Port Mapper (port 135) and is using dynamic ports
- Data encoding is negotiated by client/server

Benefit

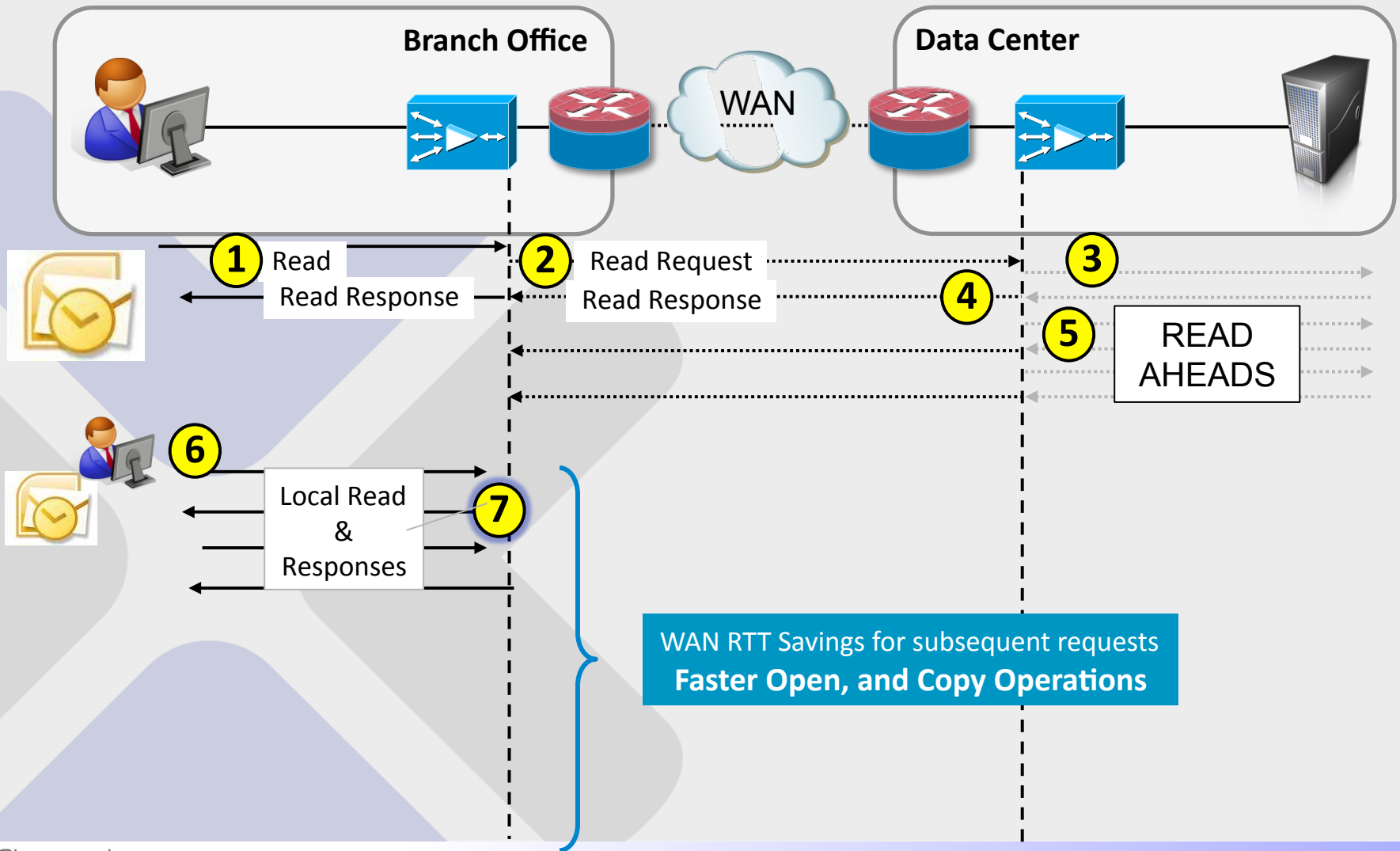
- Reduced send/receive time – key for Outlook 2000 users
- Cleans up the outbox faster – important for cached mode users
- Faster downloads of OAB, while significantly reducing BW consumption
- Optimizes native Outlook 2007 operations (disable encryption on server)
- Transparent, automatic optimization
- No reverse engineering (MSFT licensing)
- No security hole of keeping sessions open even after users have logged out

Client

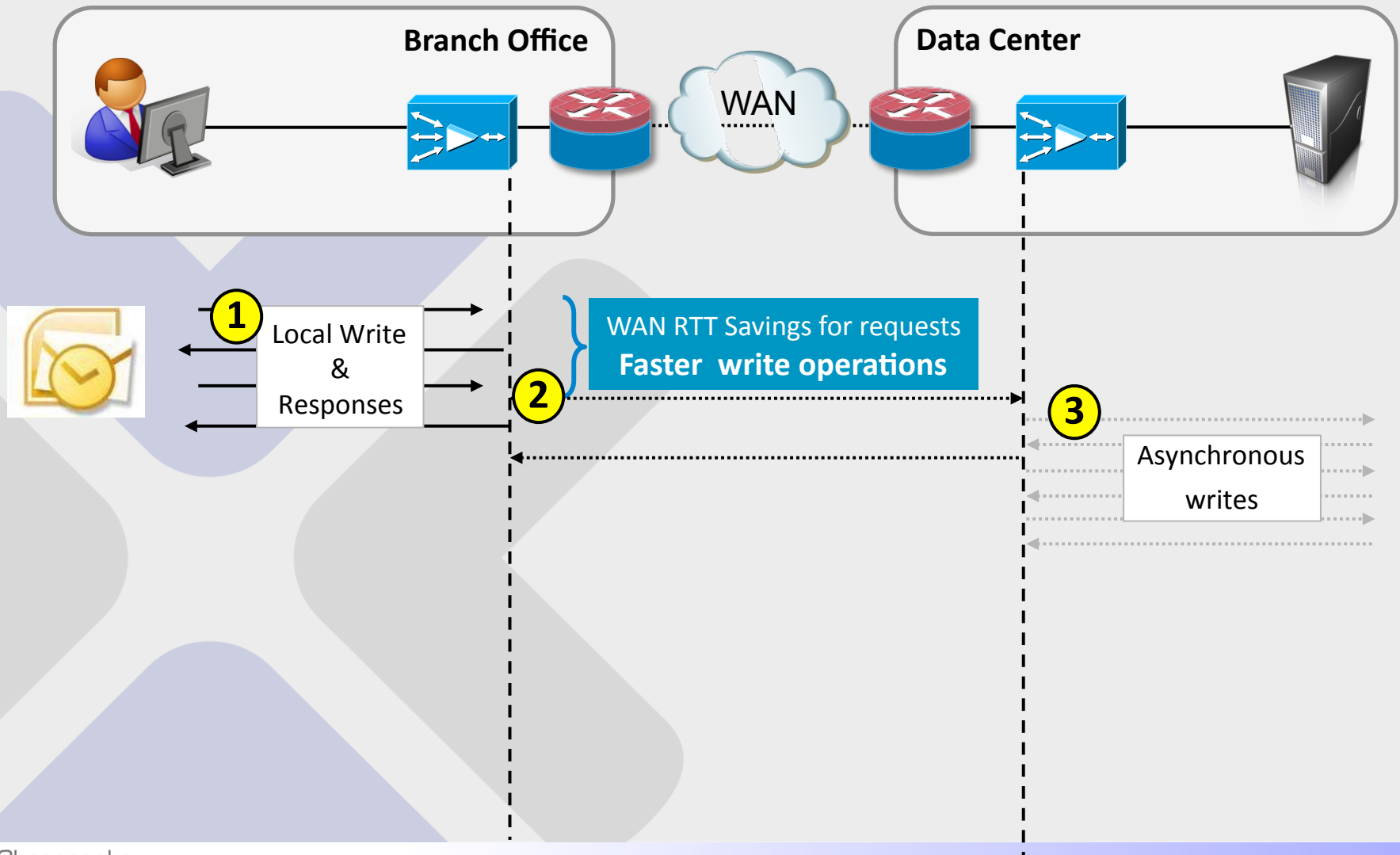
SERVER



MAPI AO Read Ahead



MAPI AO - Asynchronous Write



CIFS Application Optimizer: CIFS AO

2678/2 = 1339
CIFS messages
between client
and server

Traffic	Captured	Displayed
Between first and last packet	34.513 sec	34.369 sec
Packets	3342	1339
Avg. packets/sec	96.833	77.920
Avg. packet size	447.823 bytes	378.042 bytes
Bytes	1496624	1012396
Avg. bytes/sec	43363.853	29456.974
Avg. MBit/sec	0.347	0.236

Challenge

- "chatty" protocols
- WAN's high latency, packet loss, and bandwidth constraints significantly diminishes Server access

Solution

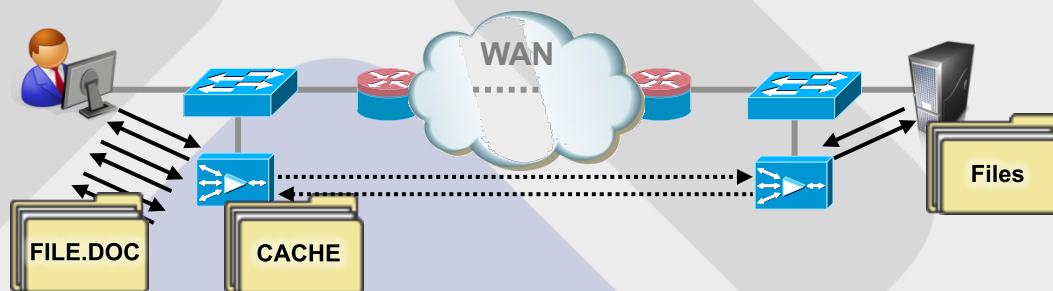
- File and Metadata caching
- Read-ahead
- Message pipelining
- Scheduled preposition to pre-populate
- Transparent integration
- Dedicated CIFS cache

Benefit

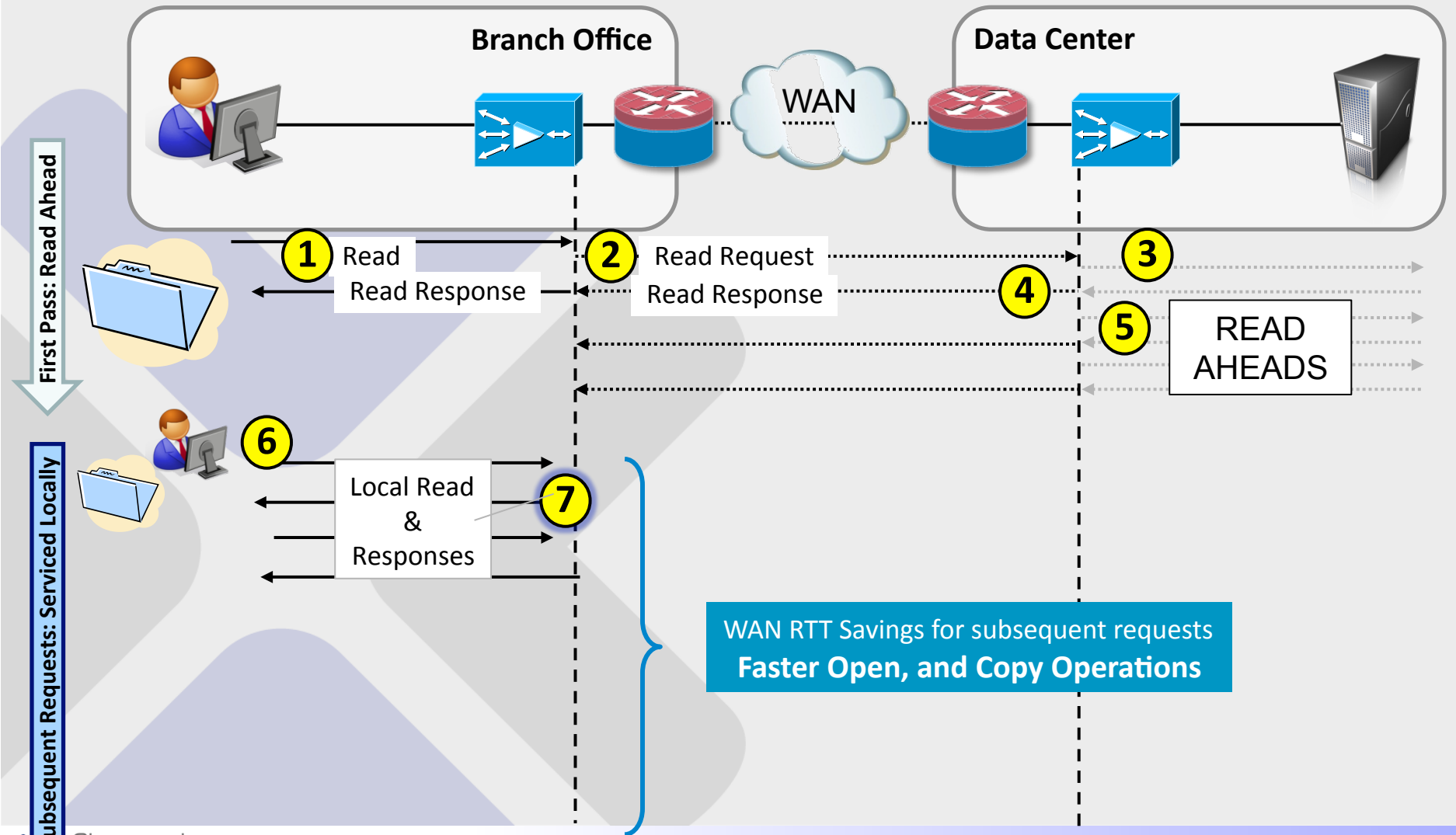
- Enable consolidation of distributed file and print resources into the data center without compromising performance
- Offload of Data Center Servers

• 2MB Word document open, results in over 1000 message exchanges.

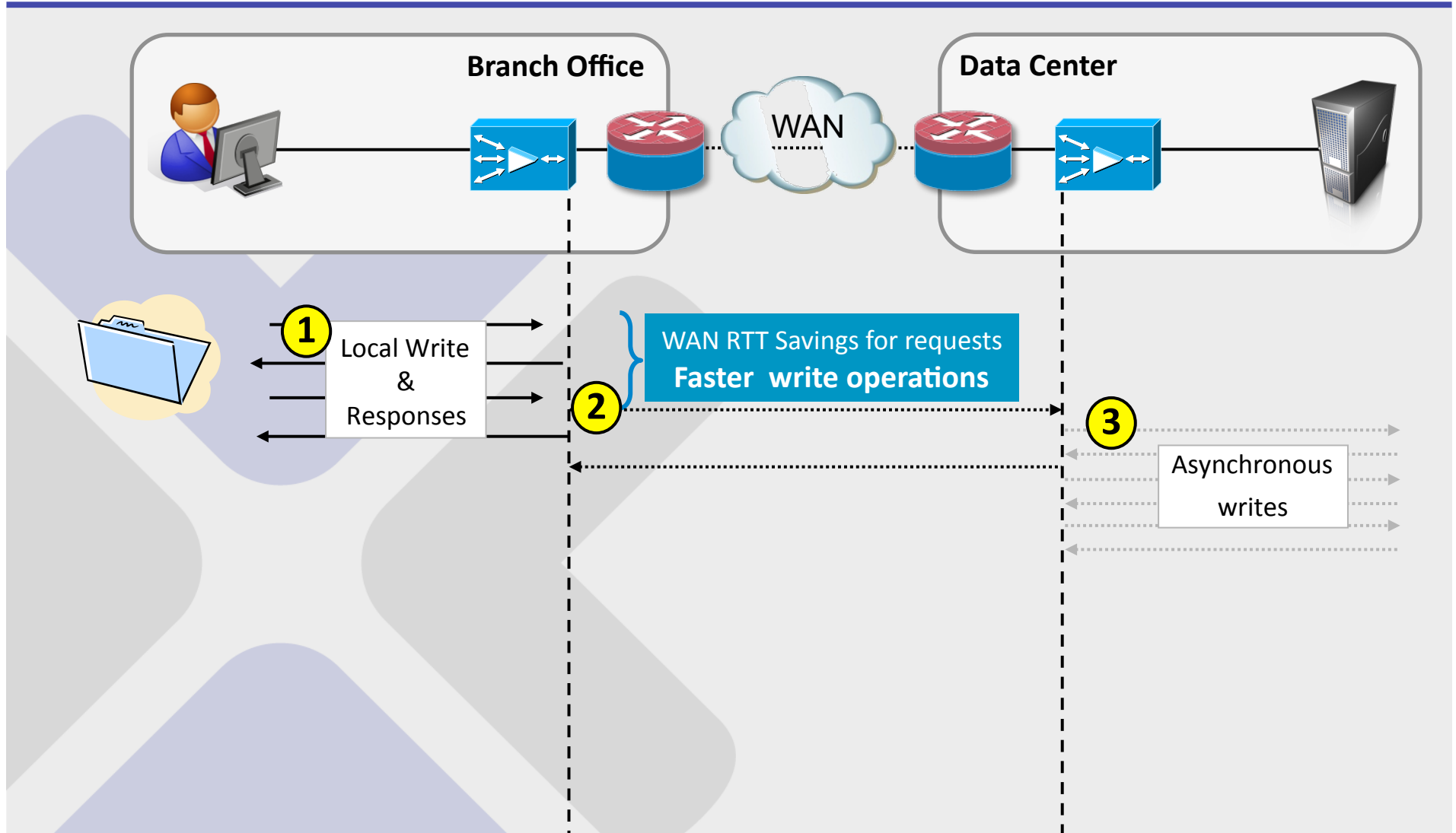
• 40ms RTT WAN, equates to more than 52 seconds of wait time before the document is usable



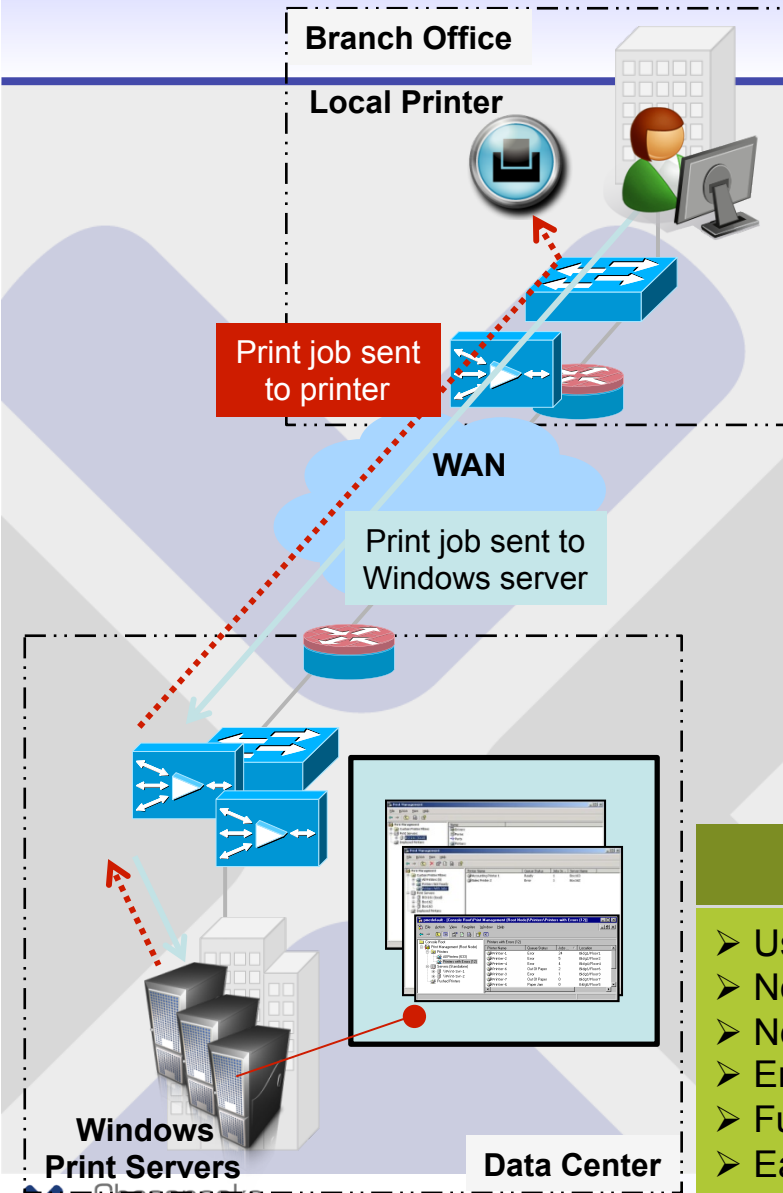
CIFS AO Read Ahead



CIFS AO - Asynchronous Write



Windows Printing Application Optimizer



Challenge

- MS Print protocol uses RPC - very “chatty”
- As A result over WAN it degrades exponentially as latency increases

Solution

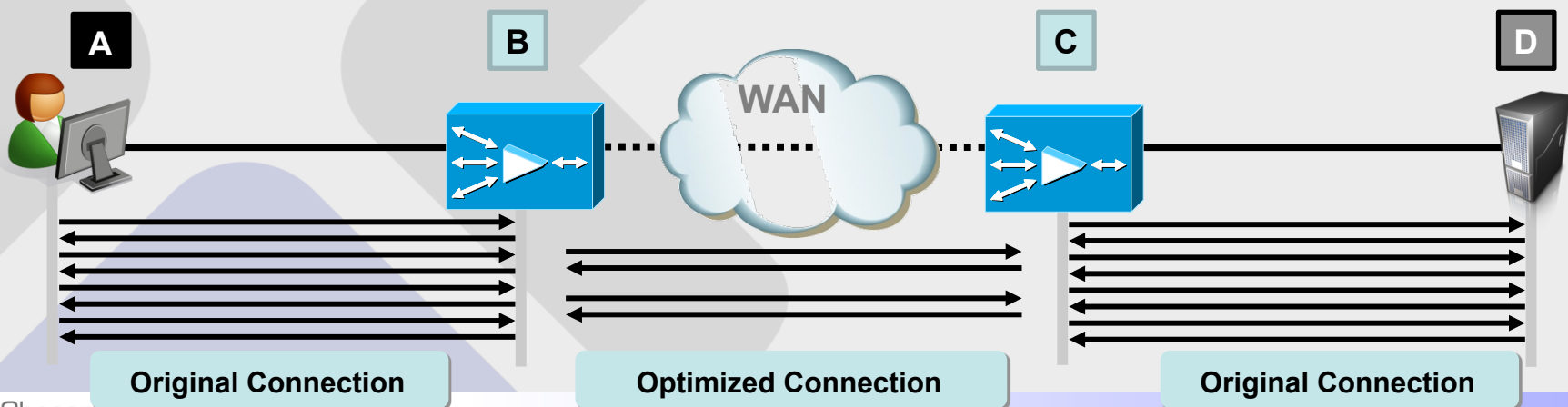
- Based on licensed MS Print Protocols
- Optimized access to print queue status and printer settings
- **Bi-directional Acceleration**
- Printer and Queue meta-data caching
- **Async write**
- **DRE hints** for enhanced payload compression
- **MS-RPC message optimization**
- **RPC command fragments handled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

Benefit

- 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

Solution	Challenge
<ul style="list-style-type: none">➤ Read-Ahead➤ Asynchronous write➤ DRE hints➤ Meta-data caching	<ul style="list-style-type: none">➤ In Unix, NFS protocol is 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
Benefit	
<ul style="list-style-type: none">➤ 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

Solution

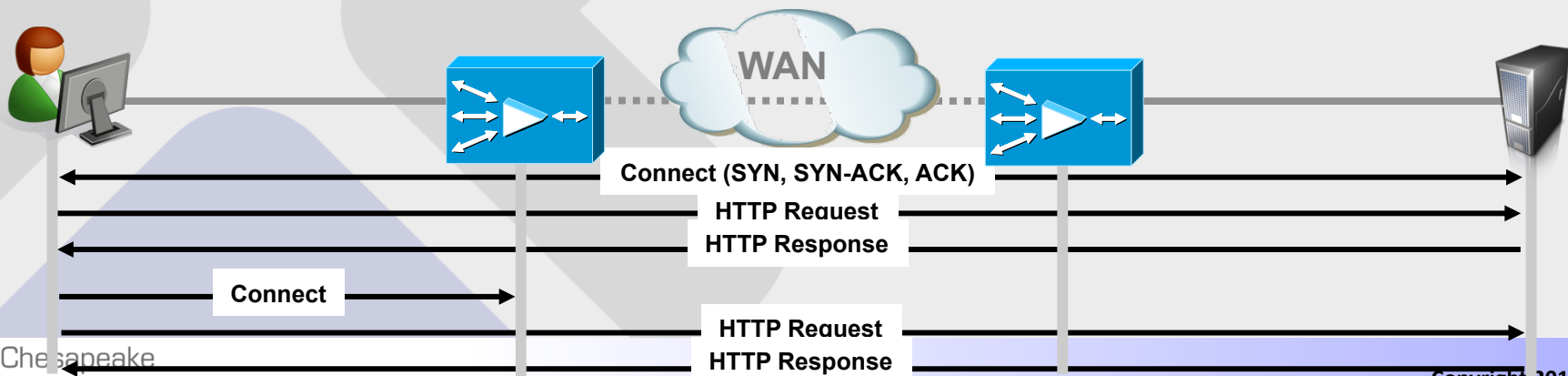
- Fast Connection Reuse
- Proxy Connect to SSL Servers
- Local HTTP responses through Metadata cache
- Content-aware optimization
 - DRE hints
 - Server compression offload

Challenge

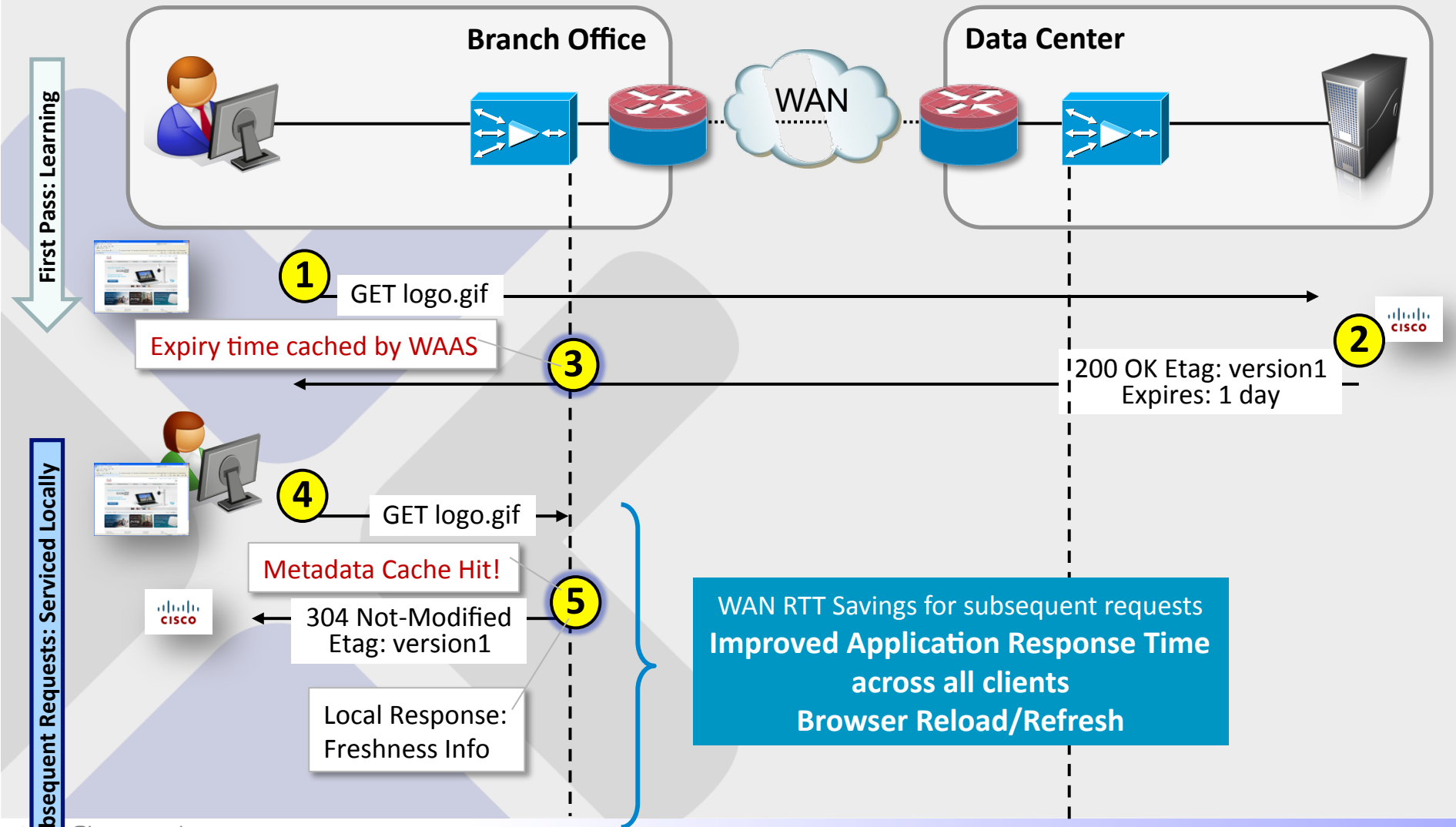
- Slow page load on Interactive Web applications
- Browsers serially open and close connections to fetch small objects (e.g graphics)
- Latency due to HTTP request/response

Benefit

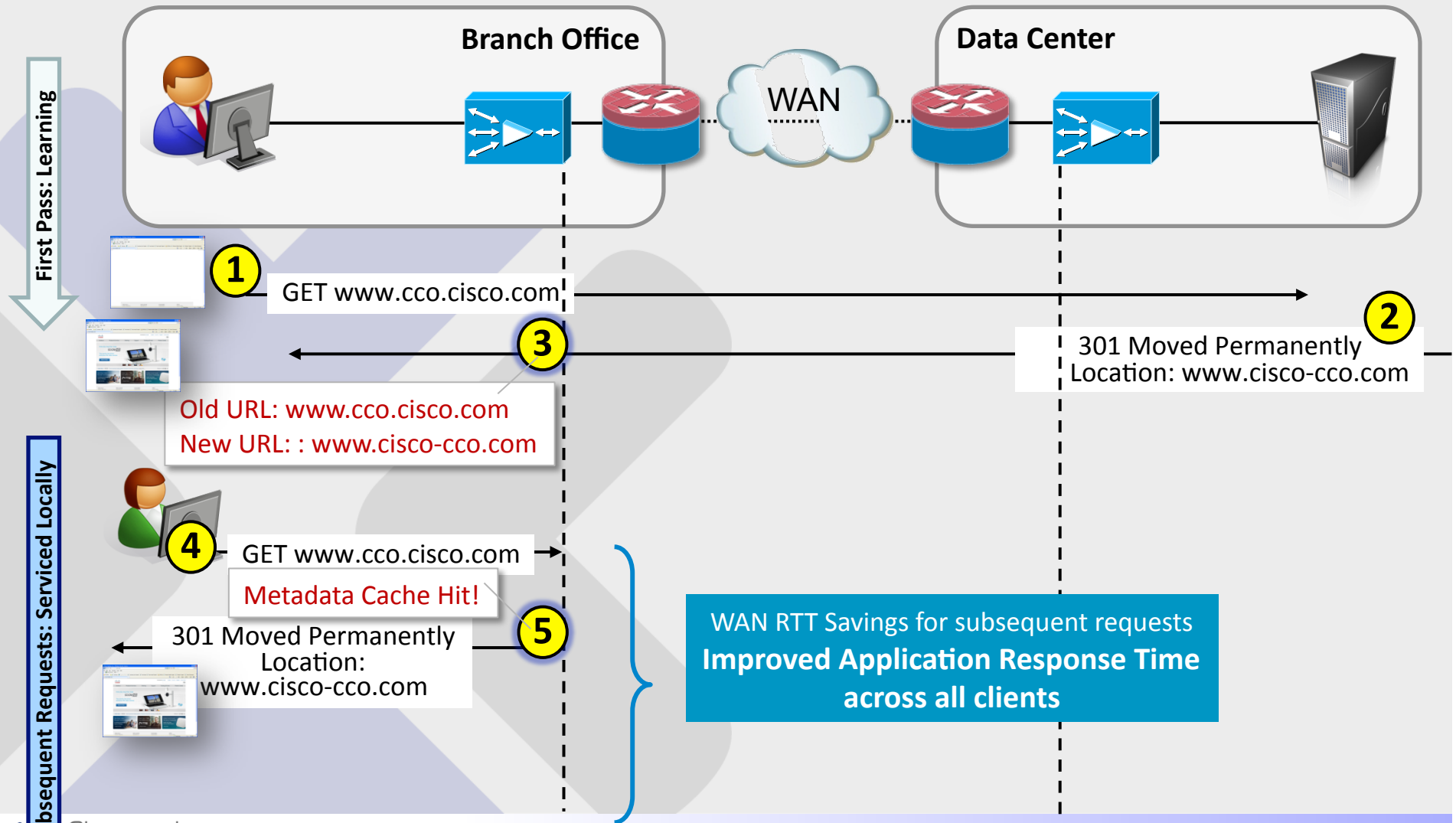
- Mitigates latency due to HTTP request/response
- Fully transparent
- Reuse of same pair of client and server requests
- Compliments and preserves http application pipelining



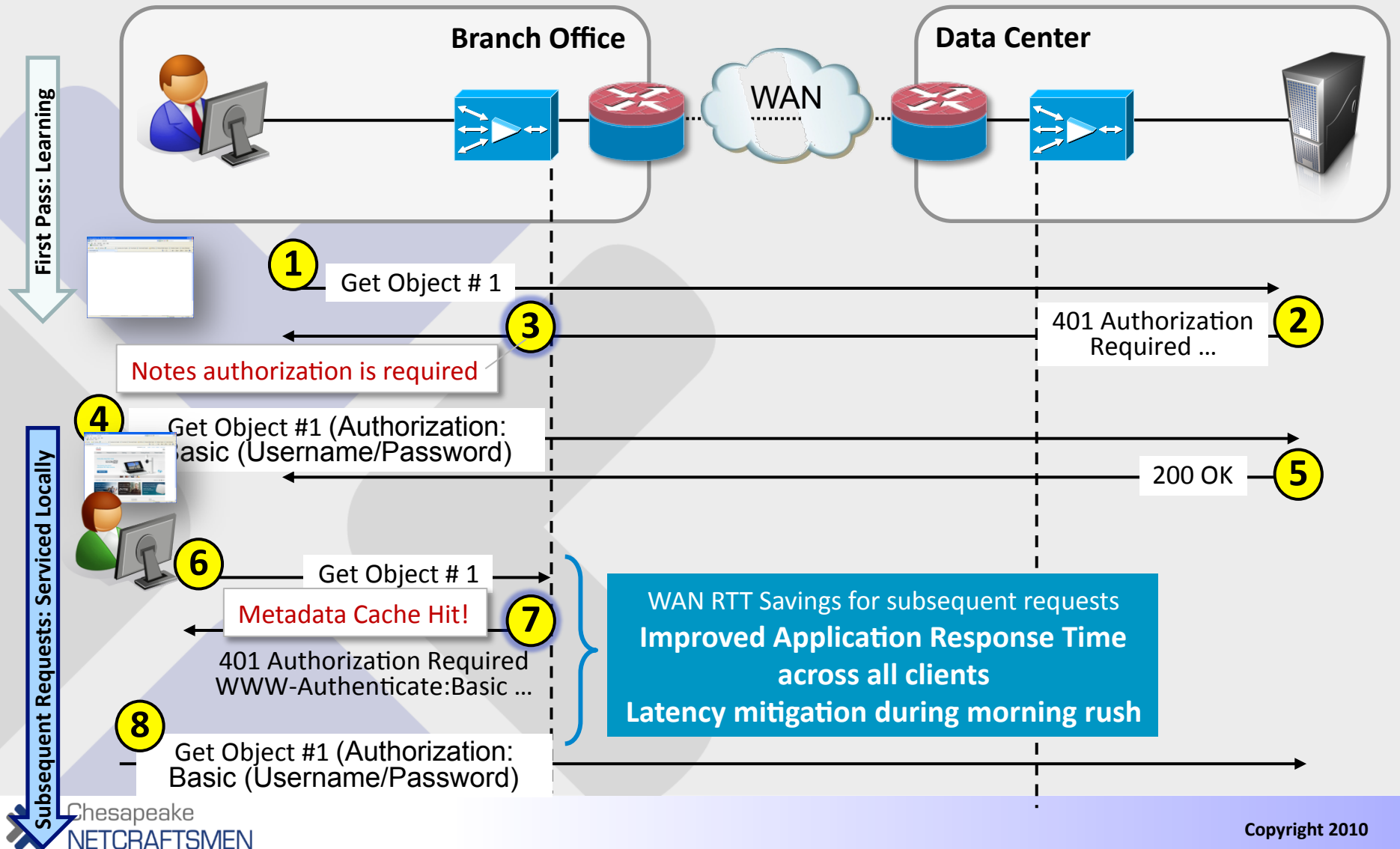
Mitigate Latency using Local Response for Content Freshness Validation



Mitigate Latency using Local Response for URL Redirect

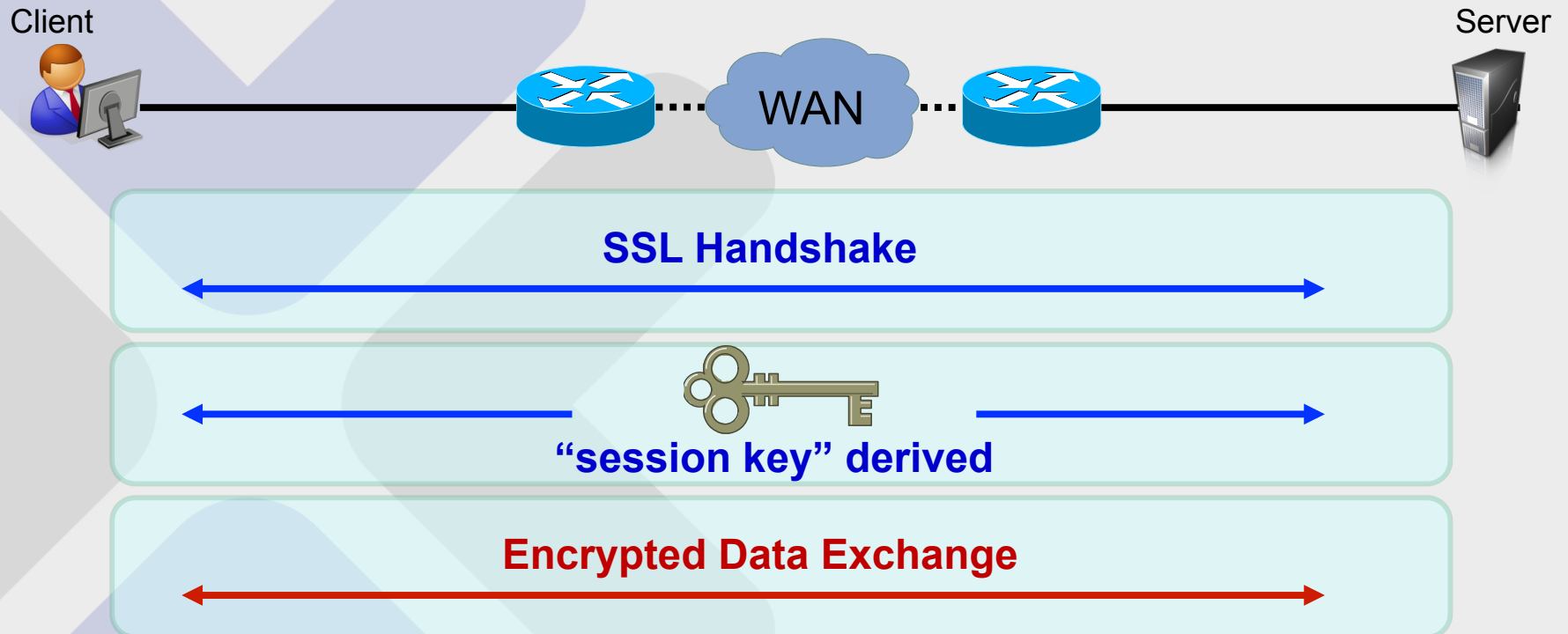


Mitigate Latency using Local Auth-Needed Response for URLs needing Authorization



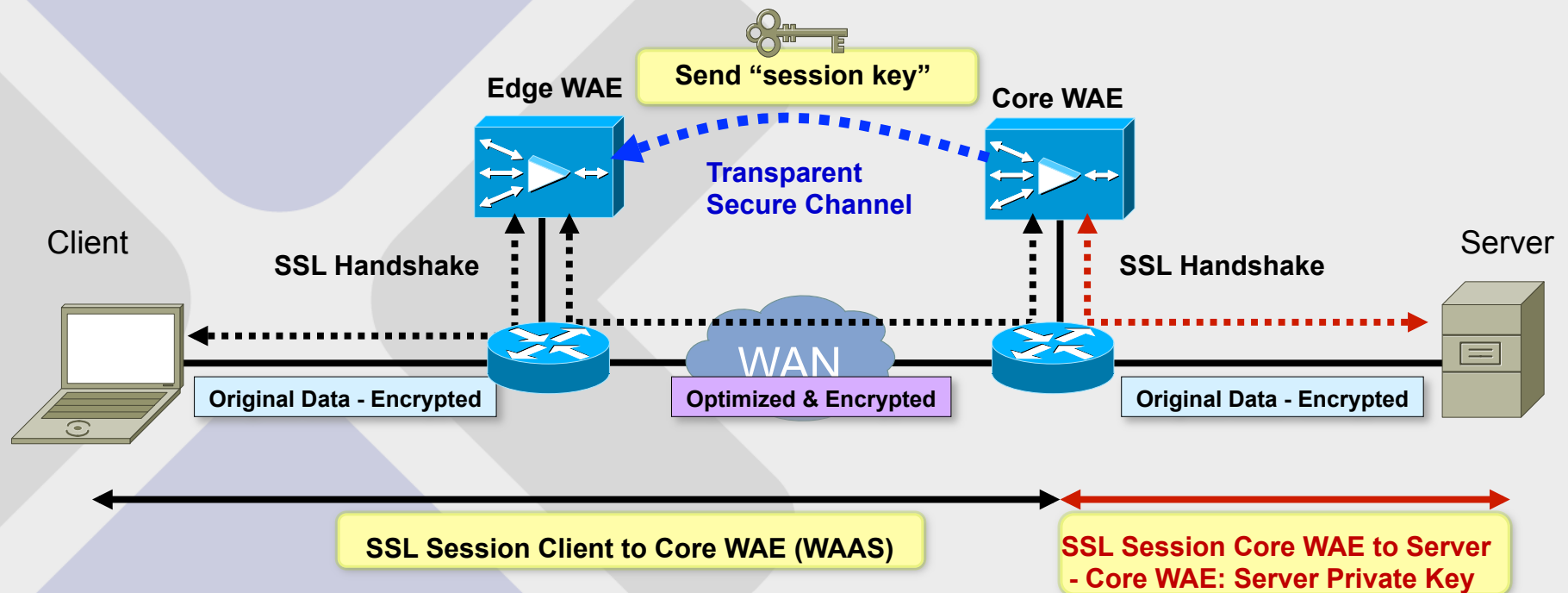
The Need for SSL Acceleration

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

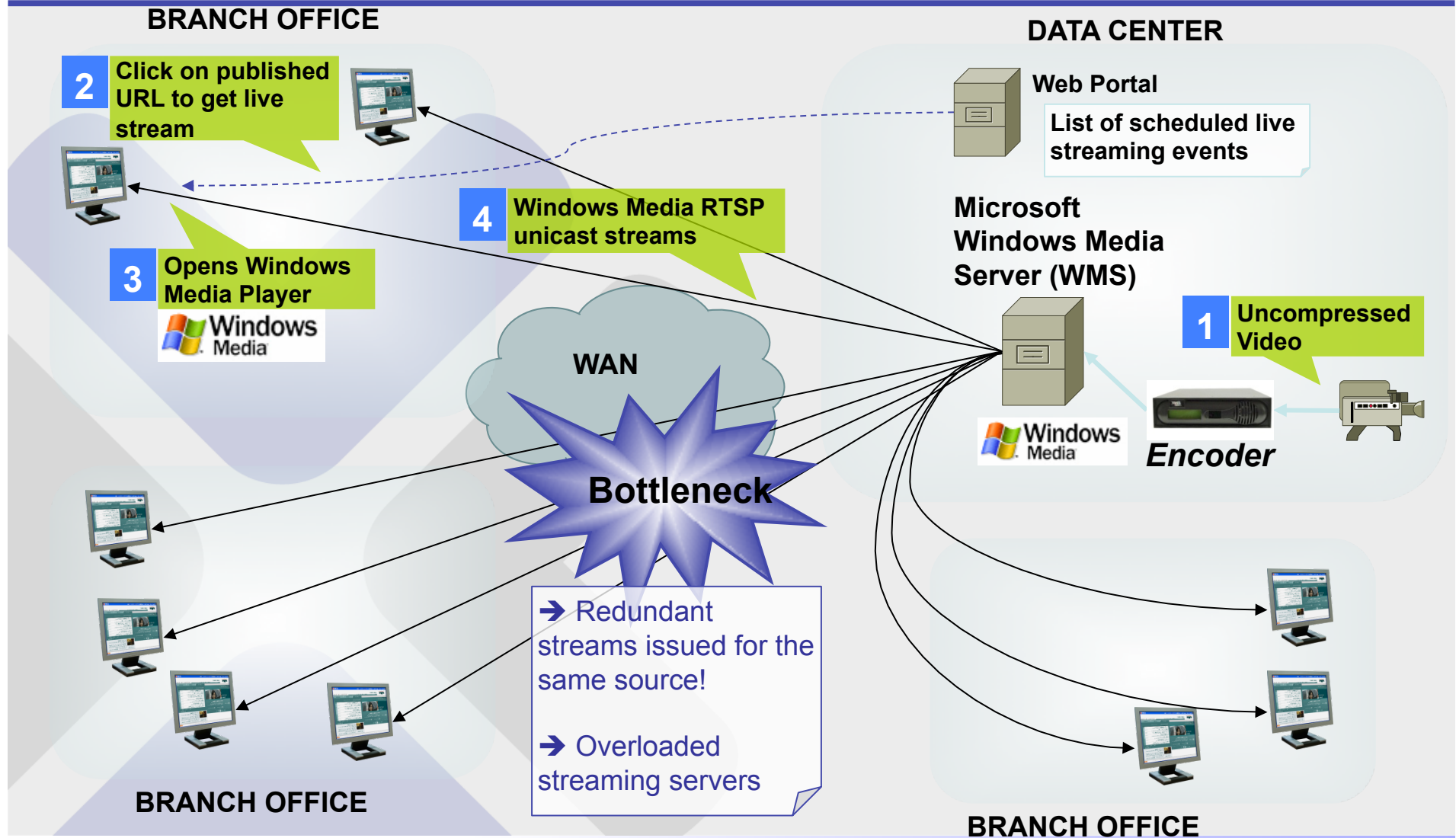


Cisco WAAS SSL Optimization Solution

- 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

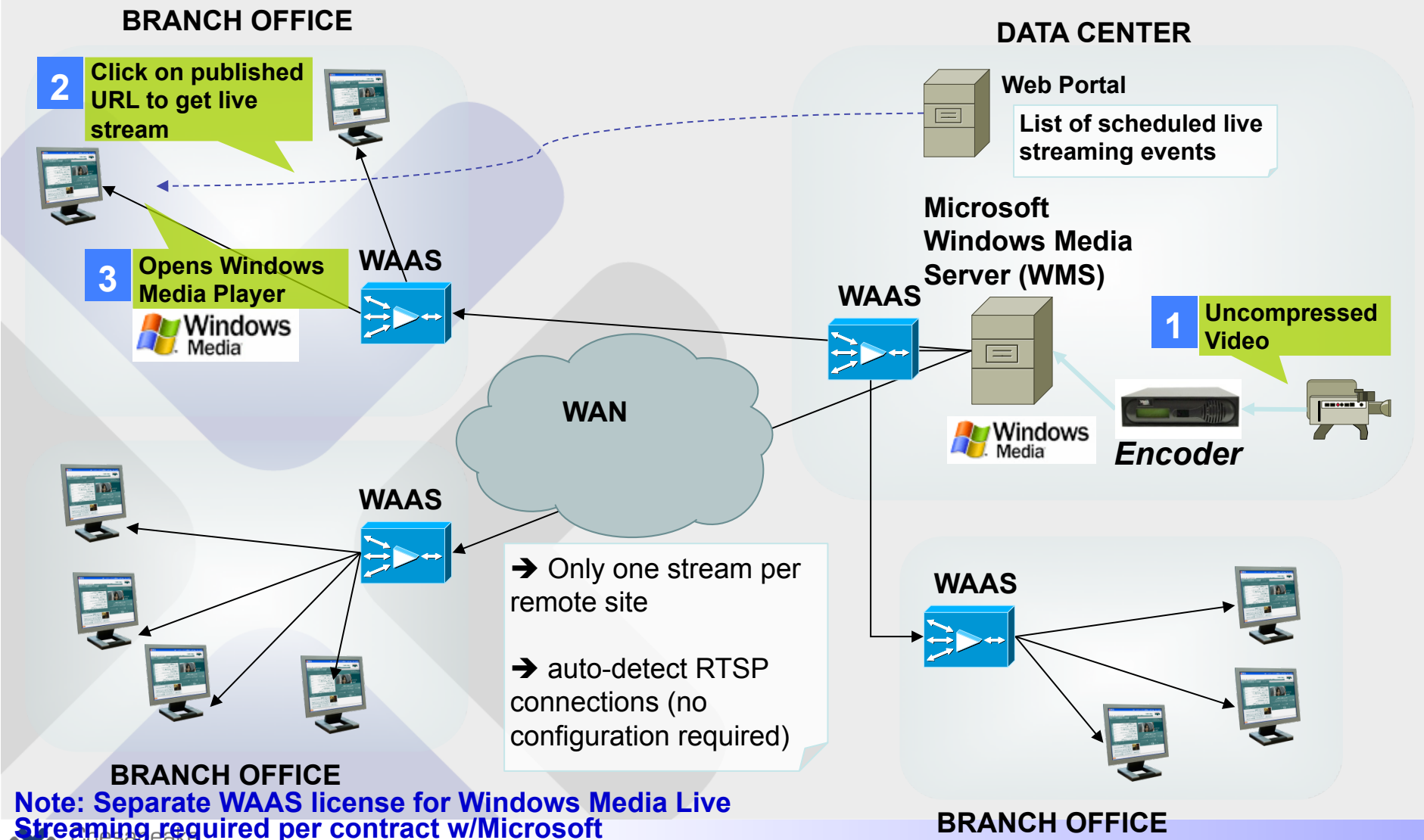


Live Video Streaming for Windows Media Environment



Live Video Streaming with WAAS

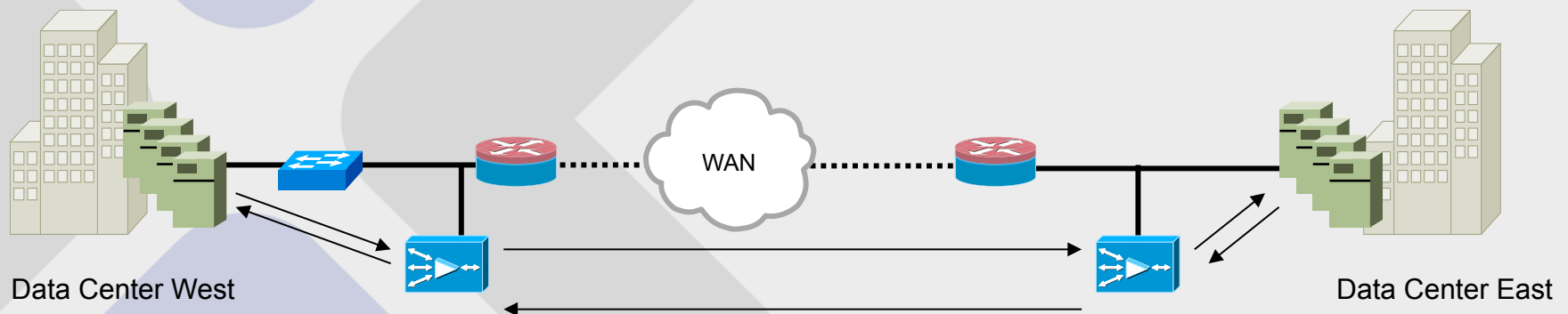
Edge stream splitting



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

Replication Accelerator

- Optimized for low number of high-throughput TCP connections
- Available on Cisco WAE-7341 and Cisco WAE-7371 platforms
- Negotiates optimized connections only with other Cisco WAEs in the same mode



Application Performance Improvements

Category	Applications	2X	5X	10X	25X	50X	100X+
File Sharing	CIFS NFS	2-20X Avg			>100X Peak		
Email	Microsoft Exchange Lotus Notes Internet Mail	2-10X Avg		50X Peak			
Web and Collaboration	HTTP WebDAV FTP Microsoft Sharepoint	2-10X Avg		100X Peak			
Software Distribution	Microsoft SMS Altiris HP Radia	2-20X Avg			>100X Peak		
Enterprise Applications	Oracle, Siebel, SAP CRM ERP	2-8X Avg		20X Peak			
Backup Applications	Microsoft NTBackup Legato Networker Veritas Netbackup CommVault Galaxy	2-10X Avg		50X Peak			
Data Replication	EMC SRDF/A EMC IP Replicator NetApp SnapMirror Data Domain Double-Take Veritas Vol Replicator	2-10X Avg		50X Peak			
SaaS Applications	Cisco WEBEX	2-8X Avg		20X Peak			

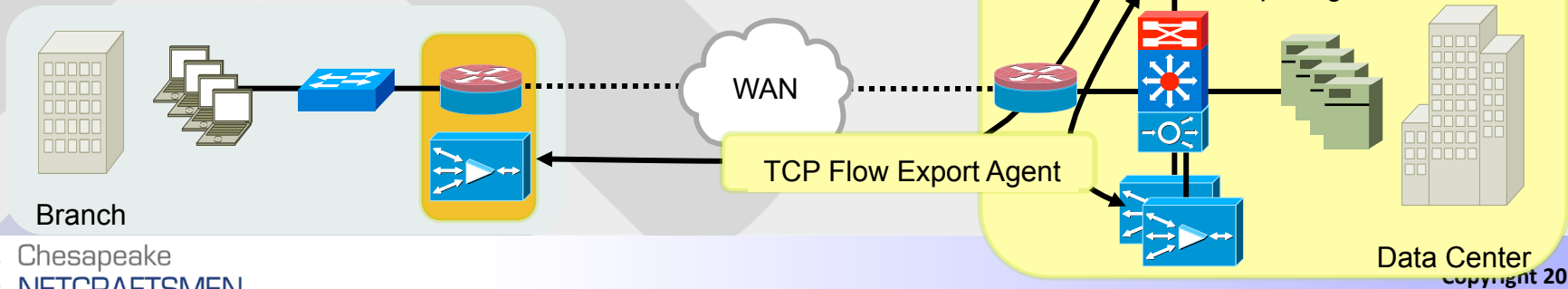
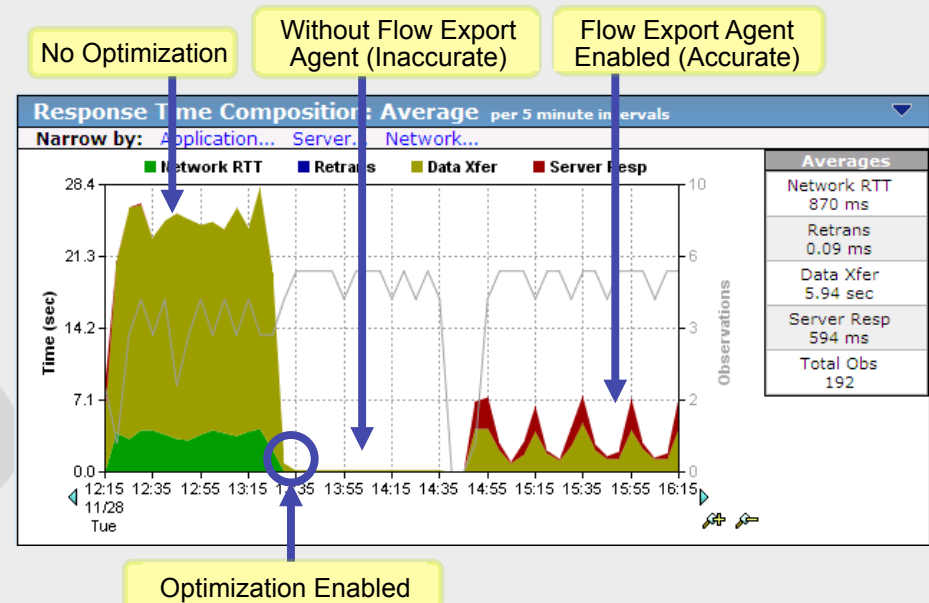
Enterprise Performance Monitoring Integration

- **Transparent integration:**

- Ensures packet header preservation
- Enables visibility to end nodes
- Provides full compatibility with NetQoS Super Agent

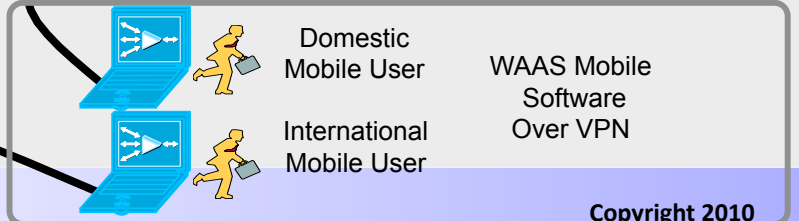
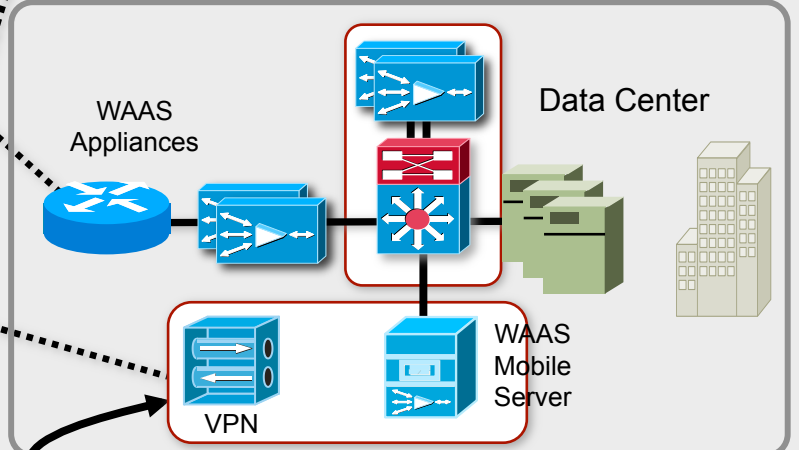
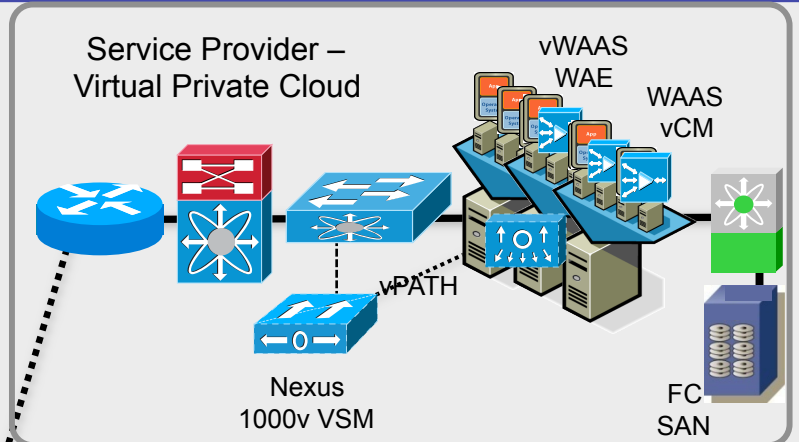
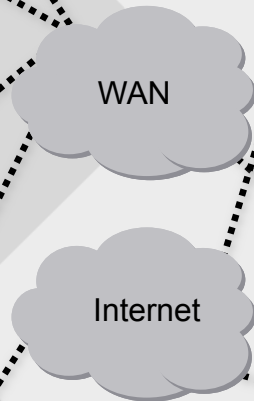
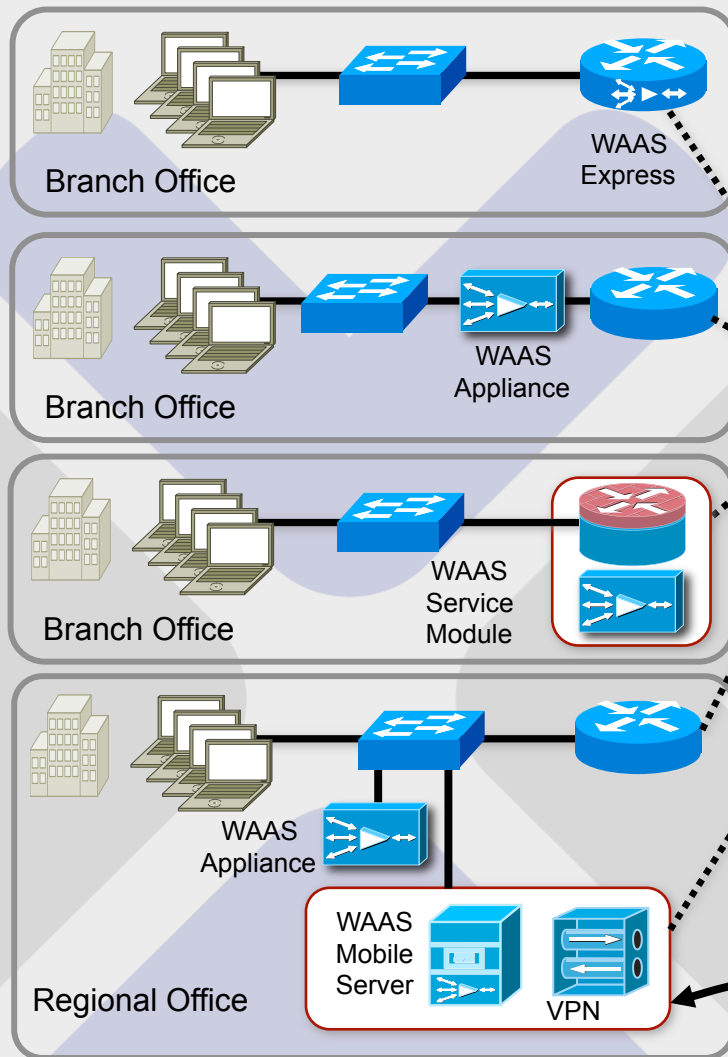
- **Flow Export Agent:**

- Transmits connection data to monitoring systems to ensure correct response time analysis



How Does WAAS Integrate With Your Network?

Cisco WAAS: WAN optimization solution



Seamless, Transparent Integration

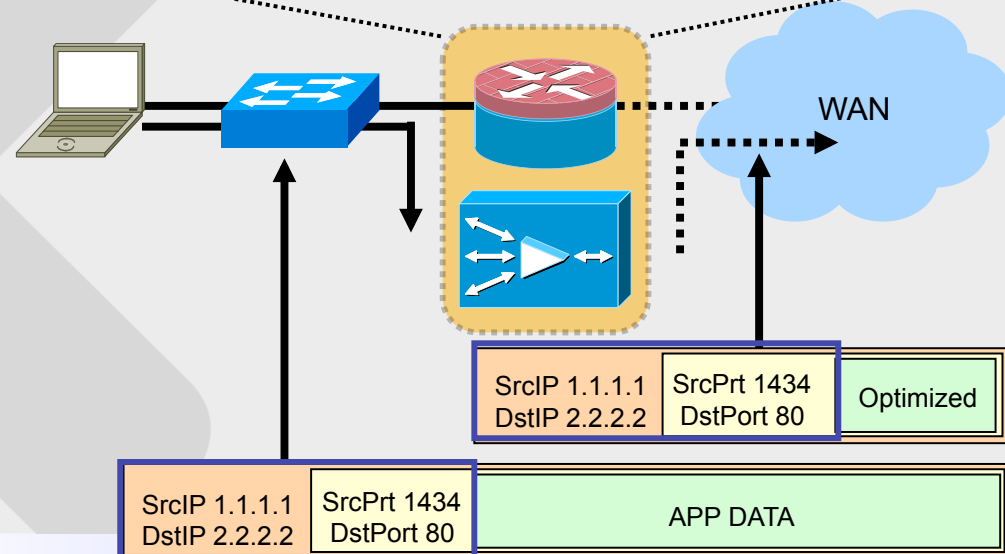
- Physical inline
- WCCPv2
- PBR
- Cisco CSM and Cisco ACE modules

A Cisco WAE provides compliance with network value-added features:

- Preserves packet headers
- Supports QoS, NBAR, queuing, policing, and shaping classifications
- Supports firewall policies* and ACLs
- Supports NetFlow, monitoring, and reporting

Cisco Wide Area Application Services

- Application acceleration
- Transport optimization
- Advanced compression
- WAN file services



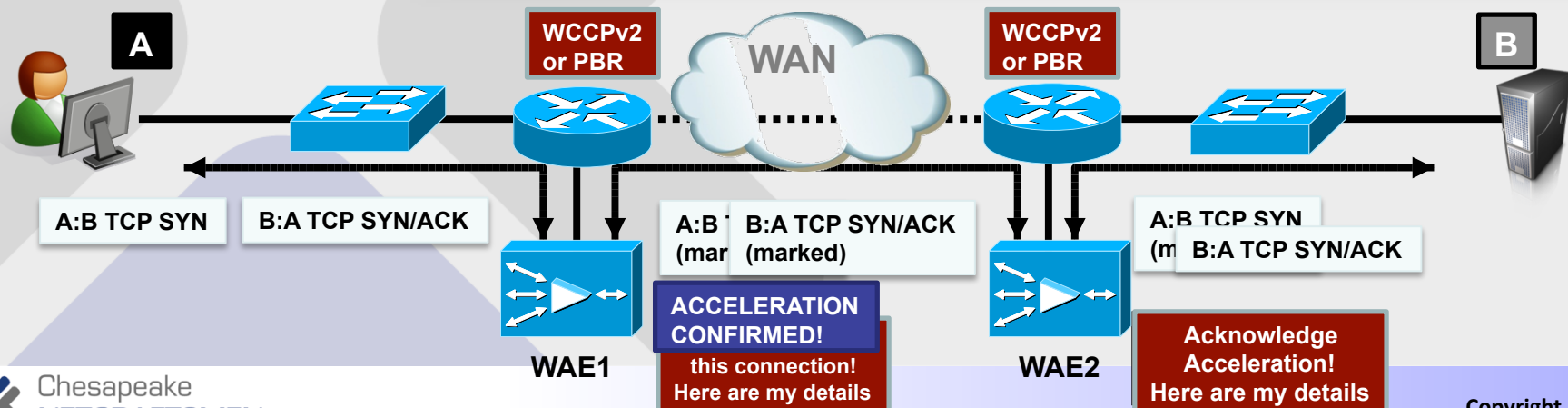
Cisco WAAS Auto-Discovery

Solutions

- Devices automatically discover one another
- Devices automatically negotiate optimization capabilities

Benefits

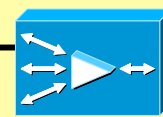
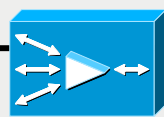
- Eliminates need for complex overlay networks with tunnels
- And as the result reduces additional efforts associated with management, security and monitoring



Cisco WAAS—Firewall Integration

- Third-party firewalls scrub TCP options used for Cisco WAAS autodiscovery.
- Third-party firewalls drop sessions with shifted sequence numbers (used by Cisco WAAS to distinguish between optimized and nonoptimized flows).
- Cisco Firewalls can be made aware of Cisco WAAS.
- Cisco WAAS directed mode supports third-party firewalls.

Remote Office



Data Center

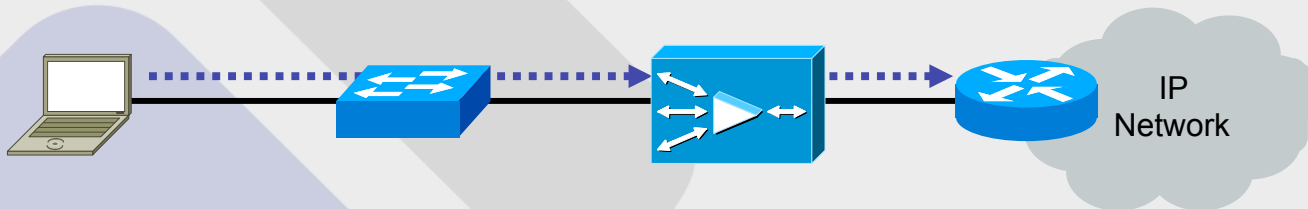


Directed Mode;
UDP Encapsulation on Port
4050 for Third-Party Firewalls

WAAS Appliances

Network Integration Overview: In-Path

- **Cisco WAEs can be deployed physically in-path:**
 - Cisco WAE devices sit physically in-path between two network elements (such as the router and the switch).
 - The devices inspect all traffic passing through and determine which traffic to optimize:
 - Interception in both directions of packet flow
 - Pass through uninteresting (non-TCP) traffic at low layer
 - Transparent optimizations maintain compatibility with most Cisco IOS features and other platforms.



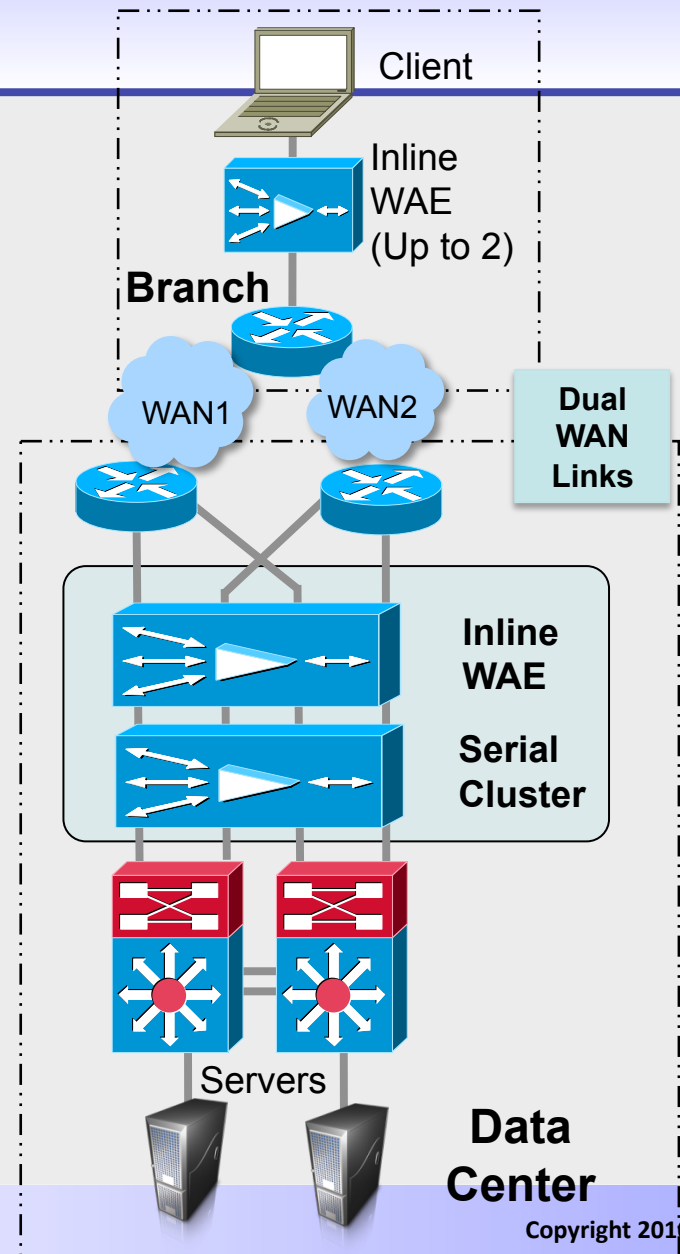
Simplified Data Center Interception Serial Inline Cluster

Solution

- Dual Inline Cards
 - Supports up to 4 inline groups
 - WAE-674, WAE-7341, WAE-7371
- HA supported by 2nd WAE
- Interception Access List
 - Bypass non-relevant traffic

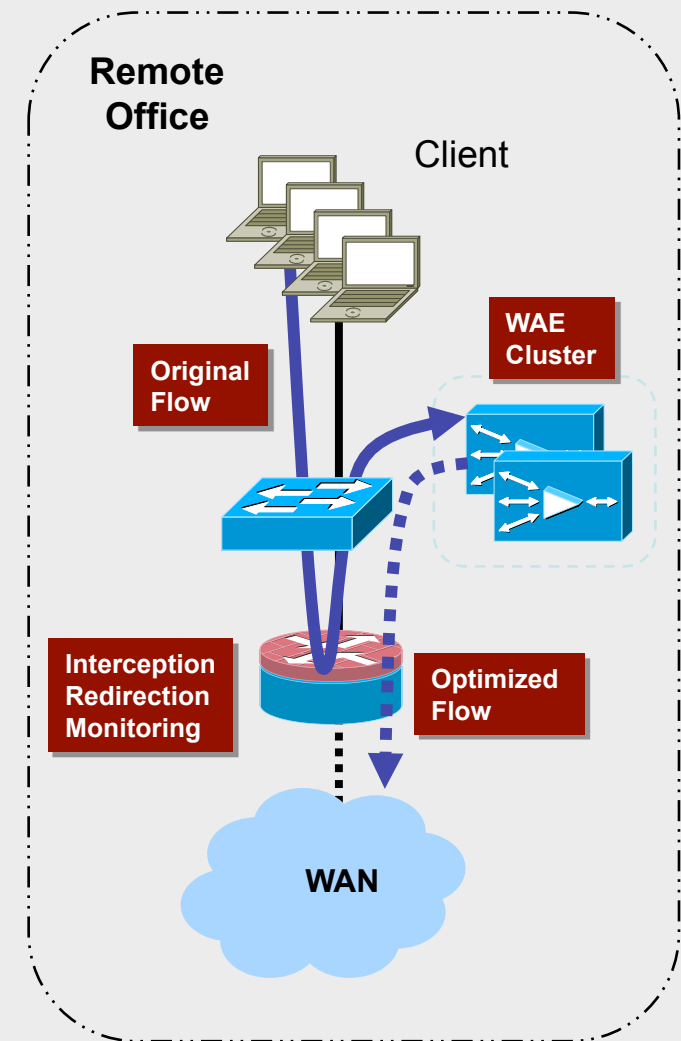
Benefits

- Simplified and highly available deployment model
- Small and medium data centers



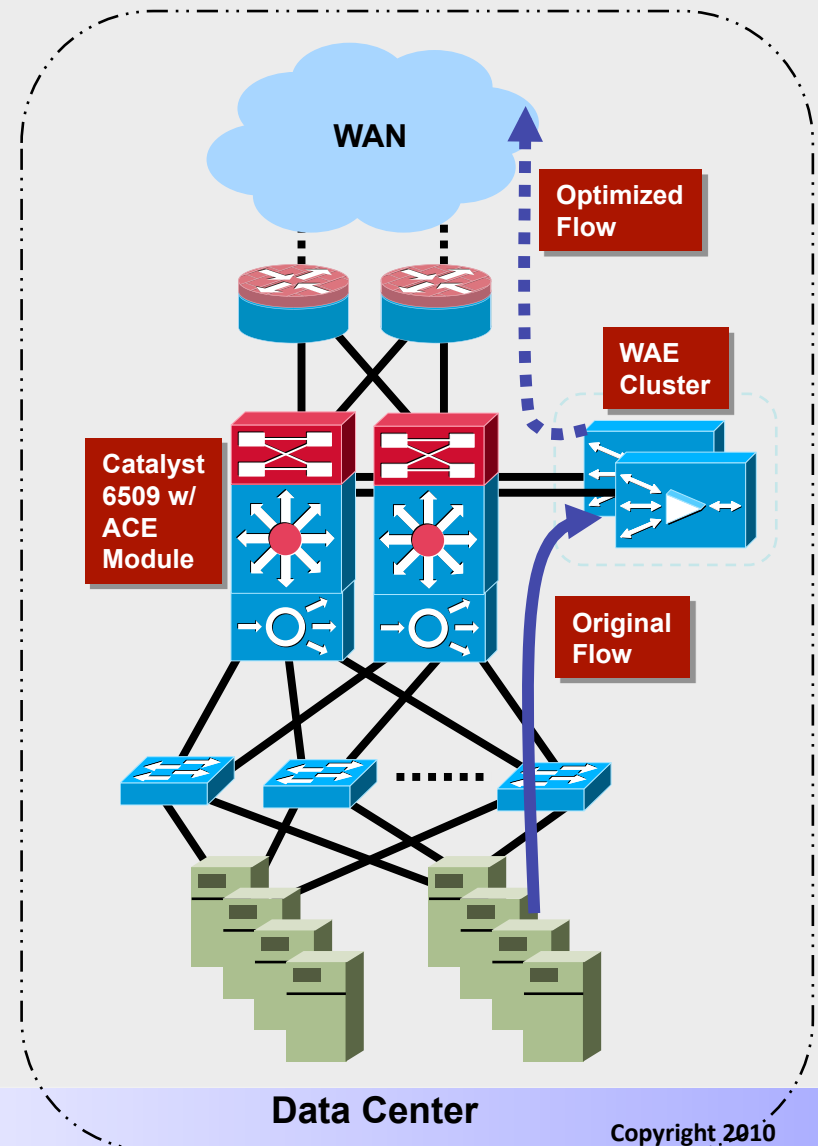
Network-Integrated Off-path Interception

- **Transparent integration and automatic discovery regardless of interception method**
- **WCCPv2 Interception**
 - Active/active clustering
 - 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



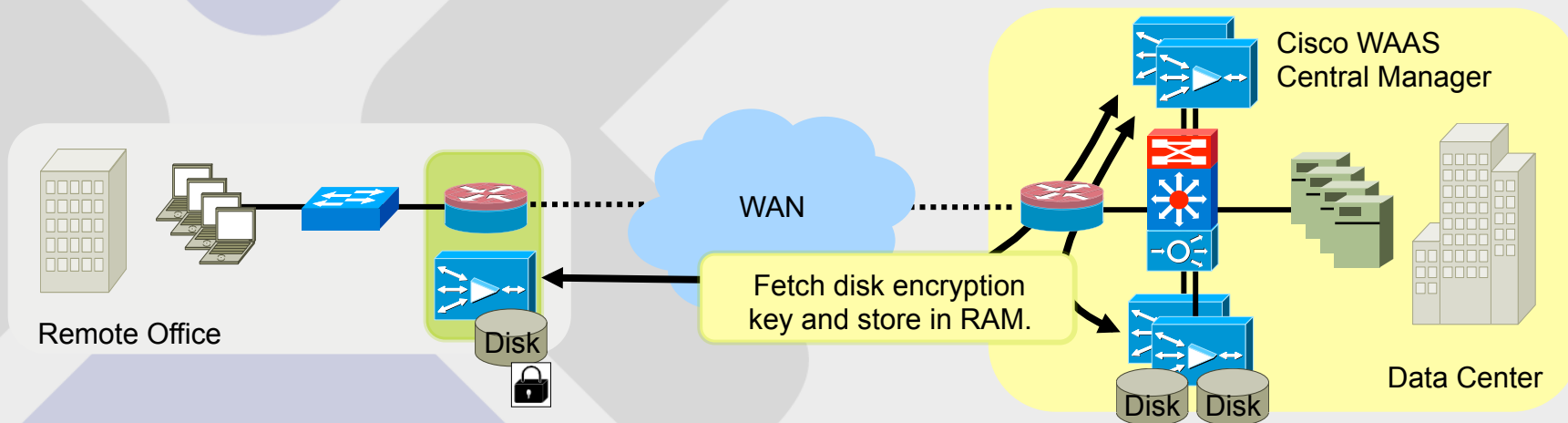
Scalable Data Center Integration

- **Application Control Engine (ACE)**
 - Appliance and Catalyst 6500 series module
 - Supports from 1Gbps to 64Gbps of aggregate throughput and up to 4M concurrent TCP connections
 - Cluster management for hundreds of WAE devices



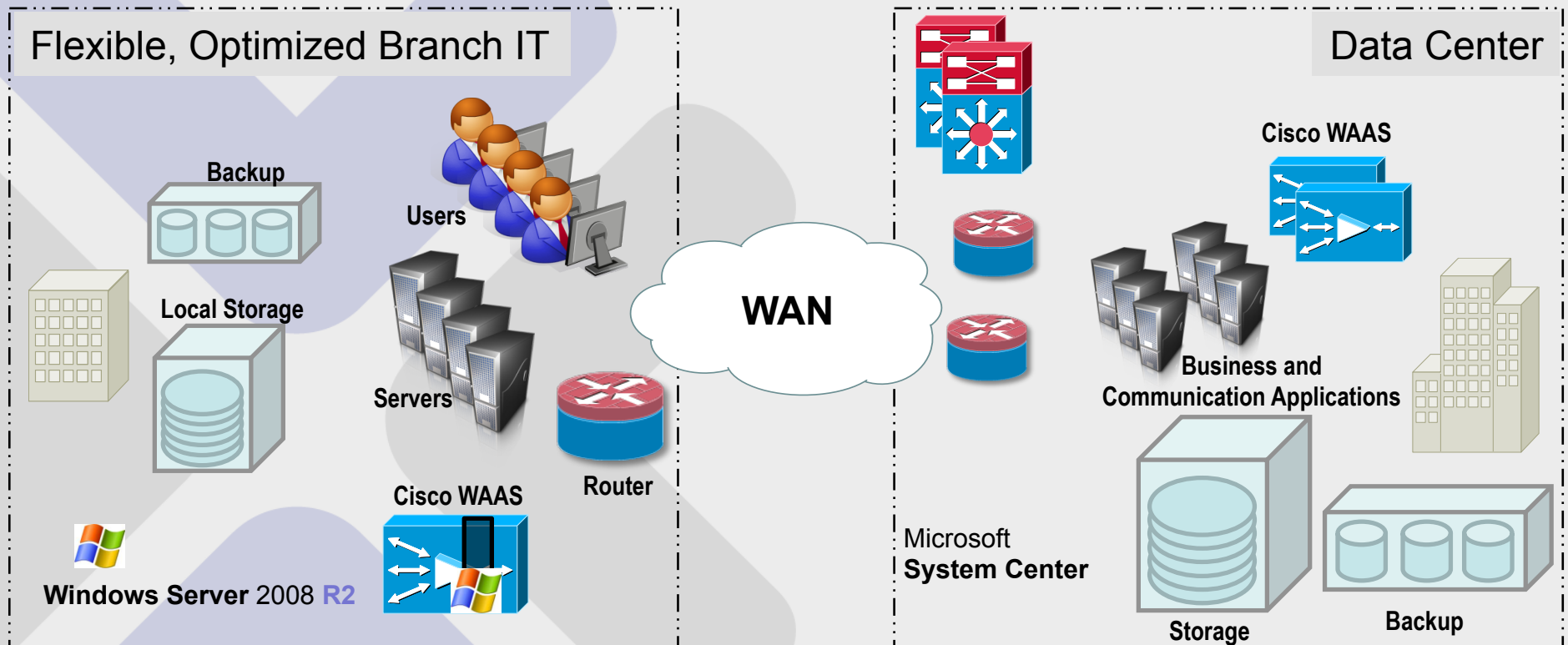
Cisco WAE Disk Encryption

- An optional feature 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
- Keys synchronized amongst Central Managers to ensure HA
- Standards-Based Strong Encryption
 - Follows FIPS 140-2 level 2 specification with certification to follow 256-bit Advanced Encryption Standard (AES) cipher



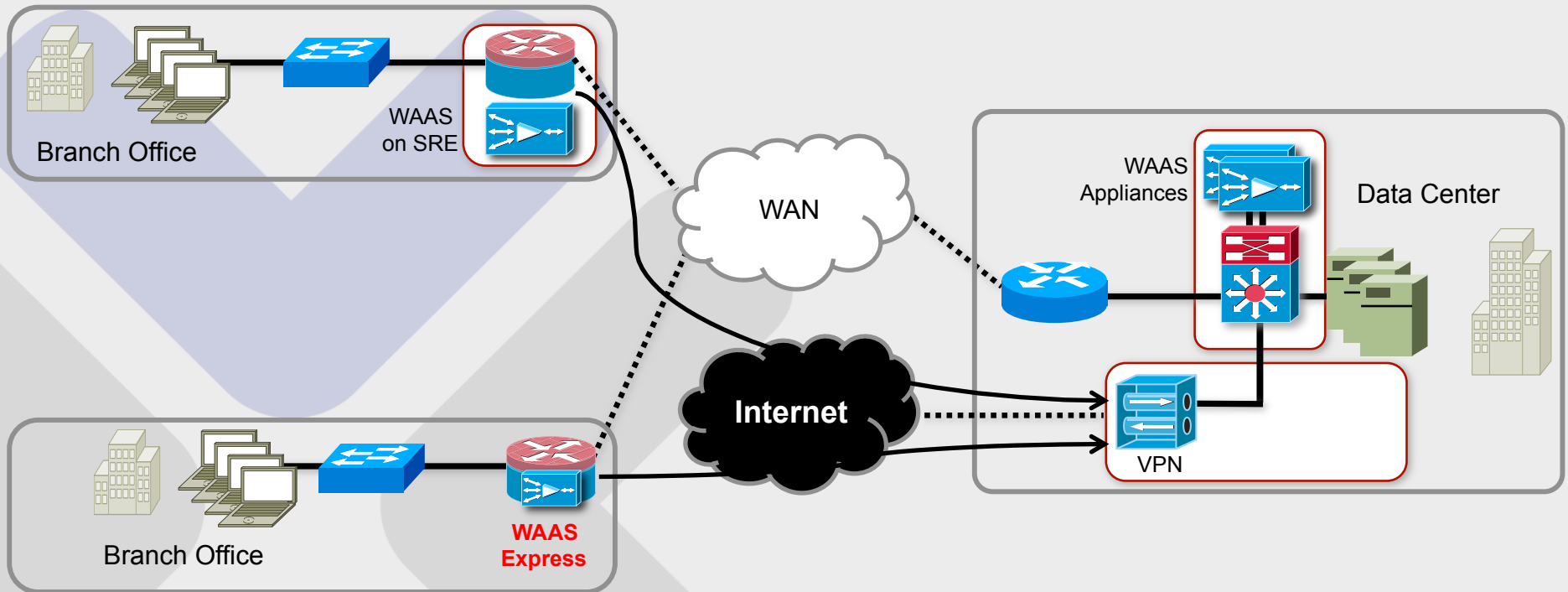
WAAS Virtual Blade

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



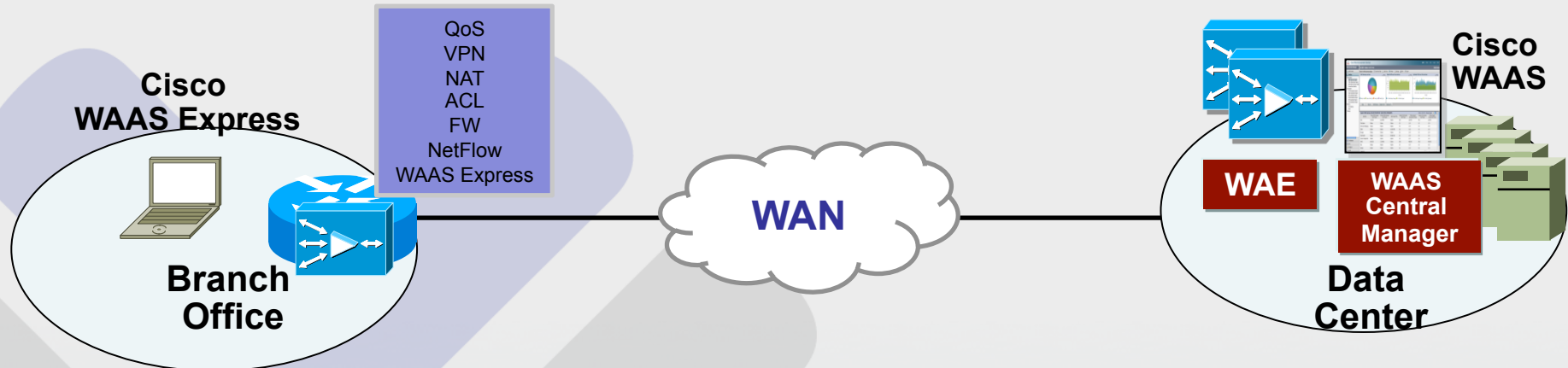
Router-integrated WAAS Solutions

New! WAAS Express and WAAS on SRE



Cisco WAAS Express

Extend Cisco WAAS product portfolio across ISR G2s



Simple

- IOS Based, Router Integrated WAN Optimization Solution
- Simple software feature activation
- Network transparency and integration with IOS based services

Cost Effective












- Defer costly WAN Bandwidth upgrades
- Reduce truck roll costs – IOS integrated solution
- Capex savings – Small branch footprint

Investment Protection

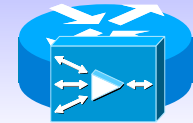
- Part of Cisco WAAS portfolio – Leverage existing WAAS deployment
- Easy migration to WAAS on SRE as business needs grow
- Integrated policy provisioning, monitoring, and, reporting



Feature comparison

	Cisco WAAS	Cisco WAAS Express
Bandwidth Compression and WAN Latency Reduction		
Router Integration		
Network Services Integration		
Transparent Security Policies		
Application Acceleration		
Virtualization		
Video		

Cisco WAAS Express Sizing Recommendations



Platform	Total DRAM Required	Maximum WAN bandwidth Supported	Recommended Number of Users	Max TCP Connections
1941	2.5 G	4 Mbps	15-20	150
2901	2.5 G	6 Mbps	15-20	150
2911	2.5 G	6 Mbps	25	200
2921	2.5 G	6 Mbps	25	200
2951	4 G	6 Mbps	25	200
3925	4 G	10 Mbps	50	500
3945	4 G	10 Mbps	50	500

- WAAS Express requires maximum DRAM installed as indicated
- Typical Interfaces – 3G, T1, E1, Multi T1s, Multi E1s, and Serial
- Performance Testing Conducted with IOS FW, VPN (IPsec), NAT, and, QoS

Enabling WAAS Express

```
Router (config) #interface <interface-name>
```

```
Router (config-if) #waas enable
```

- Simple one command configuration using default policy
- EULA is displayed for Trial licenses the first time WAAS Express is enabled
- Default built-in policy is auto-generated and applied to running-config
- WAAS Express default policy is equivalent to Cisco WAAS (version 4.2.1) default policy but without AO support
- Integrated in IOS, eliminates the need for WCCP configurations

ISR G2 Service Ready Engine (SRE)



- Centralized deployment and management model with flexibility to move services without on-site visits
- Multi-purpose router blades for appliance, compute, and storage services
- Range of virtualized branch services and applications in a compact, router-integrated footprint
- Customers benefit from enhanced IT agility and lower operational expenses with remote activation of WAN optimization

Any Service, Any Branch, Any Time

WAAS on SM-SRE

SM 700	SM 900
4GB RAM	4GB RAM
500G HDD	2x500G HDD. RAID 1. Hot swappable
1.86GHz single core	1.86GHz dual core
Target up to 500 TCP connections, up to 20Mbps WAN bandwidth	Target up to 1000 TCP connections, up to 50Mbps WAN bandwidth
Supported on 2911, 2921, 2951, 3925, 3945	

On demand WAAS deployment

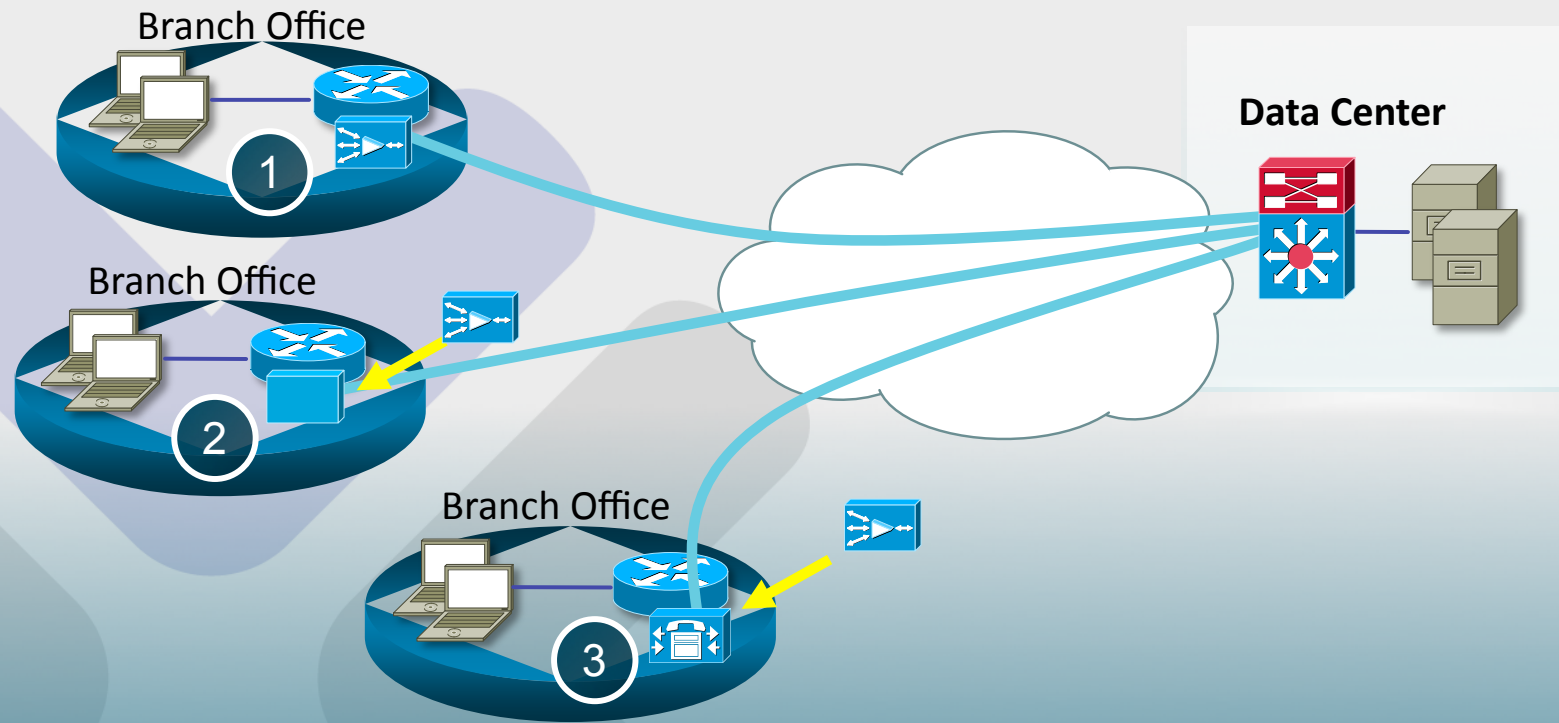
- Purchase a “blank” SM
- Deploy WAAS remotely, no truck roll
- No router reboot needed

Simple WAAS enablement

- Purchase WAAS software and licenses
- Deploy WAAS with tools (CLI, Cisco Works, Configuration Professional)
- Manage via WAAS Central Manager

Better Performance/Price, Lower Operating Cost, Investment Protection

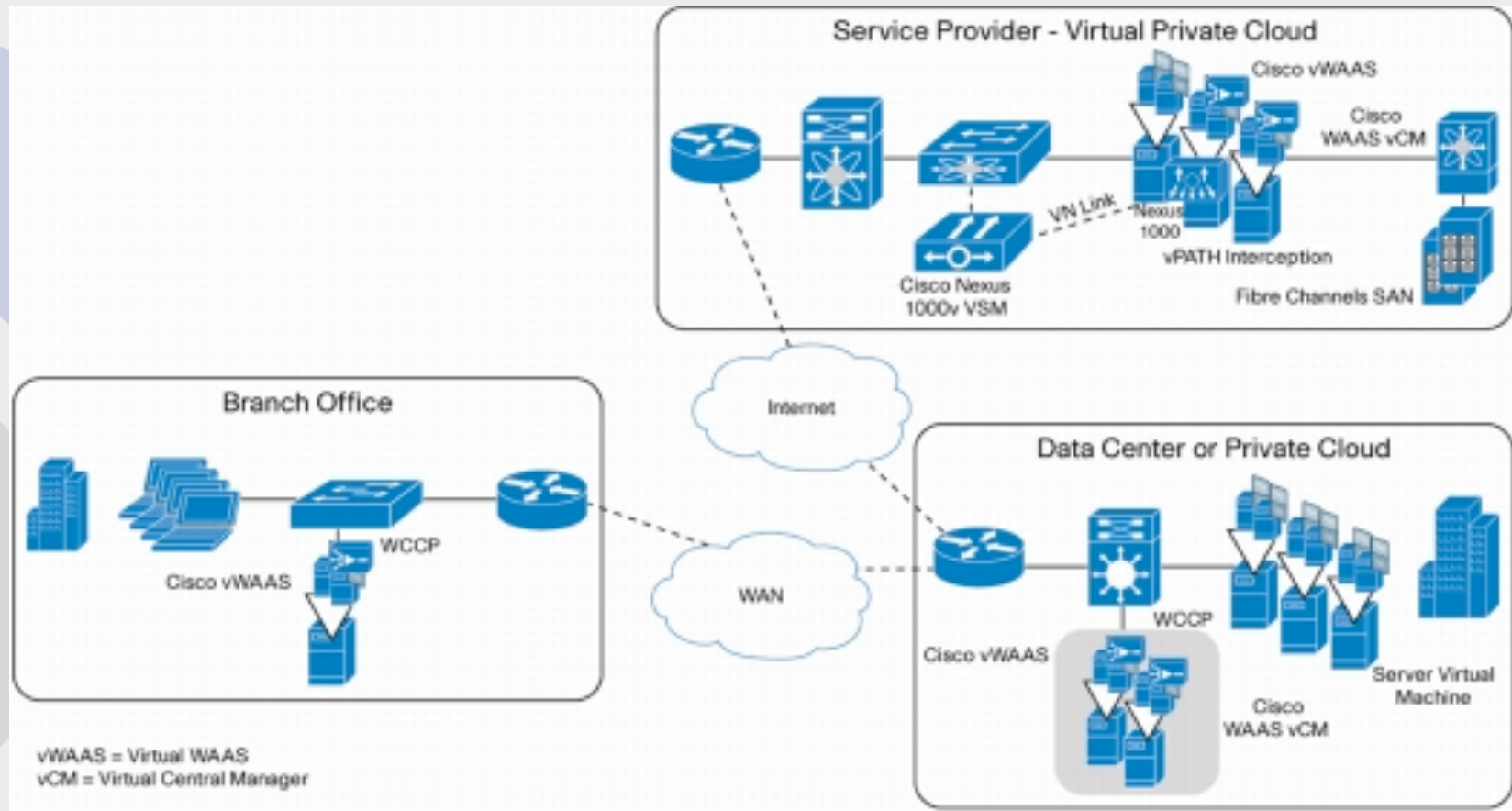
Flexible Deployment Options



- 1 Deploy router and SRE with WAAS pre-loaded
- 2 Deploy WAAS remotely on blank SRE
- 3 Replace current application remotely with WAAS

vWAAS

New! vWAAS



Elastic vWAAS Deployment

On-demand orchestration; policy follows VMs

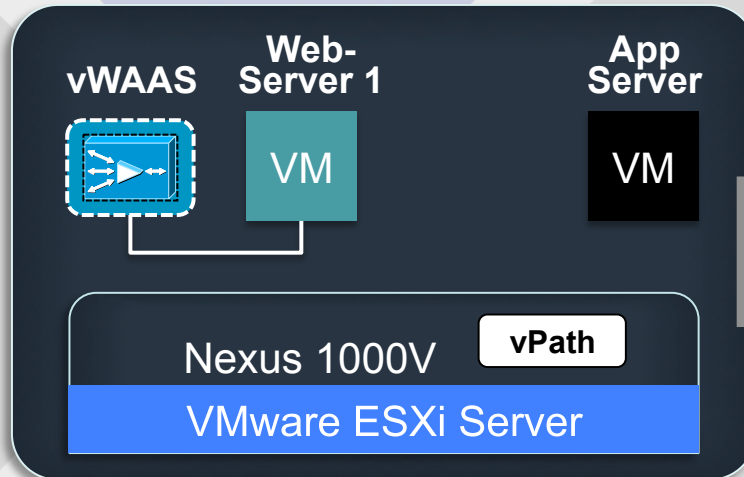
Scenario

1. Provide application-specific optimization as an on-demand service in the cloud without network disruption
2. Scale-out Virtual Web Server farm by provisioning additional VMs while applying WAN optimization

Solution

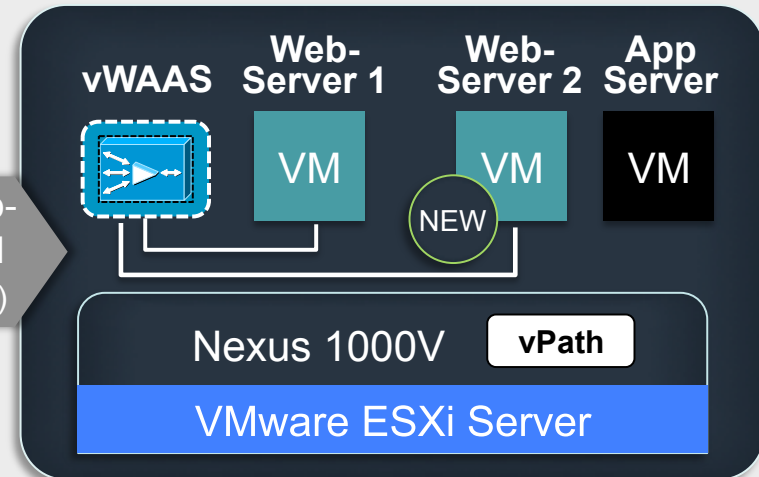
1. vWAAS services associated with 'Web server' VMs using Nexus 1000V policies.
3. Automatic application of vWAAS service when a new 'Web Server' VM gets provisioned


Cisco UCS x86 Server



Add New Web-Server Virtual Machine (VM)

Cisco UCS x86 Server



 vWAAS Optimized VM

 Non Optimized VM

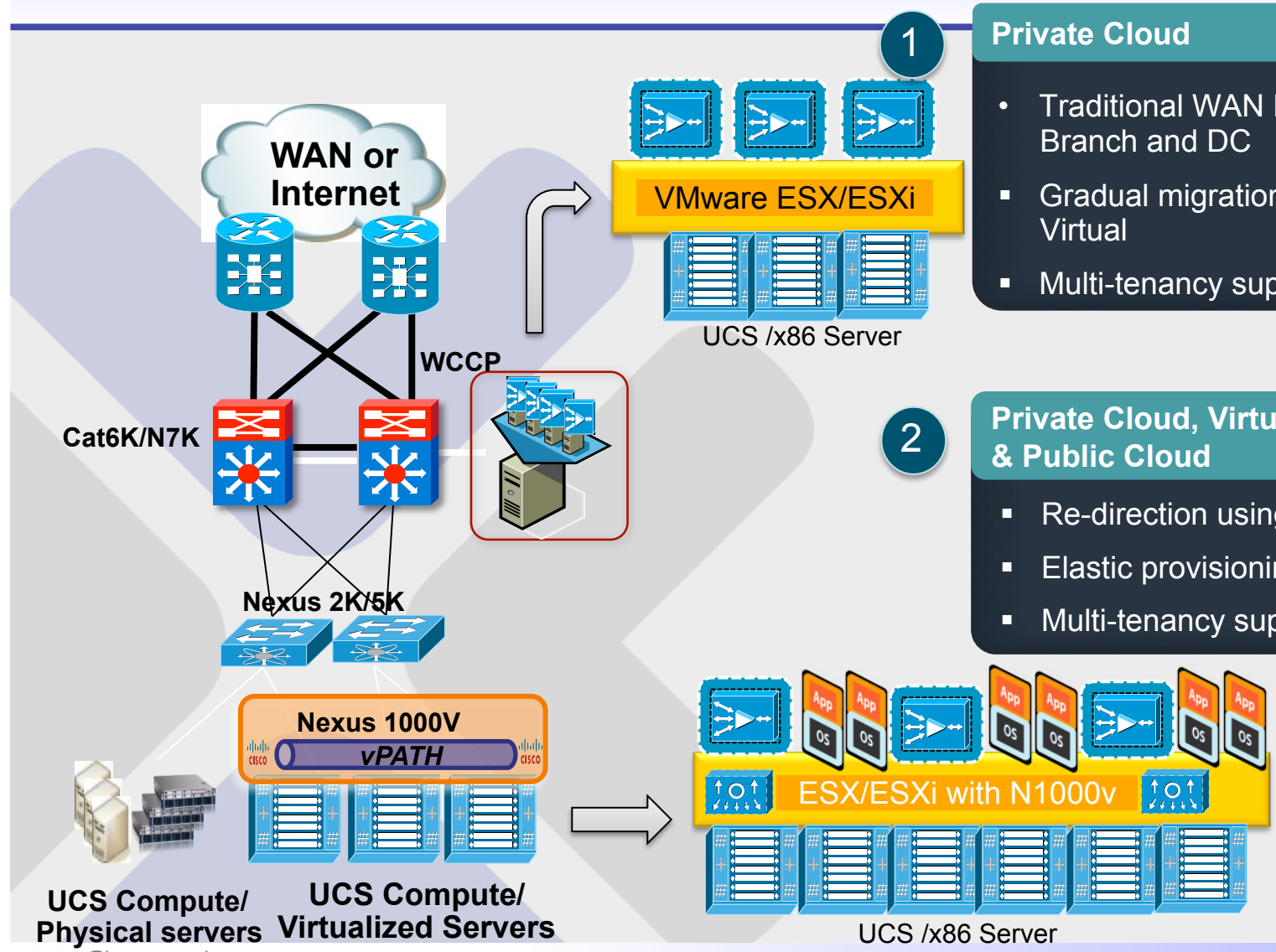
Flexible Cloud Deployment Options

1

- ### Private Cloud
- Traditional WAN Edge Deployment at Branch and DC
 - Gradual migration from Physical to Virtual
 - Multi-tenancy support

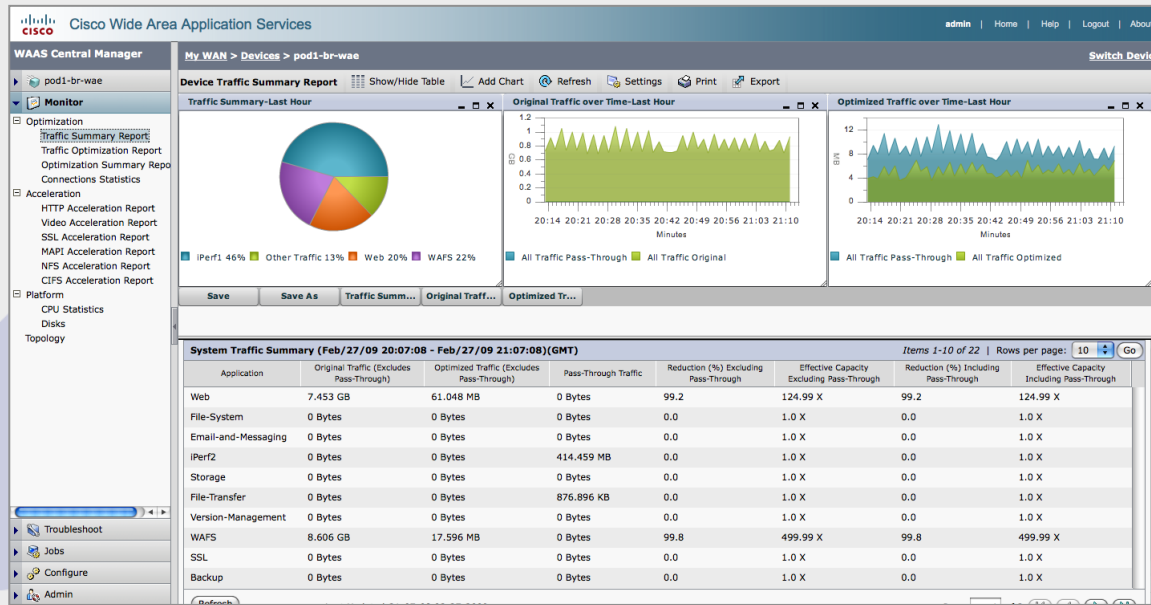
2

- ### Private Cloud, Virtual Private Cloud, & Public Cloud
- Re-direction using vPath @VM level
 - Elastic provisioning
 - Multi-tenancy support



WAAS Management

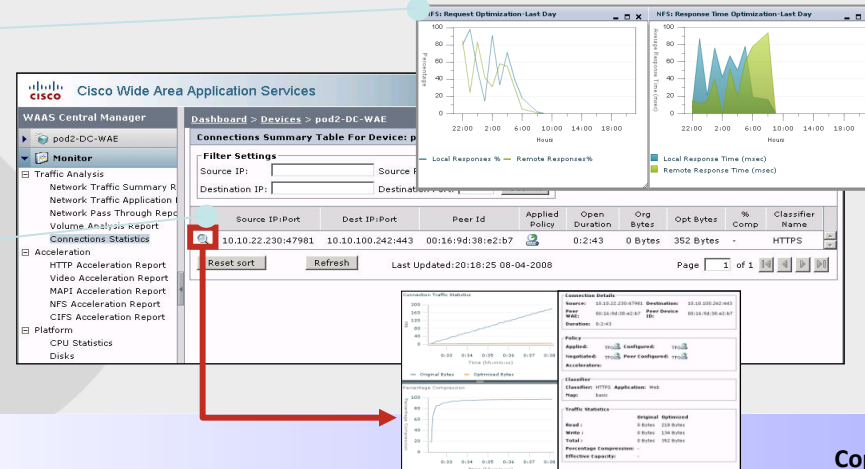
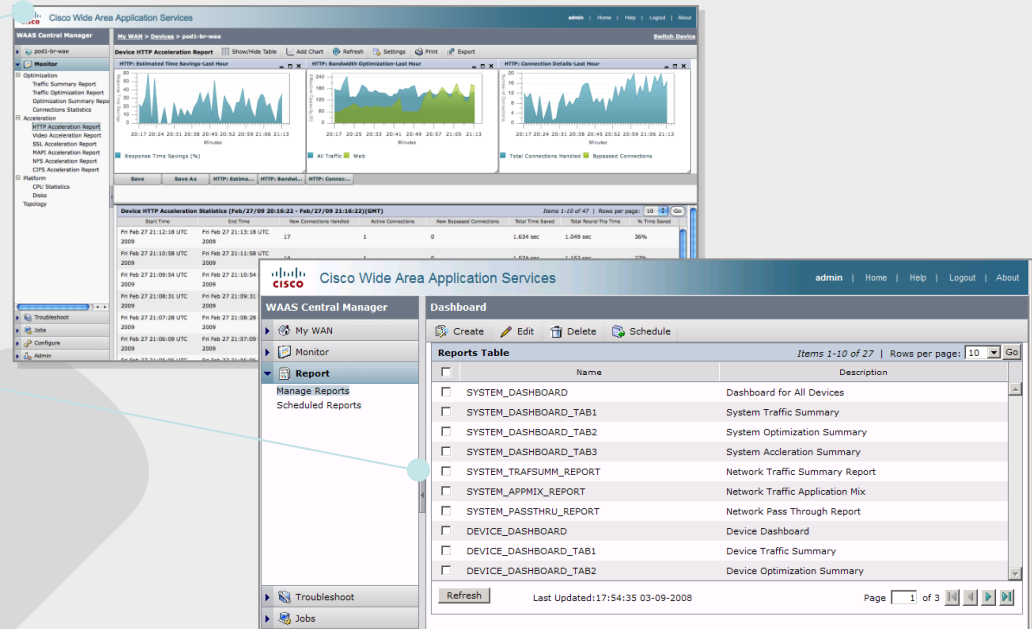
Scalable, Secure Central Management



- **Centralized Management**
 - Robust management, monitoring, and reporting for up to 2000 nodes
 - Device grouping for simplified rollout of configuration changes
 - Device and system alarms, as well as integration with SNMP and syslog
- **Platform support: WAAS appliances, WAAS Modules, WAAS Express, vWAAS**
- **SOA-ready Monitoring**
 - Standard XML Web Service (SOAP)
 - Integration with external reporting and monitoring portals

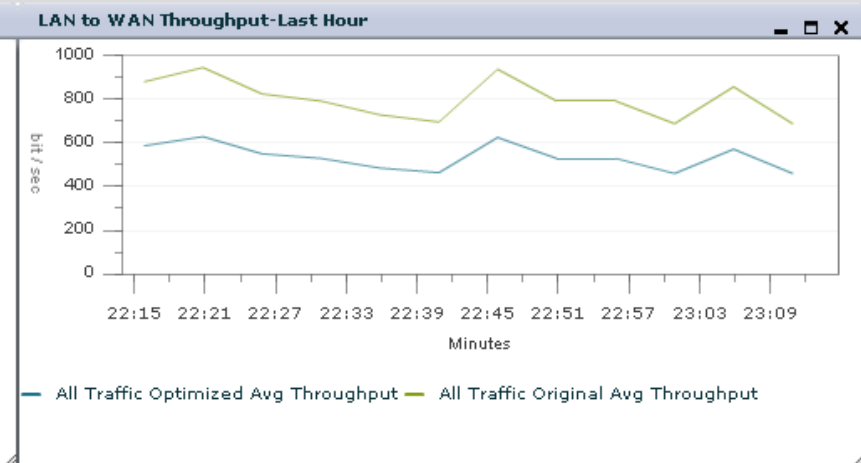
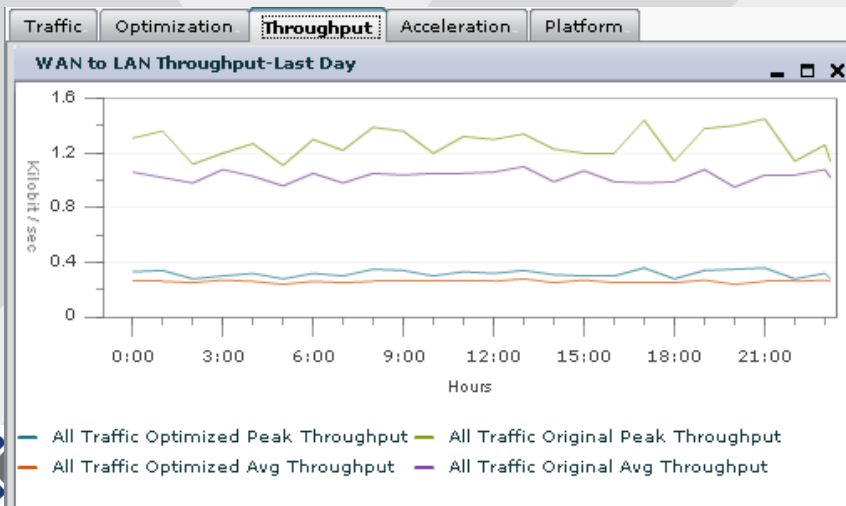
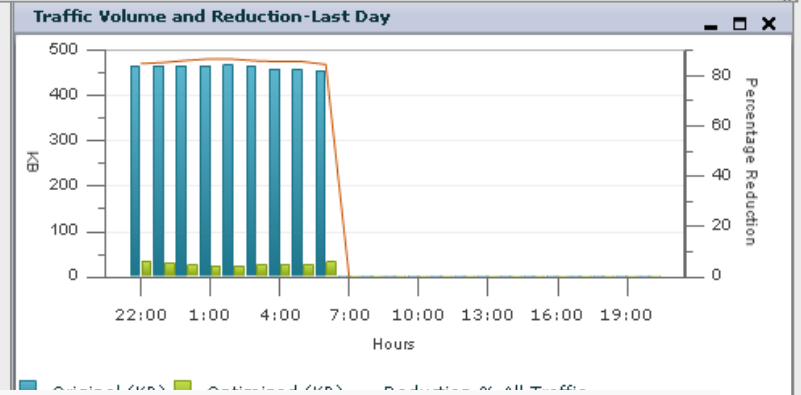
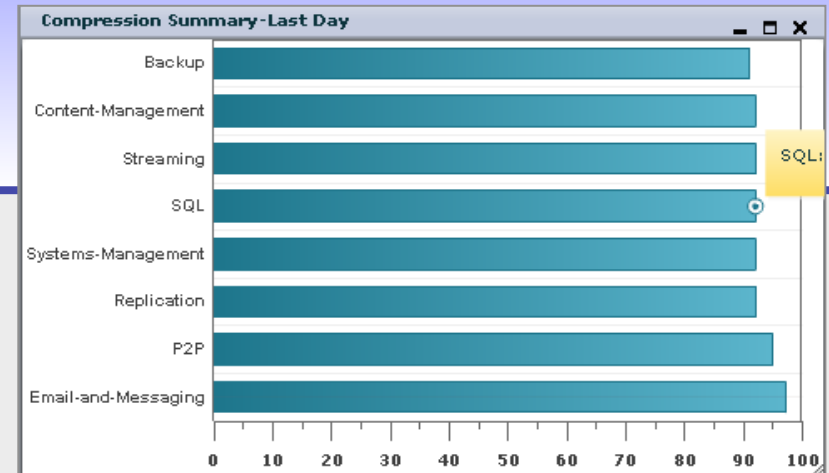
Configurable Comprehensive Reporting

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



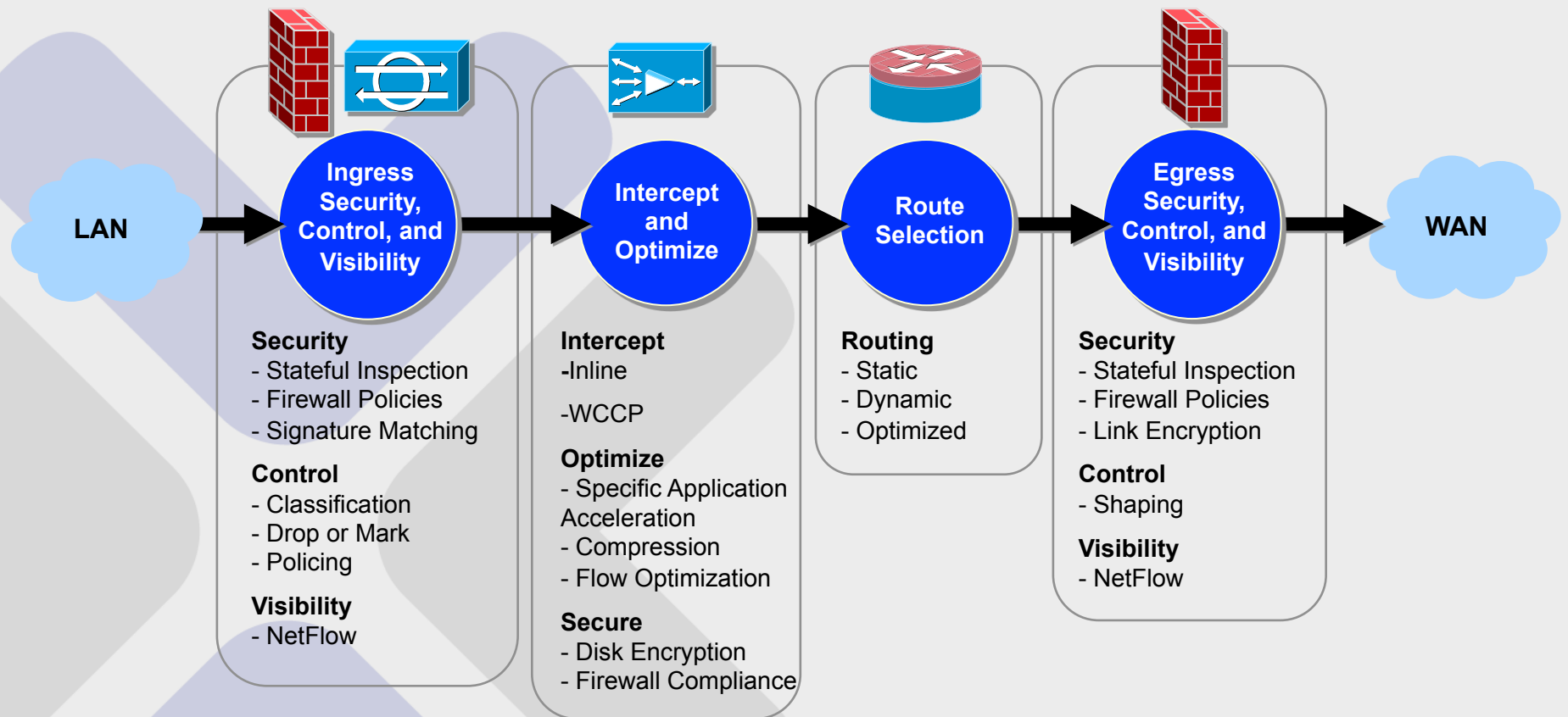
Bandwidth Savings Throughput charts

- **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
- **Throughput before and after WAAS optimization**
 - LAN to WAN
 - WAN to LAN



And In Conclusion....

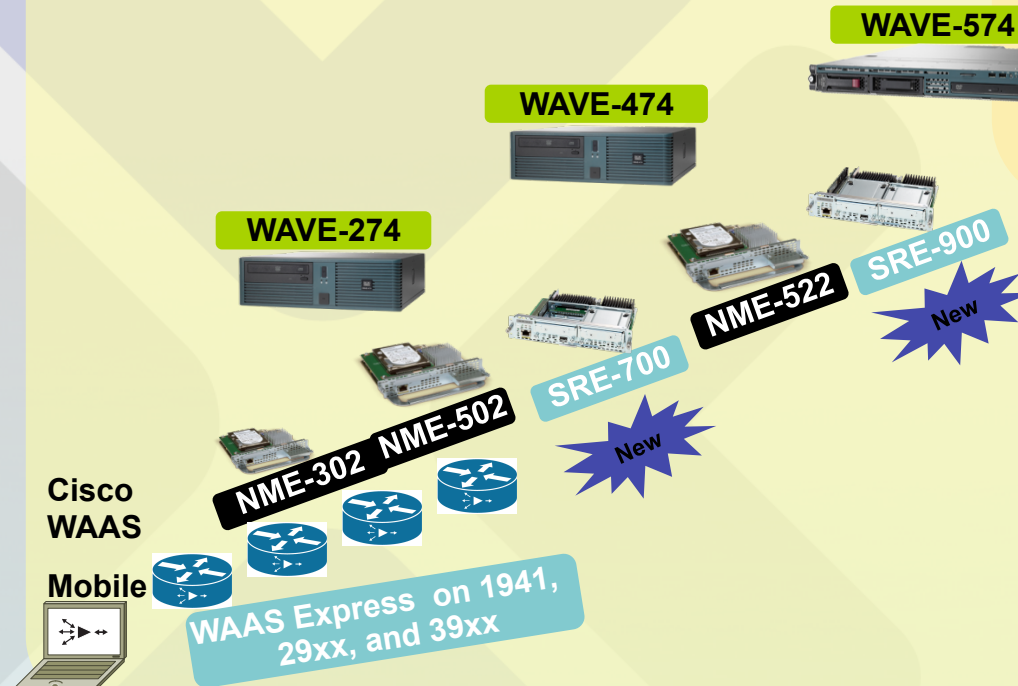
Secure WAN Optimization from Cisco



Cisco WAAS integrates seamlessly and transparently into network security, visibility, and control functions

Cisco WAAS Product Line

Branch Office and Mobile User Platforms



Data Center & Campus Platforms



Data Center Appliance, vWAAS

Branch/Virtual Blade Appliance

On-Demand WAAS on SRE, ISR G2

WAAS Module, ISR

WAAS Express, ISR G2

Mobile User

Small Branch

Medium Branch

Large Branch

Large Branch / Small Data Center

Data Center & Campus

Why Cisco WAAS?

Enhance User Productivity



Application acceleration

Module

Minimize Branch IT Costs



Branch IT consolidation
WAN bandwidth optimization

IOS

Confident Migration to Cloud



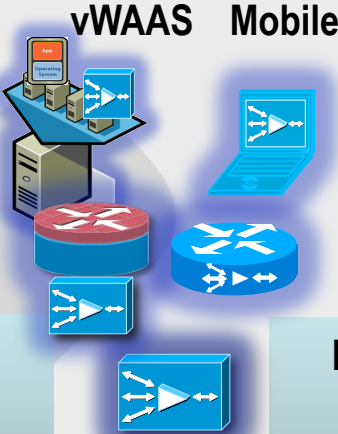
Public and Private Cloud Acceleration

Appliance

Increase Agility and Flexibility



Mix centralized and distributed IT



Questions?