



Education

The Role of WAN Optimization in Cloud Infrastructures

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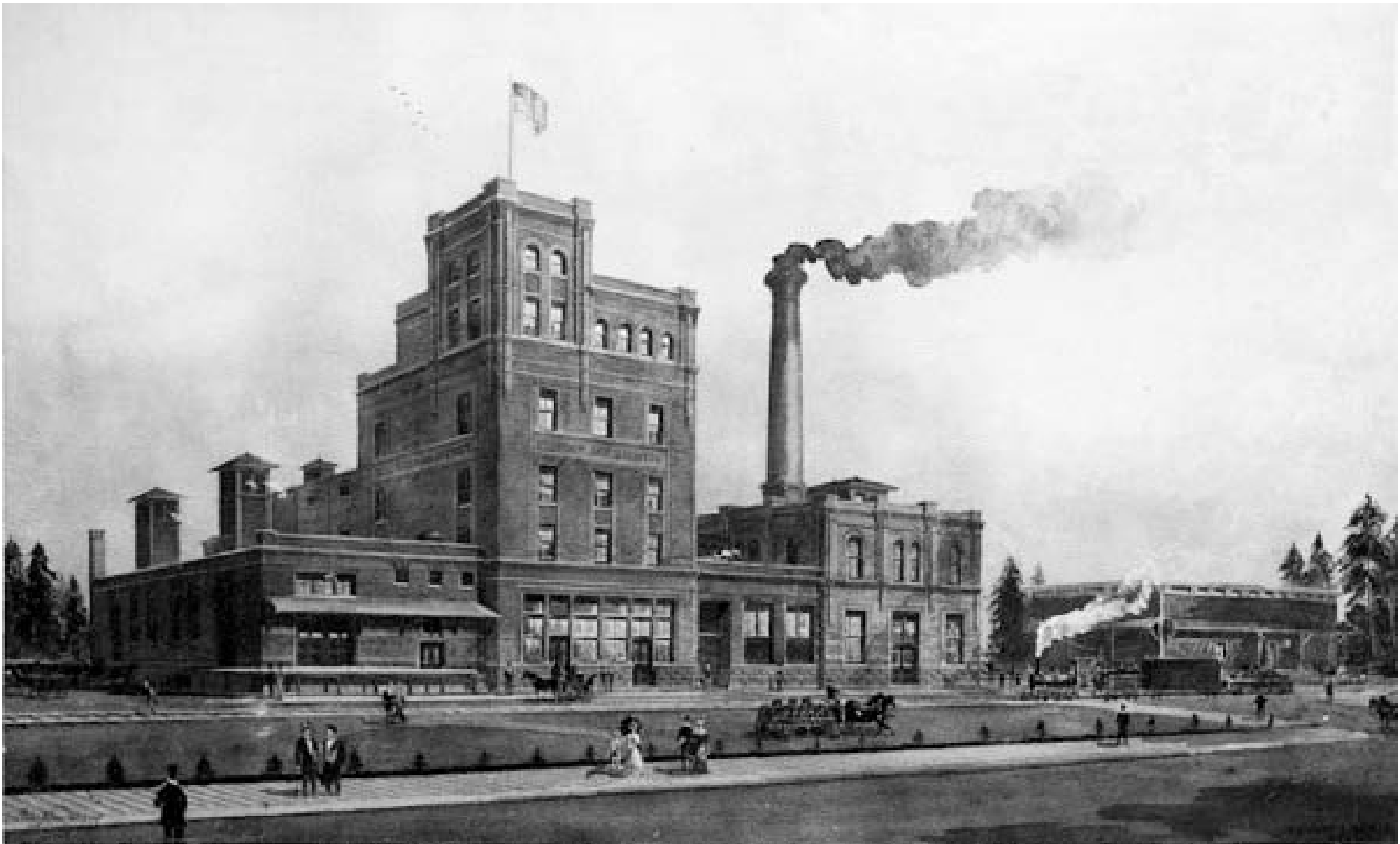
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Agenda Topics

- Importance of the WAN and the Cloud
- What is WAN Optimization and how does it work?
- Deploying WAN optimization
- How WAN optimization facilitates both Cloud Compute & Cloud Storage
- Key requirements for WAN optimization for the Cloud

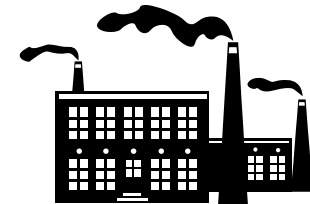
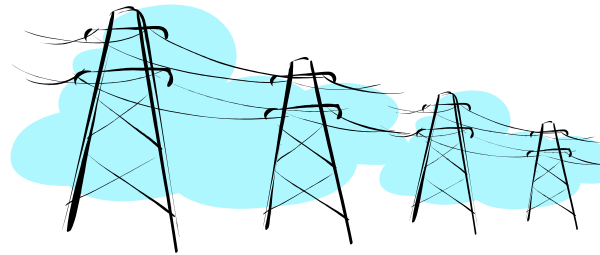
The Beer Factory (Werner Vogels, CTO Amazon)



Cloud/Utility Computing

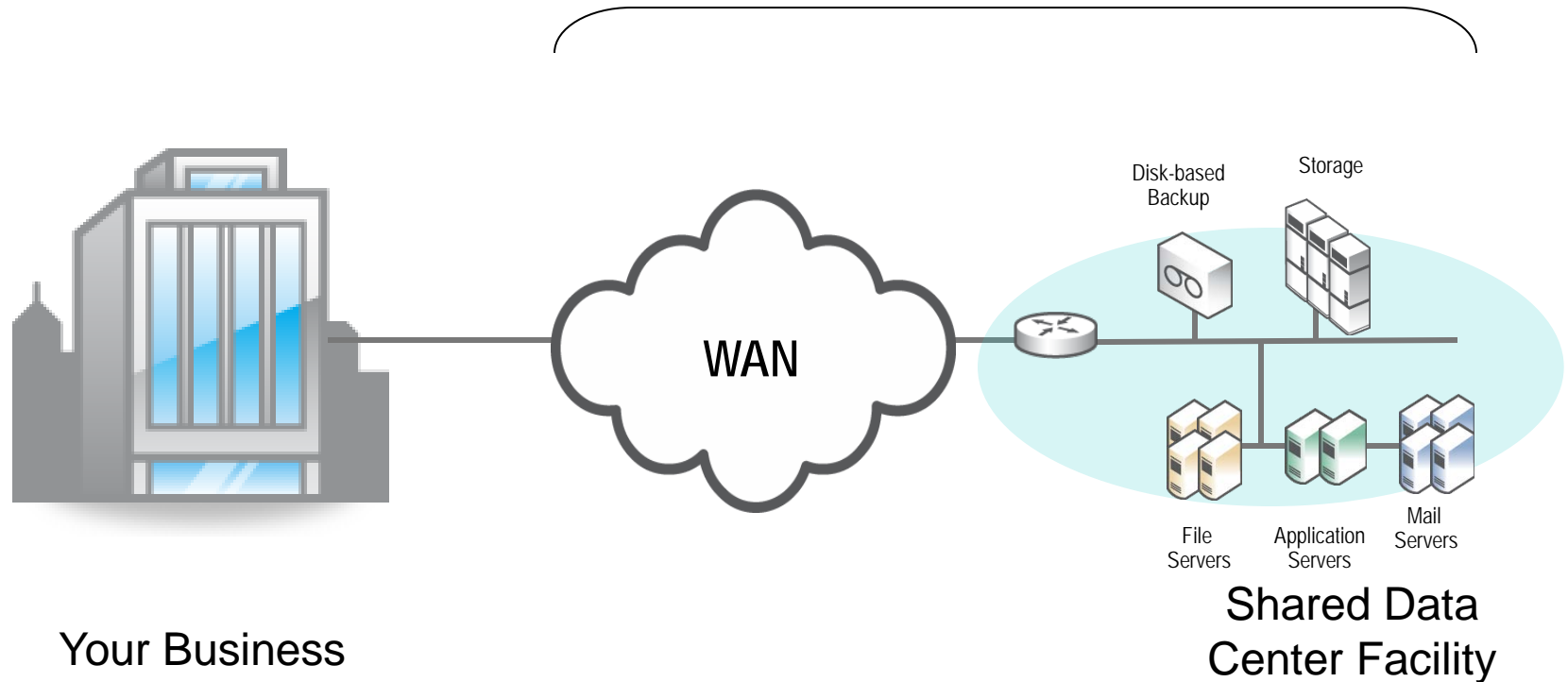


Your Business



Shared Power
Utility

The “Cloud”



➤ The WAN is a core component of The Cloud

Elasticity and Economic Benefits

- **Cloud provider realizes quantities of scale**
 - ◆ Cloud provider gets large serving multiple customers
 - ◆ Per-unit provisioning costs decrease with size
- **Expand IT resources on demand**
 - ◆ Cloud provider provisions resources
 - ◆ Procurement of IT resources hidden from consumer
- **Cloud provider provides focus and expertise**
 - ◆ Focus creates superior expertise delivering IT resources
 - ◆ Superior expertise leads to improved IT performance and efficiency

Issues with migrating to the Cloud

- Largely same physical WAN infrastructure used to access Cloud
 - ◆ Same WAN links with bandwidth and latency
- Cloud data centers are potentially “far away”
 - ◆ Cloud infrastructure supports many enterprises
 - ◆ Large scale drives lower per-unit cost for data center services
- All employees will be “remote” from their data
 - ◆ Even single-location companies will be remote from their data
 - ◆ HQ employees previously local to servers, but not with Cloud model

WAN Performance Bottlenecks

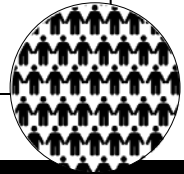
The "distance" problem

- Latency and application chattiness
- Slower application access



"Skinny Straw" problem

- Thousands of companies
- Millions of users
- Varied bandwidth



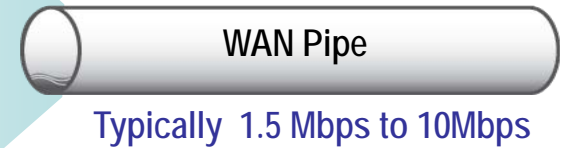
THE EXTREMELY UNFUNNY PART – UP TO 20x SLOWER

Action/ Latency	~ LAN (<10ms)	WAN (~100ms)	WAN (~200ms)
Login	2.08	23.08	34.54
"Reports" Tab	1.19	9.80	22.62
Upload 3MB doc	26.74	88.54	109.03
Download	10	38	40

Bottleneck #1: Bandwidth Limitations

- Lots of data needs to be sent over limited WAN bandwidth
- Congestion problems lead to miserable performance

- Files
- Email
- Web Apps
- Database
- Data Backup
- VOIP



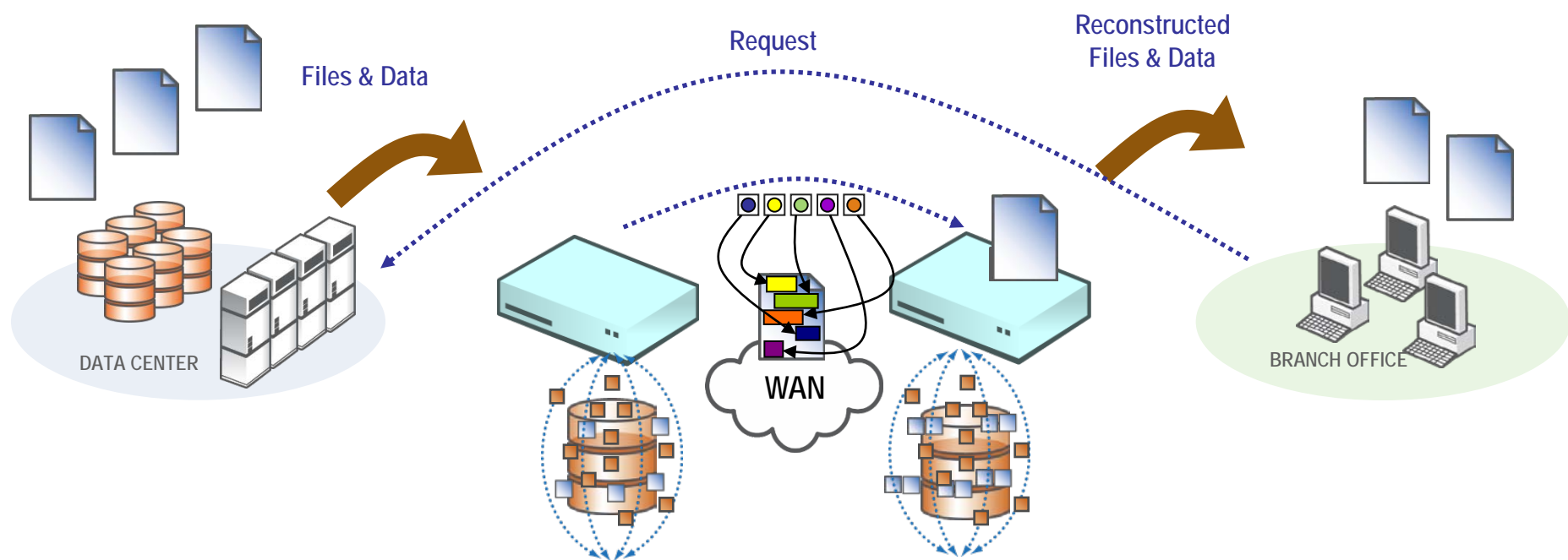
Fixing Bottleneck #1: Bandwidth Limitations

➤ Disk-based deduplication technology

- ◆ Identify redundant data at the byte level, not application (e.g., file) level
- ◆ Use disks to store vast dictionaries of byte sequences for long periods of time
- ◆ Use symbols to transfer repetitive sequences of byte-level raw data
- ◆ **Only** deduplicated data stored on disk

Disk-based Data Reduction

60 to 90 percent data reduction



Bottleneck #2: Application “Chattiness”

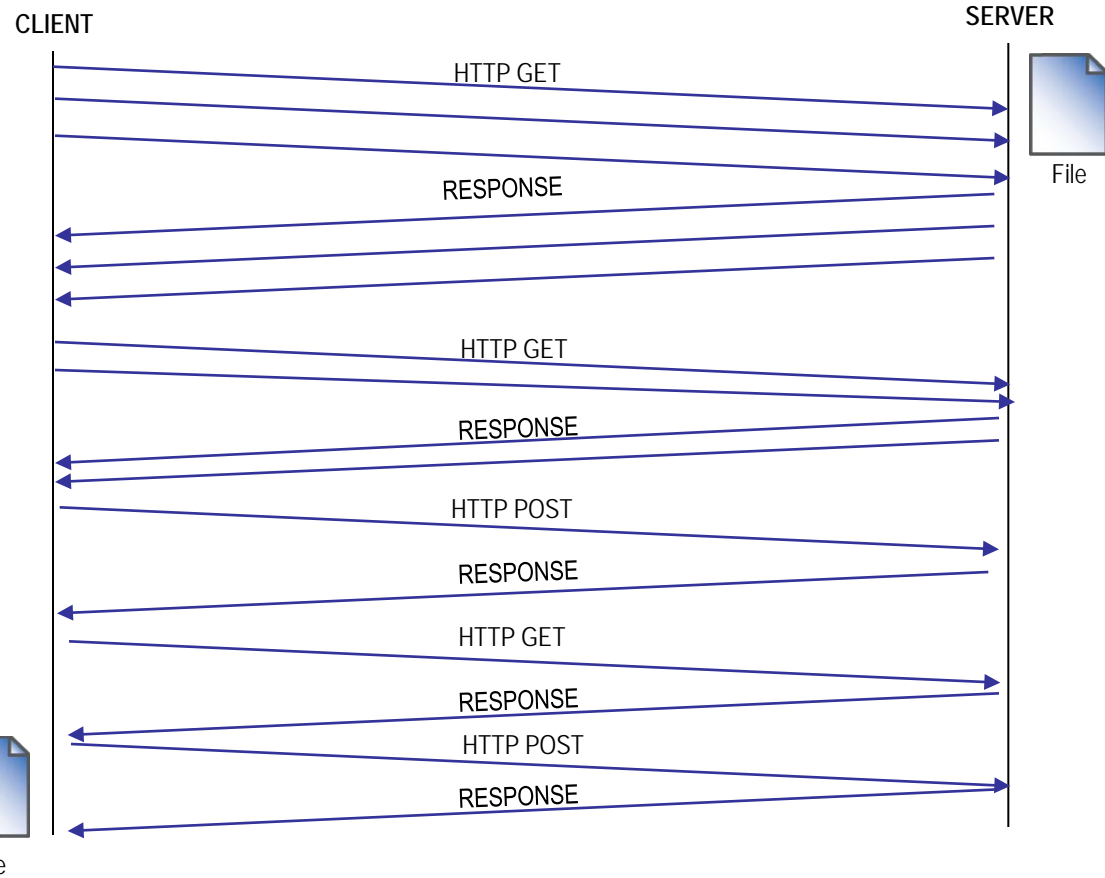
➤ Interactive apps, underlying protocols require 100s or 1000s of round trips for one operation!

- ◆ **Web-based applications**
 - › CRM
 - › Document Management
 - › Call Center Apps
 - › Project Mgmt Apps
 - › Accounting Apps
 - › Other Custom Apps
- ◆ **Legacy apps:**
 - › Common Internet File System (CIFS)
 - › Messaging Application Programming Interface (MAPI)
 - › UNIX File Sharing (NFS)



File

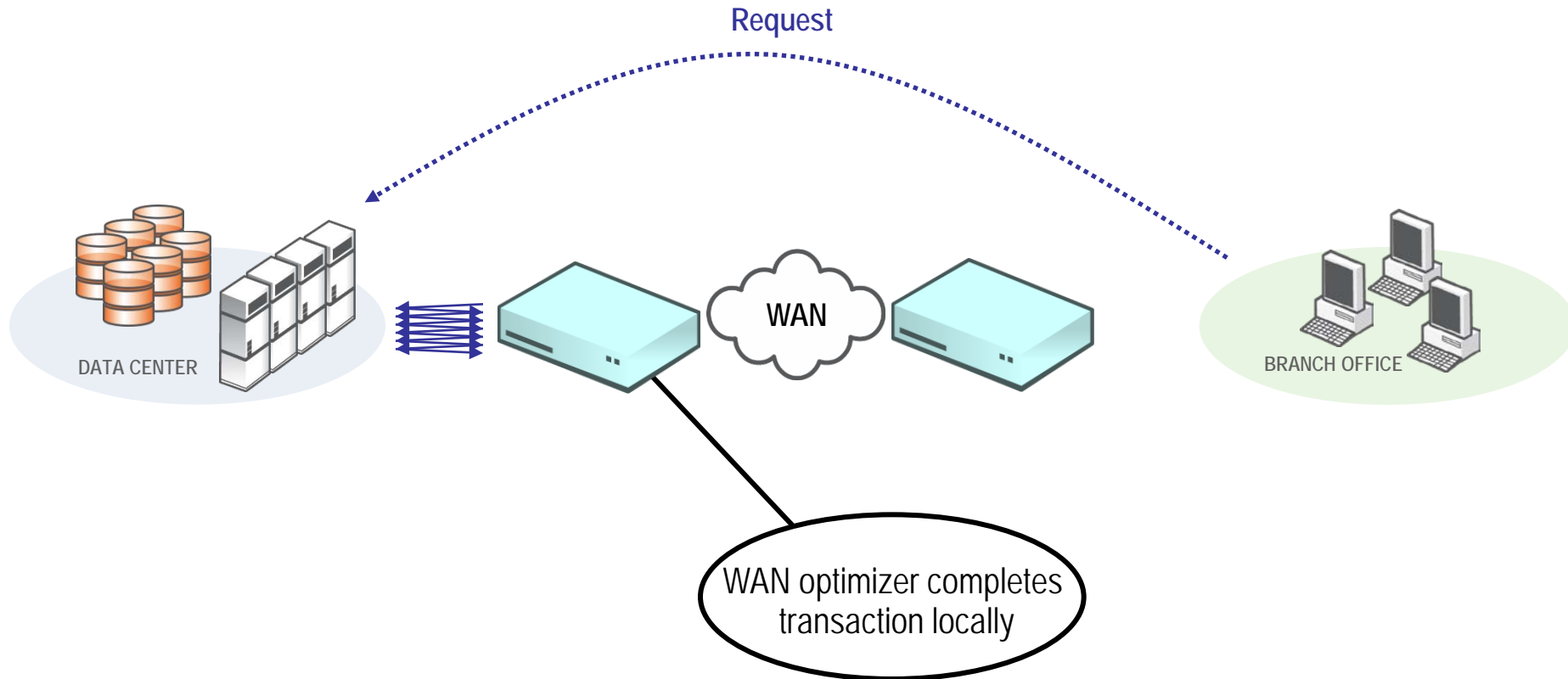
GET GIFs



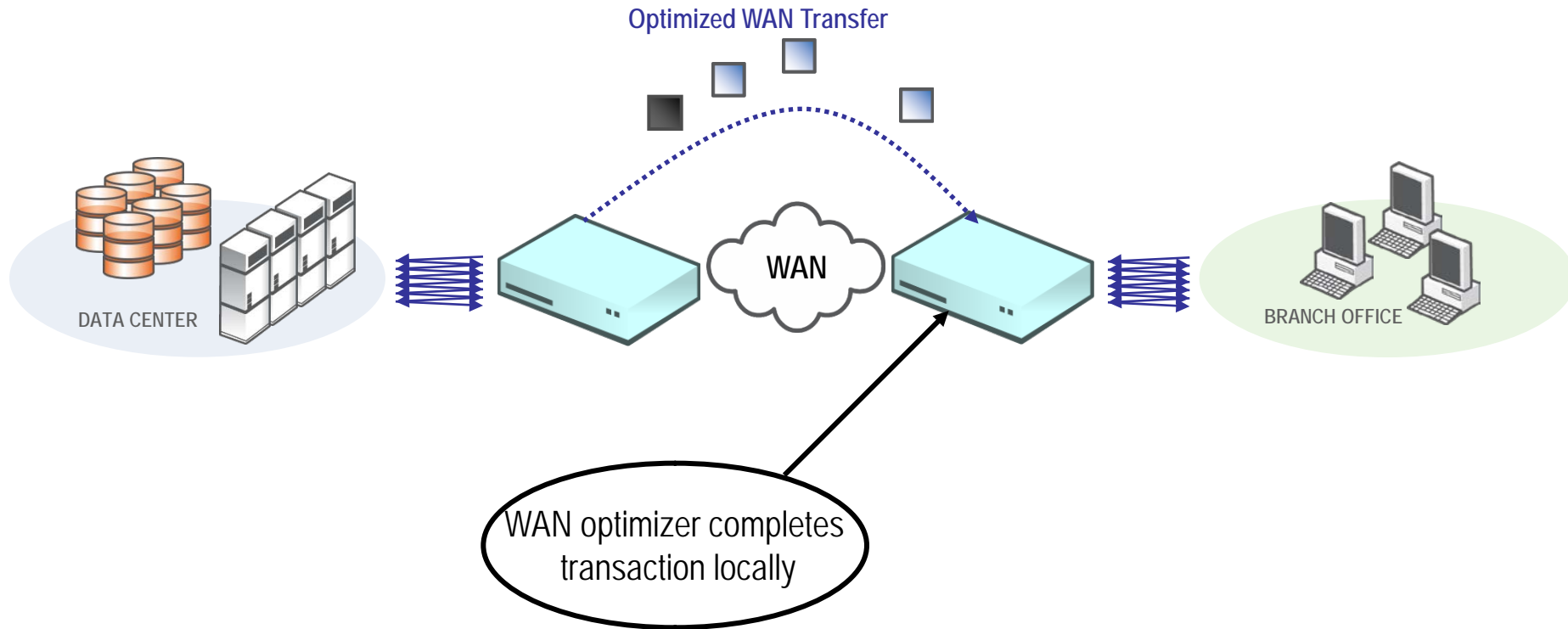
Fixing Bottleneck #2: Application-Level Chattiness

- Application-specific chattiness mitigation modules
 - ◆ HTTP, CIFS, MAPI, MAPI2003, NFS, etc...
- Protocol-compliant read-aheads to pre-fetch data
 - ◆ Pipeline delivery of all application data
 - ◆ Eliminate chattiness over the WAN

Addressing Application-Level Chattiness



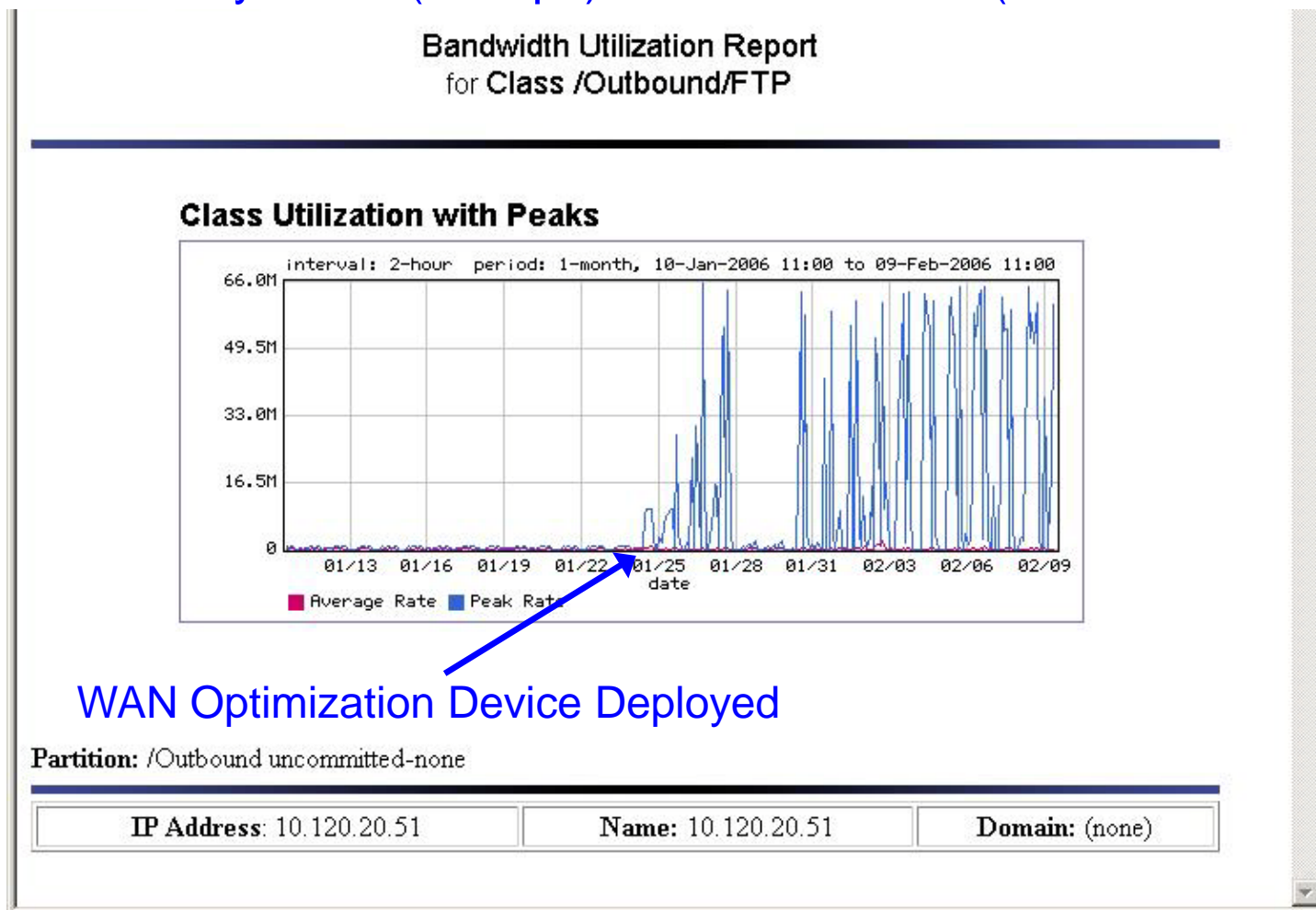
Addressing Application-Level Chattiness



Throughput achieved through WAN optimization

Actual Results:

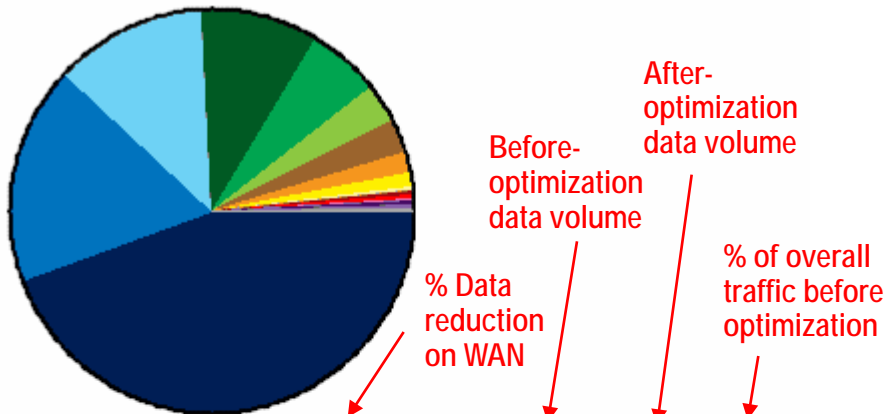
Atlanta to Malaysia E1 (2 Mbps) WAN connection (~150ms RT latency)



WAN Optimization Device Deployed

Bandwidth reduction achieved through WAN optimization

Traffic Summary



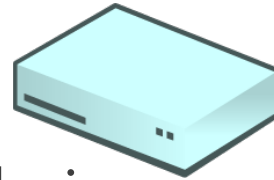
Port	Reduction	LAN	WAN	Traffic %
SQL:TDS (1433)	(47.38%)	2.3 GB	1.2 GB	2.95%
JDE (8021)	(96.69%)	1.4 GB	48.5 MB	1.82%
Asset (8300)	(94.68%)	1001 MB	53.2 MB	1.24%
Unknown (1565)	(88.96%)	375.9 MB	41.4 MB	0.46%
JDE (8005)	(52.80%)	327.3 MB	154.5 MB	0.40%
CIFS:TCP (445)	(45.92%)	312.7 MB	169.1 MB	0.39%
SMTP (25)	(85.99%)	234.8 MB	32.9 MB	0.29%
FTP (21)	(84.02%)	150.1 MB	23.9 MB	0.19%
Unknown (1112)	(66.80%)	112 MB	37.2 MB	0.14%
Other	(67.6%)	371.0 MB	120.4 MB	0.43%

Port	Reduction	LAN	WAN	Traffic %
Total Traffic	--	78.9 GB	12.7 GB	--
HTTP (80)	(95.07%)	34.3 GB	1.6 GB	43.50%
JDE (8011)	(89.33%)	13.7 GB	1.4 GB	17.39%
email (1352)	(57.57%)	9.6 GB	4 GB	12.16%
DB (1521)	(60.84%)	7.3 GB	2.8 GB	9.34%
JDE (8003)	(89.47%)	4.7 GB	511.6 MB	6.01%
JDE (85)	(89.38%)	2.5 GB	279.8 MB	3.26%

79GB of data was reduced to 13GB (83% reduced)
66GB of data was removed from the International links at Malaysia

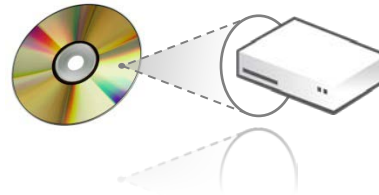
WAN optimization solution components

➤ Physical appliances



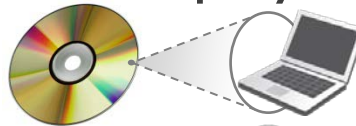
- ◆ Dedicated hardware devices
- ◆ Maximize performance/cost

➤ Virtual appliances



- ◆ Shared hardware
- ◆ Improved flexibility for deployment

➤ Software clients



- ◆ WAN optimization from anywhere

➤ Traffic interception nodes



- ◆ Also known as “load balancing”
- ◆ Scalability/clustering

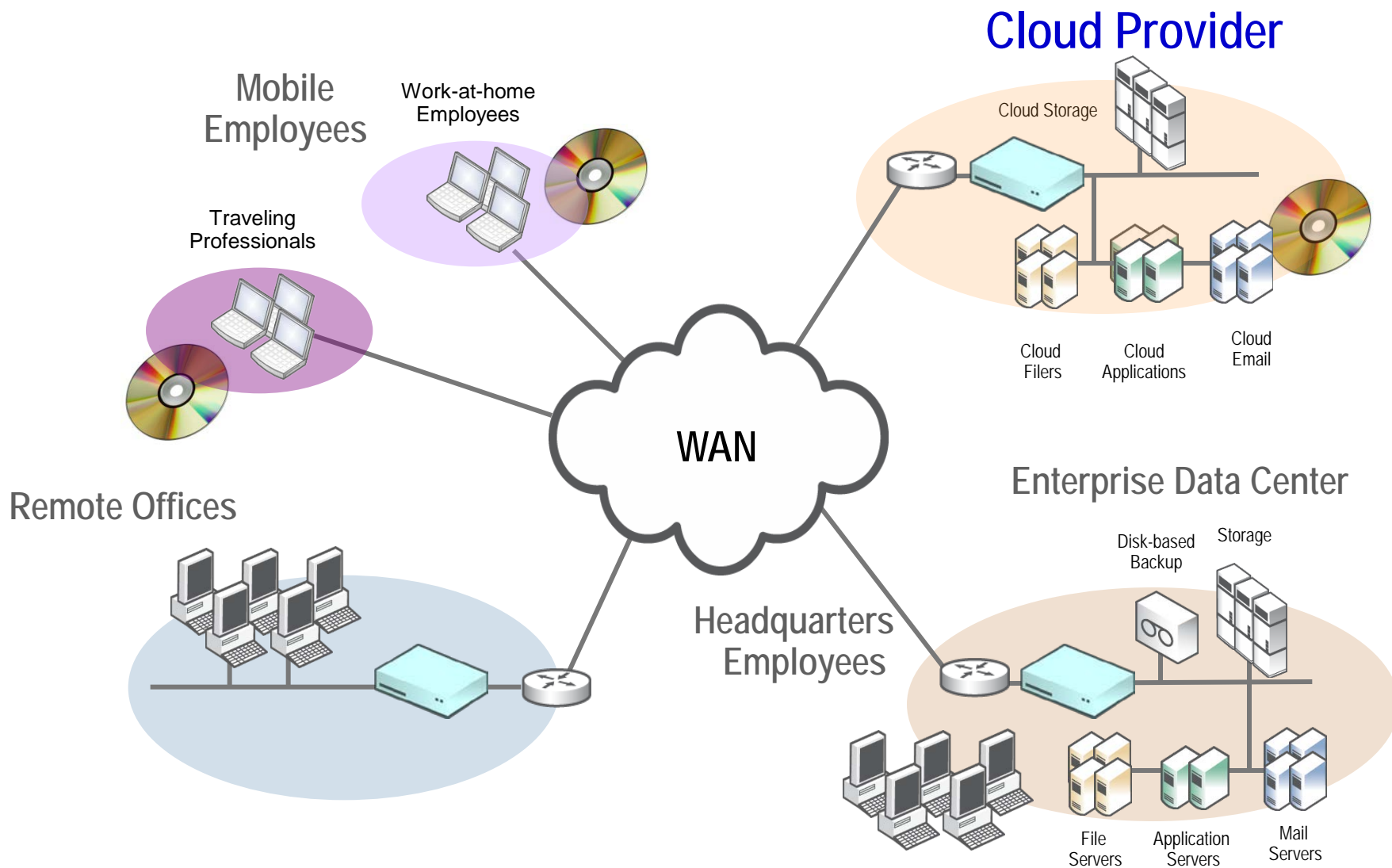
Deploying WAN Opt in the Cloud

- Deploy your own WAN optimization devices into Cloud provider's infrastructure
- Install own dedicated virtual WAN optimization software on your rented virtual machine (IaaS)
- Purchase WAN optimization from Cloud provider services catalog
 - ◆ Purchased just like software applications in SaaS model
 - ◆ Time-based and user capacity-based licensing
 - ◆ Licenses purchased as needed through provider portal interface using credit card

Deploying WAN Opt in the Enterprise **SNIA**

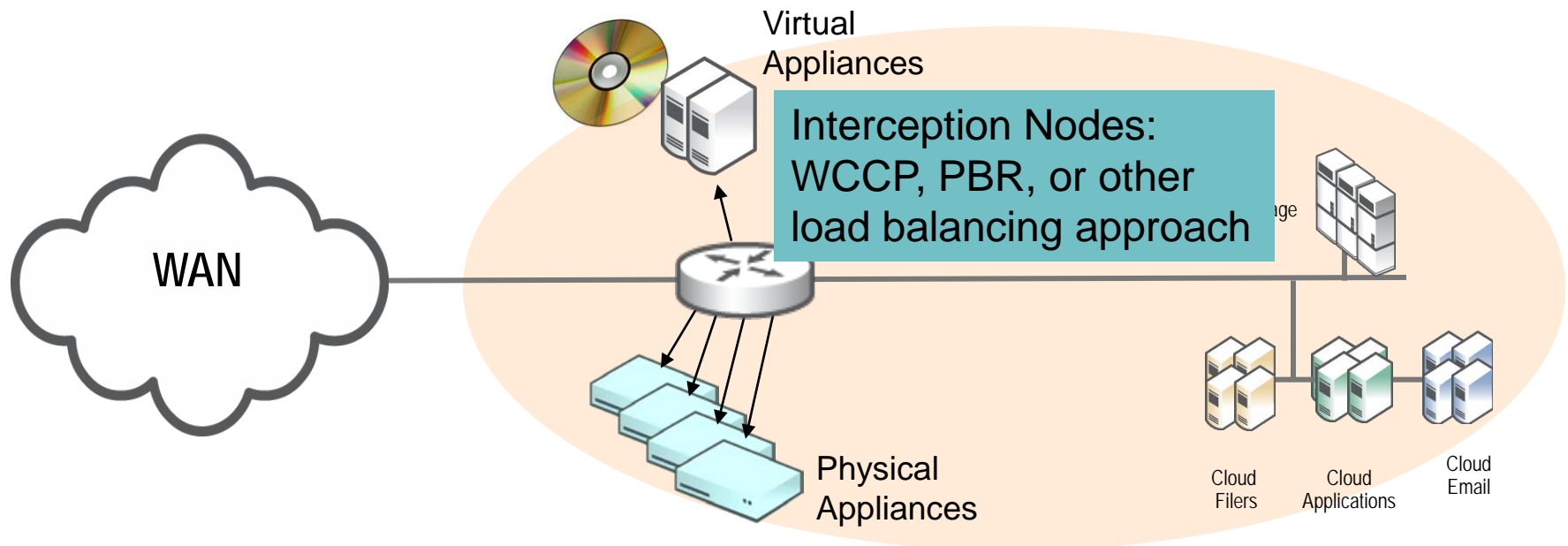
- Physical or virtual appliances at office locations
- Mobile software clients for end-users
- Provisioned directly from WAN opt equipment vendor or through service provider
- Enterprise deployment must match products in Cloud
 - ◆ WAN optimization relies on proprietary technology
 - ◆ No interoperability between products from different vendors

Deploying WAN Optimization



Cloud Provider Infrastructure

- Traffic interception nodes critical for scaling
 - ◆ Multiple physical or virtual appliance needed for scaling WAN optimization for Cloud infrastructure
 - ◆ WCCP, PBR, or other load balancing approach



- WAN optimization benefits for Cloud Computing
 - ◆ IT consolidation/operational efficiency
 - ◆ Maintain fast data access for applications



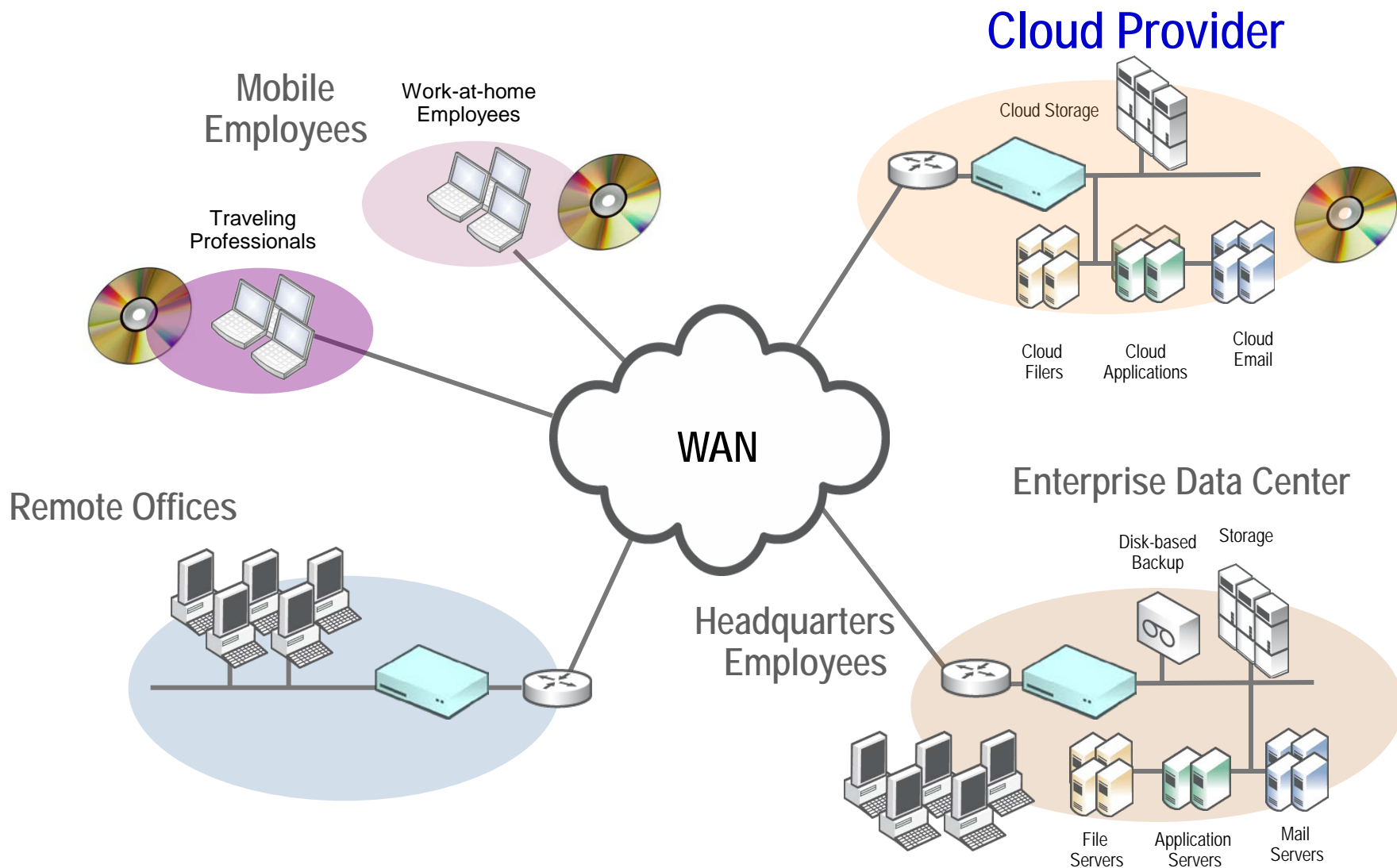
- WAN optimization benefits for Cloud Storage
 - ◆ Backup/archival of data
 - ◆ Disaster recovery



Move compute resources into Cloud (i.e., SaaS, PaaS, & IaaS)

- Consolidate applications into the Cloud
- IaaS: Deploying or migrating applications to Cloud
 - ◆ VMDK files can be very large; WAN opt needed to facilitate transfer
- SaaS, PaaS, & IaaS: Facilitate access to Cloud applications
 - ◆ Maintain performance for accessing application data
 - ◆ Minimize bandwidth consumption from accessing Cloud applications
 - ◆ Many applications accessed using chatty protocols even when in the Cloud

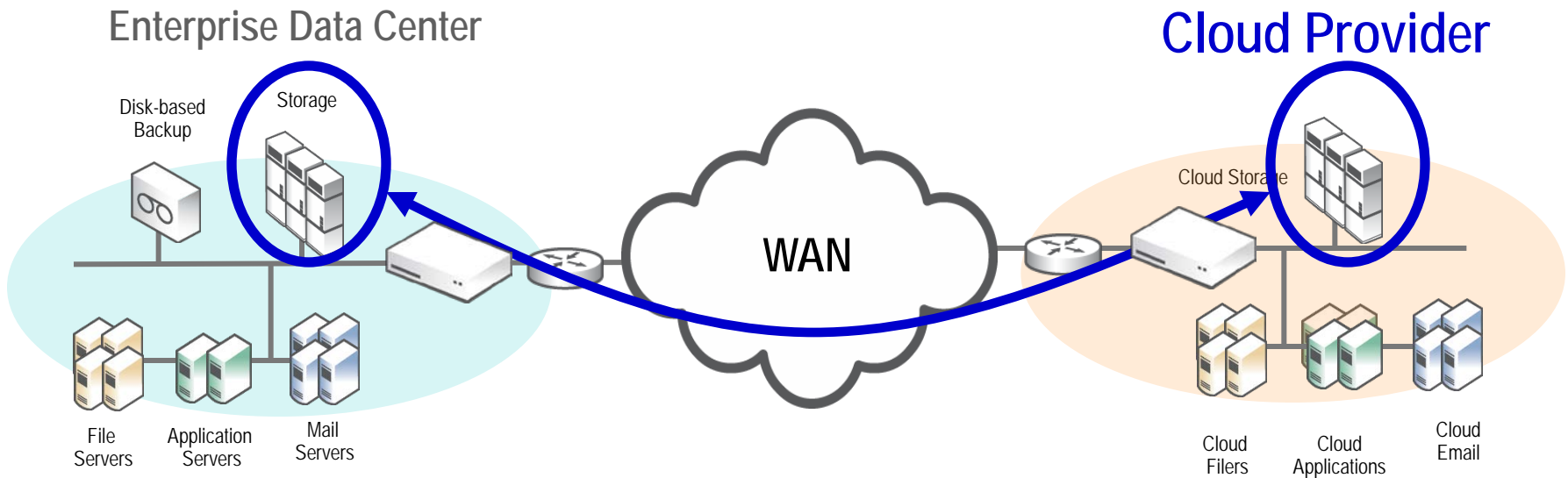
Move compute resources into the Cloud



- **Primarily backup and/or archival of data to the Cloud**
 - ◆ Optional use of data deduplication to reduce Cloud storage consumption
 - ◆ WAN throughput must support size of the backup/archival data set
- **WAN optimization is cost-effective approach to meet throughput/performance requirements**
 - ◆ Achieve performance requirements at a fraction of cost
 - ◆ E.g., OC-3 for the cost of a DS-3

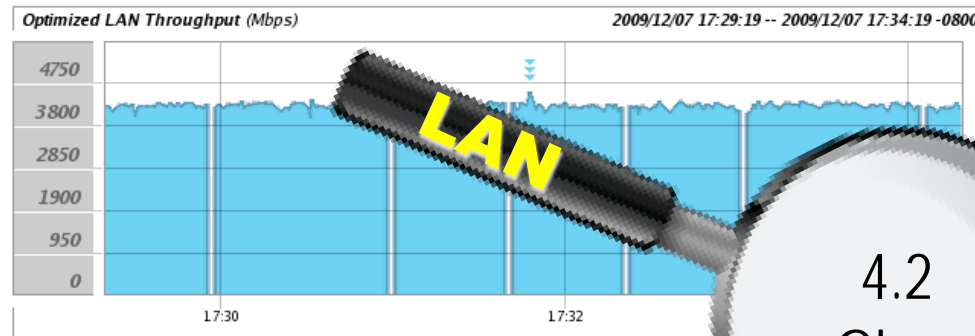
Backup/Archival of data to Cloud

- Large volumes of data moved to Cloud
 - ◆ Move potentially 10's or 100's of TB of data
 - ◆ Data may or may not already be deduplicated in array or other device

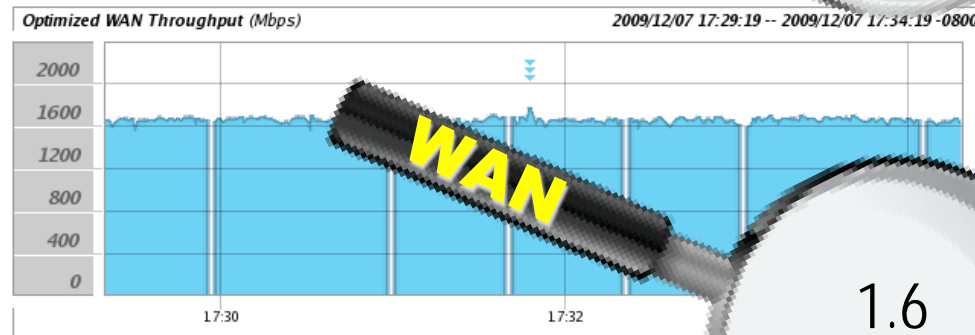


Disaster Recovery: Throughput achieved through WAN optimization

Reports > Optimization > Optimized Throughput ?



- Peak LAN Throughput At 17:31:48 on 2009/12/07
- 95th Percentile LAN Throughput
- Average LAN Throughput



Period: Last 5 Minutes
Application: All
Traffic: Bi-Directional

- Peak WAN Throughput At 17:31:48 on 2009/12/07
- 95th Percentile WAN Throughput
- Average WAN Throughput

Key WAN Optimization Requirements for Cloud Infrastructures

➤ Scaling

- ◆ What works for a private infrastructure may not work for the Cloud infrastructure
- ◆ Public Cloud providers must scale to support multiple enterprises

➤ Interoperability

- ◆ WAN optimization solutions from different vendors are not interoperable
- ◆ Standardize on a vendor solution used by Cloud providers or deploy your own through IaaS

➤ Performance and throughput

- ◆ Cloud infrastructures must support data center transfer throughputs

- Utility computing allows consolidation and sharing of IT resources
 - ◆ Similar to consolidation and sharing of power/other resources
- High-performance WAN infrastructure key to facilitating utility computing
 - ◆ WAN optimization increases capacity and performance of the WAN infrastructure
 - ◆ But WAN optimization must scale to meet Cloud provider infrastructure requirements

- Please send any questions or comments on this presentation to SNIA: trackcloudtechnologies@snia.org

**Many thanks to the following individuals
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