

How Intel and Riverbed* Are Enabling Communications Services Providers to Deliver Application Acceleration for Software as a Service at Branch Offices

Companies Work with CSPs to Develop Accelerated Cloud Connect Services to Support Enterprise Move to SaaS



Software as a service (SaaS) and cloud computing services are changing the face of branch office networking for large companies. Branch office networks used to comprise carrier IP networks put in place to provide workers in those offices with access to centralized corporate applications. Now those workers need access to both the enterprise data center and to cloud-based SaaS providers for cloud-hosted applications, requiring hybrid WANs that combine carrier networks and Internet access.



Hybrid WAN Emerges

WANs are starting to look more like this...

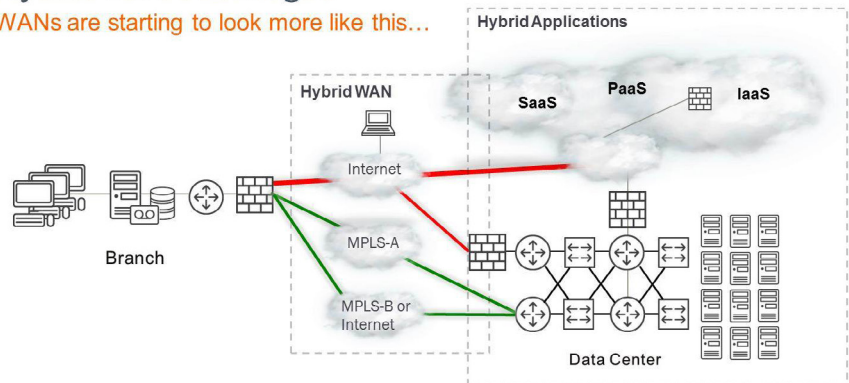


Figure 1: Advanced Hybrid WAN Services Are Emerging to Support SaaS

Carriers are launching new services to meet these needs, but branch offices still face the issue of optimizing application performance for all end users regardless of location and proximity to the data center and to cloud service providers.

The traditional approach in branch office networks has been to implement WAN optimization between branch locations and data centers to lower latency and make the most of WAN bandwidth. Cloud-based applications must have the same optimization if they are to succeed in meeting end user performance requirements.

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Many communications services providers (CSPs) are responding to this new trend with application and network acceleration services that offer access to the carrier's own cloud services, and also to selected other cloud partners such as Microsoft Office 365* or Amazon Web Services.*

Recently, these same carriers have been trialing and looking to roll out WAN optimized services that give their cloud access services the same fast performance as their traditional WAN services.

In this white paper, Riverbed Technology* and Intel will discuss the trends and technologies involved in cloud services and will discuss how BT* has developed its own accelerated cloud access service.

More Cloud Apps and Need for Connectivity at Branch Offices

Three trends point to the emerging adoption of cloud services and the impact of this trend on the branch office network.

- 72% of enterprises have at least one application running in the cloud, growing from 57% in 2012.¹ This demonstrates how many enterprises are seizing on the opportunity to leverage the cost-effective and fast deployment benefits of cloud services.
- 26% of enterprises have adopted hybrid public-private cloud models in 2015, up from 19% in 2014.¹ Private clouds are typically housed in enterprise data centers, showing that the traditional WAN will remain in place even as enterprises seek new carrier services to access public cloud services.
- Companies are leveraging six cloud services on average.² Multiple cloud services makes it challenging for IT departments to build their own cloud access services each with WAN optimization to provide the required application performance.

Adding to these trends, it's important to note that branch office networks are growing in importance to the typical large company. As companies grow through acquisition, they are adding the branch offices of the acquired companies to their networks. And they are finding that this geographic diversity is aiding in their ability to attract talented employees who do not want to relocate.

The Evolution of the WAN and Growth of WAN Optimization

Over the last decade, branch office WANs have evolved from point-to-point leased line services to circuit-switched frame relay services to today's IP-based switched networks. The bulk of today's networks are based on IP-based multiprotocol label switching (MPLS) services. Some branch offices make use of IPsec virtual private network (VPN) technology to leverage broadband Internet connections for branch access, but the uptake of these services has been limited due to a lack of reliable service level performance when compared to MPLS.

Meanwhile, data demands for the branch office have grown significantly while the cost of higher-speed MPLS connections have come down only nominally (especially compared to the steep decrease in the cost of public Internet services). This dynamic has made it financially beneficial for enterprises to get as much data throughput as possible from their WAN connections, and thus the rise of WAN optimization.

¹ IDC Cloud Computing Survey 2015 <http://www.idgenterprise.com/resource/research/2015-cloud-computing-study/>

² RightScale 2016 State of the Cloud Survey <http://www.rightscale.com/blog/cloud-industry-insights/cloud-computing-trends-2016-state-cloud-survey>

Led by Riverbed, the WAN optimization market has grown significantly since the start of the new millennium. A WAN optimization system is designed to improve application performance and comprises hardware appliances or virtual instances at both ends of a network connection to provide the following services and techniques to improve throughput:

- **Data de-duplication:** Eliminates redundant data from being transferred across the WAN, which reduces the overall amount of data that must be sent across a WAN and improves the throughput on file downloads, remote backups, replication, disaster recovery, and many other network transactions involving significant data transfer.
- **Application streamlining:** Reduce the chattiness of applications based on a number of different protocols, including CIFS, HTTP, HTTPS, MAPI, NFS, and SQL. These specific modules understand the chattiness of each protocol and work to keep the conversation on the LAN, where chattiness is not a factor and therefore creates no latency, before making transmissions over the WAN.
- **Traffic shaping:** Applies policies to prioritize traffic and control the data flow on an application basis to determine which data will be transmitted on the WAN.
- **TCP/IP optimization:** Leverages various techniques to make TCP a more efficient networking protocol. These techniques can include improving latency through window-size scaling, selective acknowledgements, layer 3 congestion control algorithms, and IP protocol spoofing. This can also include forward error correction that

reduces the need for retransmissions in error-prone and congested WAN links.

A two-ended appliance-based WAN optimization solution delivering these services can deliver LAN-like application response by boosting the WAN throughput performance significantly.

The Emergence of SD-WAN

Now that hybrid WANs are growing in importance, many enterprises are looking for ways to use broadband connections and the public Internet for branch office connectivity and software defined WAN (SD-WAN) is becoming a tool for them to do so.

According to Gartner,* SD-WAN is an emerging approach to network orchestration and management that combines a lightweight physical or virtual appliance for managing path control and secure connectivity over hybrid network topologies. This is an application-centric approach where network connections are managed via a central SD-WAN controller. SD-WAN replaces legacy device-based management that is implemented via command line interface (CLI).

There are the four key elements that define an SD-WAN solution:³

- **Replaces routers:** SD-WAN solutions provide a lightweight replacement for traditional WAN routers and are agnostic to WAN transport (that is, they support MPLS, Internet, LTE, etc.).
- **Application and business oriented:** SD-WAN solutions allow for load sharing of traffic across multiple WAN connections in an efficient and dynamic fashion that can be based on business and/or application policies.

- **Simplified management:** SD-WAN solutions dramatically simplify the complexity associated with management, configuration, and orchestration of WANs.
- **Secure and extensible:** SD-WAN solutions must provide secure VPNs and have the ability to integrate additional network services.

A typical SD-WAN should help improve efficiency in network link utilization, reduce management overhead, improve branch and application deployment agility, and enable cost avoidance from dedicated branch router appliances.

Riverbed has developed a market-leading solution⁴ for SD-WAN called SteelConnect. While SD-WAN solutions will play a major role in the delivery of cloud services, this paper will focus on traditional WAN optimization. Intel and Riverbed's collaboration in the SD-WAN market will be the subject of a future paper.

Trends in Branch Office Cloud Access

With enterprises depending on multiple cloud service providers, accessing those services from the branch office with good application performance can be a challenge. Without WAN optimization, a WAN service that requires Internet access to be routed through the company's data center will not deliver required levels of application performance. Reconfiguring branch office routers via a command line interface (CLI) to provide cloud access to multiple services is tedious and time-consuming for IT within a large and evolving network.

Instead, communications services providers (CSPs) today are delivering branch office cloud access services, in

³ Source: Gartner Technology Overview for SD-WAN, July 2015

⁴ Riverbed Again Named as a Leader in the 2016 Gartner Magic Quadrant for WAN Optimization – press release from May 2016.

<http://www.riverbed.com/press-releases/riverbed-technology-again-named-a-leader-in-the-2016-gartner-magic-quadrant-for-wan-optimization.html>

which they will provide consolidated access to multiple cloud providers, including their own cloud offerings as well as to other popular services such as Microsoft Office 365, Salesforce.com, or Amazon Web Services.*

These emerging services bring centralized management and access to otherwise separate and unconnected cloud services.

But even cloud services can't overcome geographic distances involved when branch workers from around the world access a SaaS vendor's cloud. Many cloud providers provide services from a single location near a company's main headquarters. This can mean extreme application latency issues for workers at other sites around the world.

Anytime a network is used for accessing applications, WAN optimization is essential for application performance over distance, and service providers are just now realizing this and debuting the first generation of cloud WAN optimization services.

Riverbed SteelHead* Adapts for Cloud Access

Just as it has led the WAN optimization industry since the early 2000s, Riverbed has been leading the emergence of WAN-optimized cloud services since 2012.

The company's SteelHead* WAN optimization technology is available in a number of platforms and is designed for enterprises and CSPs that need to deliver an amazing end-user application experience in traditional or hybrid WANs composed of MPLS, private VPN, and public Internet networks.

SteelHead has been adapted for cloud services with support for all of the major virtualization platforms such as VMware ESX, KVM, and Hyper-V. It also is supported in all the major public

cloud platforms such as Amazon Web Services and Microsoft Azure.* SteelHead for cloud environments include models that cater to performance optimization in all the three cloud service segments including IAAS, PAAS, and SAAS.

Through its decade of industry leadership,⁴ SteelHead has developed sophisticated optimization performance to WANs. For application users, it can provide:

- Faster file transfers
- Faster webpage download times
- Less bandwidth consumption
- Greater web server efficiency
- Carrier-grade scalability through an intelligent and scale-as-you-grow performance architecture
- IT control with quality of service (QoS), path selection, and secure transport features
- Increased visibility with end-user monitoring for all optimized traffic

on premises and optimized web and SaaS applications

- Dynamic selection of the best application path based on network availability
- Reduced latency with integrated video-ready web caching

The effect of this performance increase, in many cases, is to make the performance of data center or cloud hosted applications feel like they are local – that is, served from a server on the local LAN.

Riverbed has tested SteelHead SaaS with Microsoft Office 365⁵ to determine just how much download speeds could be improved. SteelHead SaaS is designed for public Internet access to SaaS services. The test involved downloading a 20.8 MB file with the optimized version transferring in 3.8 seconds, which is 33 times faster than a non-optimized connection. The tests also revealed a more than 97% reduction in network bandwidth used to download the same 20.8 MB file in subsequent downloads.



Figure 2: Performance Improvement from Use of SteelHead in SaaS application

⁵ Test conducted by Riverbed. The test used a WAN simulator to simulate a 1.5Mbps WAN link with 100ms RTT to Office 365. For more details, see "Accelerating Microsoft Office 365 with Riverbed SteelHead SAAS" (PDF download): http://www.riverbed.com/document/fpo/Steelhead_performance_brief_SaaS_Office365_AV081414.pdf

SteelHead can identify and differentiate among more than 1,300 on-premises or SaaS applications. With this ability, SteelHead can automatically create application groups that simplify policy based management and enforcement.

SteelHead encrypts traffic flowing between SteelHead physical appliances or between a SteelHead and a virtual instance for both MPLS and Internet links. SteelHead appliances have high-performance Intel S3500 solid-state drives that enable optimization of demanding protocols such as SSL/TLS. This is especially important as cloud-served applications increasingly depend on SSL to help secure data transfer. The SteelHead's advanced SSL/https optimization capabilities deliver significant performance advantages for these secure web applications.

SteelHead technology has been used in some of the largest branch office WANs in the world, and has developed management software that provides complete configuration and management from a single management console.

NFV and Service Chaining

To adapt the complete SteelHead feature set to the cloud service optimization opportunity, Riverbed began to adopt network functions virtualization (NFV) to allow CSPs to deploy a massively multi-tenant service with the need to rapidly turn service to specific customers on or off, or to increase throughput.

NFV replaces purpose-built network appliances with an application [called a virtual network function (VNF)] running on commercial Intel® architecture servers. NFV is transforming telecom infrastructure by enabling more efficient use of hardware, dramatically improving service flexibility and accelerating time to deployment.

In the case of a branch office cloud service, the service provider can spin up new instances of SteelHead on-site at the cloud service provider as it adds new customers. The new instances can be configured within hours to match the bandwidth and service parameters that the customer has ordered, and if that throughput changes, so can the SteelHead instance.

Intel® Technology and NFV Expertise

To assist with its transition to NFV-based services, Riverbed worked closely with Intel in order to implement several key technologies needed in order for its NFV systems to match the performance it offered in its SteelHead appliances.

The company joined the Intel® Network Builders NFV ecosystem as well as the Titanium Cloud ecosystem of Wind River, an Intel company. As part of the Titanium Cloud Ecosystem, Riverbed conducted validation and pre-integration of its SteelHead VNF on Wind River Titanium Server. This work further simplified the deployment of its solution by CSPs who use Titanium Server.

In addition, Riverbed is part of the Intel Network Builders ecosystem, a collaborative group of over 200 NFV industry leaders, service providers, start-ups, and other industry participants coming together to help CSPs adopt transformative NFV technology.

Intel works with Riverbed and other Intel Network Builders members to support the creation of end user solutions, leverage strategic partner engagements and pilots, and to invest in solution blueprints, labs, solution characterization, and benchmarking.

Riverbed and Intel also worked together on adapting SteelHead to run on Intel architecture servers based on either the

Intel® Xeon® processor E5 2600 v3 or the low-power Intel® Atom™ processor C2000 family.

BT Is First to Market with Cloud Connect Acceleration Service

BT has been a pioneer in cloud services with its BT Cloud Connect* service, a series of cloud access service built on BT's MPLS network, which spans more than 198 countries and territories and points of presence at major Internet peering and business hubs. This infrastructure enables the company to offer a full range of cloud access services:

- **Cloud Connect Data Centers:** Access to more than 250 data centers and co-location centers operated by a wide range of third-party data center operators and all connected by high-speed fiber-optic networks directly to the carrier neutral meeting points.
- **Cloud Connect Direct:** In addition to data centers, BT Cloud Connect provides high-speed connections directly to popular cloud-based infrastructure as a service (IaaS), platform as a service (PaaS), and SaaS providers such as Microsoft Office 365, Azure, Amazon Web Services, Salesforce, and the company's own BT Cloud Compute.*
- **BT Cloud Connect Internet Gateways:** These services let customers connect their WAN (BT IP Connect or MPLS IP VPN) to Internet Connect Global. This gateway eliminates a customer's need to carry Internet bound traffic across its network, and requires no additional on-premises equipment thanks to an embedded network firewall.

The BT Cloud Connect services embrace NFV and SDN with Intel architecture servers running VNFs at each of the data center connection points and the goal to transition customer premises equipment to NFV as it makes sense.

As part of Cloud Connect Direct, BT is working with Riverbed to offer Cloud Connect Acceleration, a WAN optimization service for Cloud Connect Direct to boost the throughput to SaaS applications like Office365.

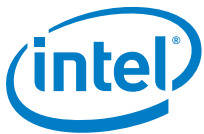
For many years, BT has offered a managed SteelHead WAN optimization service to its customers to help them get better WAN performance on branch office networks. The successful service has customers in 82 countries. With Cloud Connect Acceleration, these companies can add cloud access services and leverage their existing SteelHead appliances to provide WAN optimized hybrid WAN-cloud services.

For companies that don't currently have BT's managed SteelHead WAN optimization service, the CSP can install the service as a VNF on an Intel processor-powered server at the customer premises, which provides the freedom to add additional services or expand the SteelHead service as customer requirements change.

In tests conducted by BT, Cloud Connect Acceleration demonstrated a 92% reduction in data passed on the WAN, and 88% reduction in file download time when compared with a non-accelerated network connection. This makes Office365 email as responsive as if it were hosted on-site.⁶

Conclusion

With all of the technology changes impacting users in branch offices, one thing is constant – the need for highly responsive applications. CSPs have the ability to build hybrid WANs that help these customers to fully embrace cloud computing and SaaS as well as their existing private cloud implementations, while optimizing WAN performance across the entire network infrastructure. Riverbed and Intel are partnering to help CSPs deploy these services in a flexible, scalable, and cost-effective manner.



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⁶ Test conducted by BT. Configurations: the server for these tests used a quad-core Intel Atom processor C2000 with 32GB RAM and Intel S3500 solid state drives. The VNFs running on the server included: A Brocade* Router using two vCPUs, a Check Point* Firewall using 2 vCPUs and a Riverbed SteelHead using 2 vCPUs, each with 2G RAM.