CONVERGENCE FOR THE BRANCH OFFICE

Transforming Resiliency and TCO with Riverbed SteelFusion

APRIL 2014

The branch office has long been a critical dilemma for the IT organization. Branch offices for many organizations are a critical point of productivity and revenue generation, yet the branch has always come with a tremendous amount of operational overhead and risk. Worse yet, challenges are often exacerbated because the branch office too often looks like a carryover of outdated IT practices.

More often than not, the branch office is still a highly manual, human-effort-driven administration exercise. Physical equipment too often sits at a remote physical office, and requires significant human management and intervention for activities like data protection and recovery, or replacement of failed hardware. Given the remote nature of the branch office, such human intervention often comes with significant overhead in the form of telephone support, less than efficient over-the-wire system configuration, equipment build and ship processes, or even significant travel to remote locations. Moreover, in an attempt to avoid issues, the branch office is often over-provisioned with equipment in order to reduce the impact of outages, or is designed in such a way as to be too dependent on across the Wide Area Network (WAN) services that impair user productivity and simply exchange the risk of equipment failure for the risk of WAN outage. But while such practices come with significant operational cost, there's a subtler cost lurking below the surface – any branch office outage is enmeshed in data consequences. Data protection may be a slower process for the branch office, subjecting the branch to greater risks with equipment failure or disaster, and restoring branch office data and productivity after a disaster can be a long slow process compared to the capabilities of the modern datacenter.

When branch offices are a key part of a business, these practices that are routinely accepted as the standard can make the branch office one of the costliest and riskiest areas of the IT infrastructure. Worse yet, for many enterprises, the branch office has only increased its importance over time, and may generate more revenue and require more responsive and available IT systems than ever before. The branch office clearly requires better agility and efficiency than it receives today.

Riverbed Technologies has long proven their mettle in helping enterprises optimize and better enable connectivity and data sharing for distributed work teams. Over the past decade, Riverbed has come to dominate the market for WAN optimization technologies that compress data and optimize the connection between branch or remote offices and the datacenter. But Riverbed rose to this position of dominance because their SteelHead appliances do far more than just optimize a connection – Riverbed's dominance of this market sprung from deep collaboration and interaction optimization of CIFS/SMB and other protocols by way of intelligent interception and caching of the right data to make the remote experience feel like a local experience. Moreover, Riverbed SteelHead could do this while making that remote connection effectively stateless, and eliminating the need to protect or manage data in the branch office.

Almost two years ago, Riverbed announced a continuing evolution of their "location independent computing" focus with the introduction of their SteelFusion family of solutions. The vision behind SteelFusion was a focus on delivering far more performance and capability in branch offices, while

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doing away with the complexity of multiple component parts and scattered data. SteelFusion does this by transforming the branch office into a stateless "projection" of data, applications, and VMs stored in the datacenter. Moreover, SteelFusion does this with a converged solution that combines storage, networking, and compute all in one device – the first comprehensive converged infrastructure solution purpose-built for the branch. This converged offering though, is built on branch office "statelessness" that, as we'll review, transparently stores data in the datacenter, and allows the business to configure, change, protect, and manage the branch office with enterprise tools, while eradicating the risk associated with traditional branch office infrastructure.

SteelFusion today does this by virtualizing VMware ESXi VMs on a stateless appliance that in essence "projects" data from the datacenter to a remote location, while maintaining localized speed of access and resilient availability that can tolerate even severe network outages. Three innovative technology components that make up Riverbed's SteelFusion allow it to host virtual machines that access their primary data via the datacenter, from where it is cached on the SteelFusion appliance while maintaining a highly efficient but near synchronous connection back to the datacenter storage. In turn, SteelFusion makes it possible to run many local applications in a rich, complex branch office while requiring no other servers or devices. Riverbed promises that SteelFusion's architecture can tolerate outages, but synchronize data so effectively that it will operate as a stateless appliance, enabling branch data to be completely protected by datacenter synchronization and backup, with more up to date protection and faster recovery regardless of whether there's a loss of a single file, or the loss of an entire system. In short, this is a promise to comprehensively revolutionize the practice of branch office IT.

In January of 2014, Taneja Group took a deeper look at what Riverbed is doing with SteelFusion. While we've provided other written assessments on the use case and value of Riverbed SteelFusion, we also wanted to take a hands-on look at how the technology works, and whether in real world use it really delivers management effort reductions, availability improvements, and increased IT capabilities along with consequent improvements in the risks around branch office IT. To do this, we turned to a hands-on lab exercise – what we call a Technology Validation.

What did we find? We found that Riverbed SteelFusion does indeed deliver a transformation of branch office management and capabilities, by fundamentally reducing complexity, injecting a number of powerful capabilities (such as enterprise snapshots and access to all data, copies, and tools in the enterprise) and making the branch office resilient, constantly protected, and instantly recoverable. While the change in capabilities is significant, this also translates into a significant impact on time and effort, and we captured a number of metrics throughout our hands-on look at SteelFusion. For the details, we turn to the full report.

Our Findings: Validating Riverbed SteelFusion	
Time required to deploy a complete branch office and applications	10 minutes
Improvement in time required to recover from a branch office disaster versus traditional hardware	96x+ (minutes versus days)
Amount of data loss in a branch office disaster	Seconds (versus hours or days with traditional hardware)
Time required to boot a new branch office	2 minutes, 7 seconds

Table 1: Sample data points from our testing with Riverbed SteelFusion.

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FOCUS ON RIVERBED STEELFUSION

Building on Riverbed's rich distributed enterprise network and application optimization pedigree, SteelFusion has paired SteelHead optimization technology with a technology that Riverbed calls BlockStream, and packaged it into a single appliance that also runs VMware ESXi and can host branch office VMs. BlockStream connects to block storage in the datacenter, and makes it possible for the ESXi hypervisor to access and operate many VMs from datacenter storage without requiring any local storage in the branch office. Moreover, the embedded WAN optimization technology can also optimize all other connectivity between a branch office and the datacenter, making it possible to operate a truly stateless and infrastructure free branch office. Riverbed SteelFusion appliances provide from 10GB to 64GB of vRAM (varies by model) to an ESXi host, and two Riverbed SteelFusion appliances can operate in tandem as a VMware HA cluster, serving up twice as much vRAM and allowing large branch offices to run almost any complex assortment of servers and applications across many VMs.

Figure 1: A Riverbed SteelFusion 1260

SteelFusion deployment consists of two components, the SteelFusion appliance called the SteelFusion Edge, and a datacenter solution called SteelFusion Core that runs on a virtual or physical Windows Server (see Figure 3, next page, for a diagram of SteelFusion Edge and Core components in our test environment). SteelFusion Core manages SteelFusion Edge connections to datacenter iSCSI or Fibre Channel volumes, and coordinates the execution of storage tasks (such as snapshots) when the SteelFusion Edge requests such operations. SteelFusion Edge connects to storage volumes by requesting the connection from SteelFusion Core, and the SteelFusion Edge then connects to the datacenter storage via SteelFusion Core and SteelHead systems in the datacenter; thereby optimizing the storage connections and intelligently pre-fetching data with Riverbed's BlockStream technology.

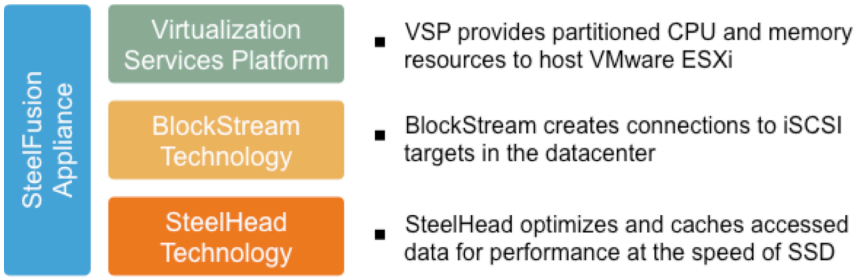

Figure 2: Three different technologies are combined in a Riverbed SteelFusion appliance to deliver local branch office compute with a single stateless appliance connected to storage in the datacenter.

This combination of technology turns the branch office into a stateless environment, where any branch office application can run from a single SteelFusion appliance, and where all data is transparently written, read, and cached from the enterprise datacenter. In addition to the obvious benefits of branch office simplification and improved IT provisioning capabilities, a number of other potential benefits stem from this:

- Elimination of branch backup (which can now be performed in the datacenter).
- A catastrophic failure at the branch can be rapidly recovered from, with no loss of data.

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- Data management takes place in the datacenter, where a full range of enterprise storage tools for enterprise backup, disaster protection, compliance, and more are available.

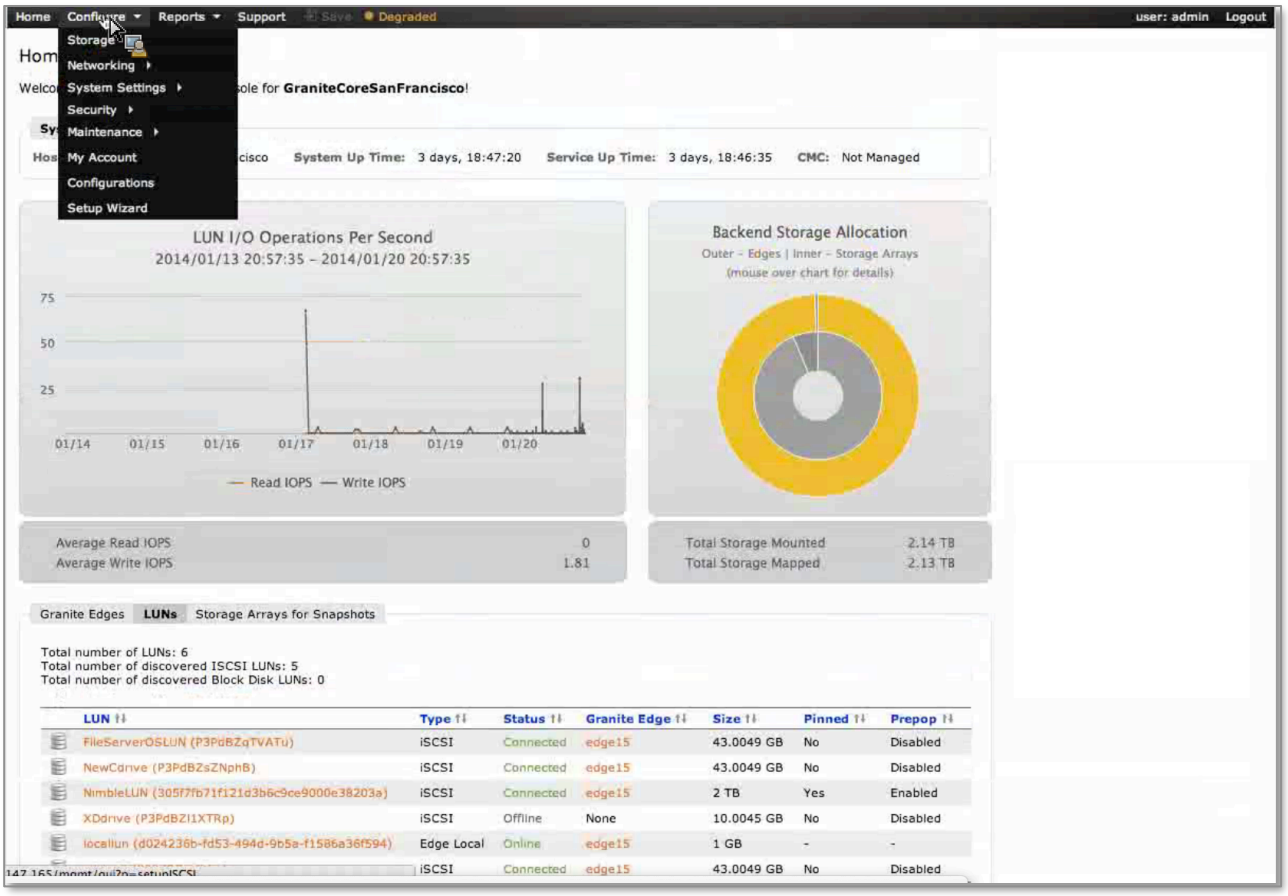

Figure 3: Configuring Riverbed SteelFusion Core during our testing – this screen is the SteelFusion Core Web GUI dashboard showing LUNs that are configured for access by SteelFusion Edge appliances.

VALIDATING RIVERBED STEELFUSION

We turned to Riverbed SteelFusion testing to examine these and other claims that Riverbed says stand to reinvent how the branch office is deployed and managed. As we looked at SteelFusion capabilities, we summed them up in three questions that we intended to seek answers to in our testing:

- How does SteelFusion simplify the branch office, and simultaneously inject it with additional compute capabilities?
- How does SteelFusion change data protection, resiliency, and governance for the branch office?
- How does SteelFusion make the branch office more flexible and efficient than it has been in the past?

Moreover, throughout our testing, we kept an eye on how Riverbed SteelFusion could fundamentally alter the time and effort associated with branch office management compare to the traditional practices and technologies. As we encountered these data points, we've summarized them in this test report.

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WHAT WE TESTED

To test SteelFusion, we used a simulated WAN environment provided by Riverbed in their San Francisco datacenter. This environment consisted of an Apposite WAN emulator configured to simulate a T-1 style 1.5Mbps, 100ms latency WAN link. In our simulated datacenter, we utilized a NetApp FAS2050 as our storage system, and a SteelHead CX WAN optimization gateway. We then ran a SteelFusion component – the SteelFusion Core – as a VM on an ESXi host in the datacenter.

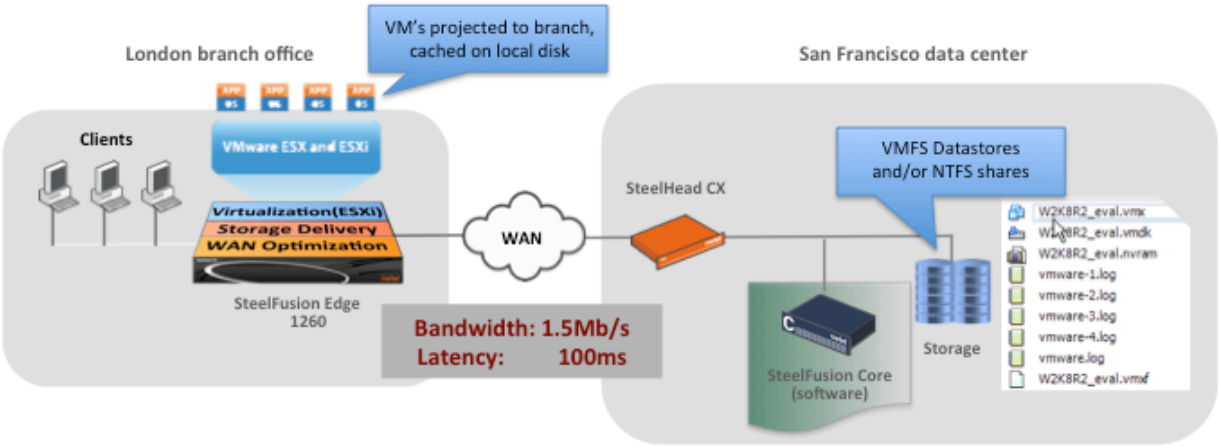

Figure 4: Riverbed SteelFusion consists of two components – a SteelFusion Edge appliance in the branch office, and a SteelFusion Core VM that managed connections to our storage infrastructure in the datacenter. These two components are connected across the WAN, through a SteelHead CX in the datacenter.

At the far side of our Apposite WAN link, we deployed a SteelFusion Edge 1260-VH to serve as our converged infrastructure for a branch office. This SteelFusion Edge appliance is a high capacity unit, with a blend of SSD and rotational disk storage (just over 4TB raw capacity), and 10GB of memory available for an ESXi host.

In our environment we used a variety of VMs, but for many tests we used a basic Windows 2008 R2 server VM with IOMeter installed. This VM's storage capacity – which will be relevant when we discuss the speed and efficiency of SteelFusion BlockStream technology – was approximately 12GB of a 40GB fat provisioned disk.

SIMPLIFIED CAPABILITY FOR THE BRANCH OFFICE

We started our exercise with a deployment of SteelFusion technology. An initial configuration of SteelFusion includes two exercises. First, SteelFusion Core is deployed from an OVF as a VM in the datacenter, together with a SteelHead WAN optimization appliance. As will be the case with many customers, we utilized an existing SteelHead appliance at the datacenter's network edge, and configuring the SteelFusion Core software to work with the SteelHead was a matter of a single initial setup screen. Following this, we provisioned an iSCSI LUN to the SteelFusion Core, which in turn manages the iSCSI storage access for SteelFusion Edge appliances.

Following the SteelFusion Core setup, we turned our attention to powering on and configuring the SteelFusion Edge appliance at our simulated branch office. We did this by accessing a web setup GUI. This process required the population of data on 3 screens of a setup wizard, and then this wizard triggered and prepopulated the VMware vSphere Add Host Wizard to configure our built-in ESXi host.

Although we could have used a vCenter Server deployed in the branch for management of our VMs, we utilized a centralized vCenter Server in the datacenter instead as we believe this configuration will be more typical of SteelFusion. This provides consolidated visibility and a single pane of

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management across all branch offices and this gives virtualization at the branch office tremendous value.

Rapid Deployment

As we went through this process, we kept an eye on a stopwatch to see how much time and effort setting up Riverbed SteelFusion would require. But at this point in our deployment process, a key capability of SteelFusion became clearly pronounced, and had a substantial impact on our measured deployment times.

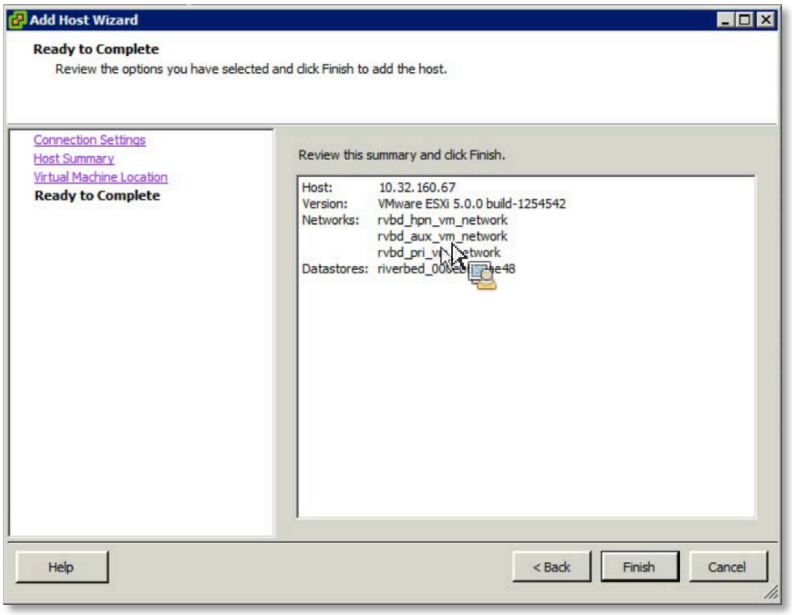

Figure 5: After an initial SteelFusion setup wizard is completed, SteelFusion automates the launch and population of VMware's vSphere Add Host Wizard for the configuration of the ESXi host.

Our expectation was that we would deploy a VM at the branch office, using a typical install approach. But we realized that with our shared storage infrastructure, and existing master copies of pre-configured VMs stored on our NetApp array, we could simply snapshot a master volume that already contained a Windows Server 2008 R2 installation, and connect that volume to our SteelFusion appliance. We did this, and almost instantaneously (within a matter of seconds) had a Windows 2008 R2 server ready to boot in our simulated branch office. *SteelFusion has the ability to extend all of a businesses datacenter processes and resources to the branch office.* This radically reduced our deployment time for our branch office, allowing us to completely deploy our branch office in less than 10 minutes (we measured 8 minutes and 7 seconds, but have rounded up to 10 minutes to account for a normal administrator's needing to reference configuration data and/or multi-task).

Key Takeaway

Just as important as our rapid deployment time, our boot volume remained thin provisioned and deduplicated using our NetApp FAS2050 storage system in the datacenter. This stands to deliver better storage efficiency than typical branch office deployments, as traditional deployments in the branch have utilized less efficient direct-attached storage, and each branch office creates another duplicate copy of data. Moreover, this consolidated data efficiency, as we'll discuss, also has tremendous implications for data protection.

Performance at the Speed of Local Data

Following our deployment of the branch office SteelFusion Edge, we then turned to evaluating boot time and interaction with the branch office. Since SteelFusion Edge gained its deployment simplification and speed advantages by avoiding the remote install of our application server, we wanted to assess whether there would now be a data movement and latency penalty when we fired up this application.

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We timed an initial boot of this Windows 2008R2 Server VM from power on executed through the vCenter management interface. The time to boot, as determined by vCenter was 2 minutes and 9 seconds, and after we hit CTRL-ALT-DEL to login, the total time to the login screen was 2 minutes and 32 seconds. Considering that all of this data was transferred across a 1.5mbps T-1 style WAN link, this is a fairly phenomenal boot time. Part of the secret to this optimized boot is a more subtle technology that operates behind Riverbed's BlockStream. BlockStream uses very efficient communication between SteelFusion Edge and the SteelFusion Core in the datacenter to both identify block data on-demand and predictively cache surrounding and associated data so the remote SteelFusion can deliver IO with very low delay. But the assessment doesn't stop here, as part of the value proposition of SteelFusion Edge is the use of local SSD/HDD as a branch office resident stateless cache that can perform with local storage speed; after the first boot, the system should operate even faster.

Consequently, we performed a second boot, and measured boot speed that was slightly better than twice our original results (see Table 2). This suggests the additional delay for the remote boot portion of this exercise was approximately 1 minute.

Deploying a Branch Office with Riverbed SteelFusion	
Deployment	10 minutes
First Boot from WAN	2 minutes, 09 seconds 2 minutes, 32 seconds to login screen
Next Boot	57 seconds 1 minute, 13 seconds to login screen

Table 2: Boot speed for our branch office VM that was stored on an FAS2050 in our datacenter on the far side of a simulated T-1 line.

During this time, the Apposite WAN emulator indicated the SteelFusion Edge read approximately 3GB of data, and wrote approximately 560MB. There is no truly accurate way to figure the deduplication and effective speed over this period of time since the time spent booting versus time spent waiting on data to arrive cannot be clearly separated. But if we examine the read data and assume that the entire time of the first boot was used to transfer data (suggesting that SteelFusion's predictive transfer is very effective) then this suggests that the Riverbed SteelFusion technology transferred this boot data 127X faster than the raw speed of the 1.5mbps WAN link would have allowed non-deduped, uncompressible data to transfer.

In a nutshell, SteelFusion allowed us to use datacenter storage and VM images for radically reduced branch office deployment time, and then delivered storage access that performed just as well as local storage, and makes the remote connection to datacenter storage nearly transparent. As a footnote, we evaluated what this boot would look like without optimization, and the required time was approximately 23 minutes. Clearly, Riverbed's WAN optimization expertise and BlockStream technology are serious enablers for their SteelFusion solution.

The bottom line though is that SteelFusion stands to transform branch office deployment. Traditional branch office practices have involved the purchase, configuration, setup, repacking, and shipping of multiply pieces of physical hardware, including servers, network gear, storage, and backup, along with additional time for branch office employees to setup and cable all of these separate components (or travel time for dedicated staff). As represented in Table 3, we've used very conservative numbers

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to indicate what the minimal deployment time and effort might be for an incredibly simple branch office. Based on our informal and on-going assessment across mid-sized enterprise customers, this number is highly conservative, and branch office configuration efforts often are far more complex. But using this conservative baseline, we estimate that Riverbed's SteelFusion yields at least a 30X reduction of time and effort in branch office configuration processes.

Comparison of time and effort to configure a branch office		
	Traditional Hardware	Riverbed SteelFusion
Traditional server build time (hardware and imaging)	3 hours	0
Storage configuration and setup	1 hour	10 minutes
Backup hardware and software configuration	1 hour	0
Total	**5 hours of labor***	**10 minutes**
Reduction		**30X**

Table 3: Deploying a VM utilized a clone of an existing "golden" master image of a Windows 2008R2 virtual server – a resource that is commonly available in the datacenter. Moreover, this server remained stored on datacenter storage where it was protected by existing backup. Compared to traditional physical hardware, this saves time in hardware setup, imaging, and configuration. We have not included in this table the time and effort that many organizations require to pack and ship equipment to a remote office after configuration, whereas the stateless SteelFusion Edge can be direct shipped to the branch without requiring additional configuration ahead of time. *Note, actual time may be significantly longer due to planning and coordination between multi-disciplinary teams.

Just a Bit Deeper – A Closer Look At Transferring Data and IO Performance

Examining the effectiveness of data transfer and caching is no easy task, since different data types behave in different ways. Nonetheless, we wanted to examine in closer detail what the typical data transfer and IO performance pattern is for typical VM images. To do this, we used an IOMeter file constructed from VMDK data – basically, we concatenated application drive VMDKs from various server VMs into a large VMDK, and then we trimmed this file down to a single 1GB IOMeter test file. Then we ran IOMeter against this test file from a VM on the SteelFusion Edge appliance, using a 50/50 read/write mix of 100% random 4KB IO.

What this showed was how effectively data was initially accessed, and then how it was locally cached and improved in performance over time. This random IO was a much more challenging mix, and utilized less predictable, prefetchable or dedupeable data than our boot volume. SteelFusion nonetheless rapidly accelerated this IO, delivering local performance approximately 26X faster than it would have taken to transfer this data onto local disk without optimization.

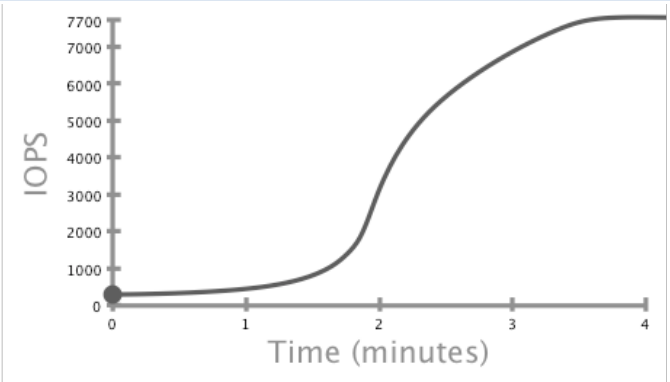

Figure: IO testing against a 1GB file of VM data began at 300 IOPS, and accelerated to 7600 IOPS at approximately 3 ½ minutes.

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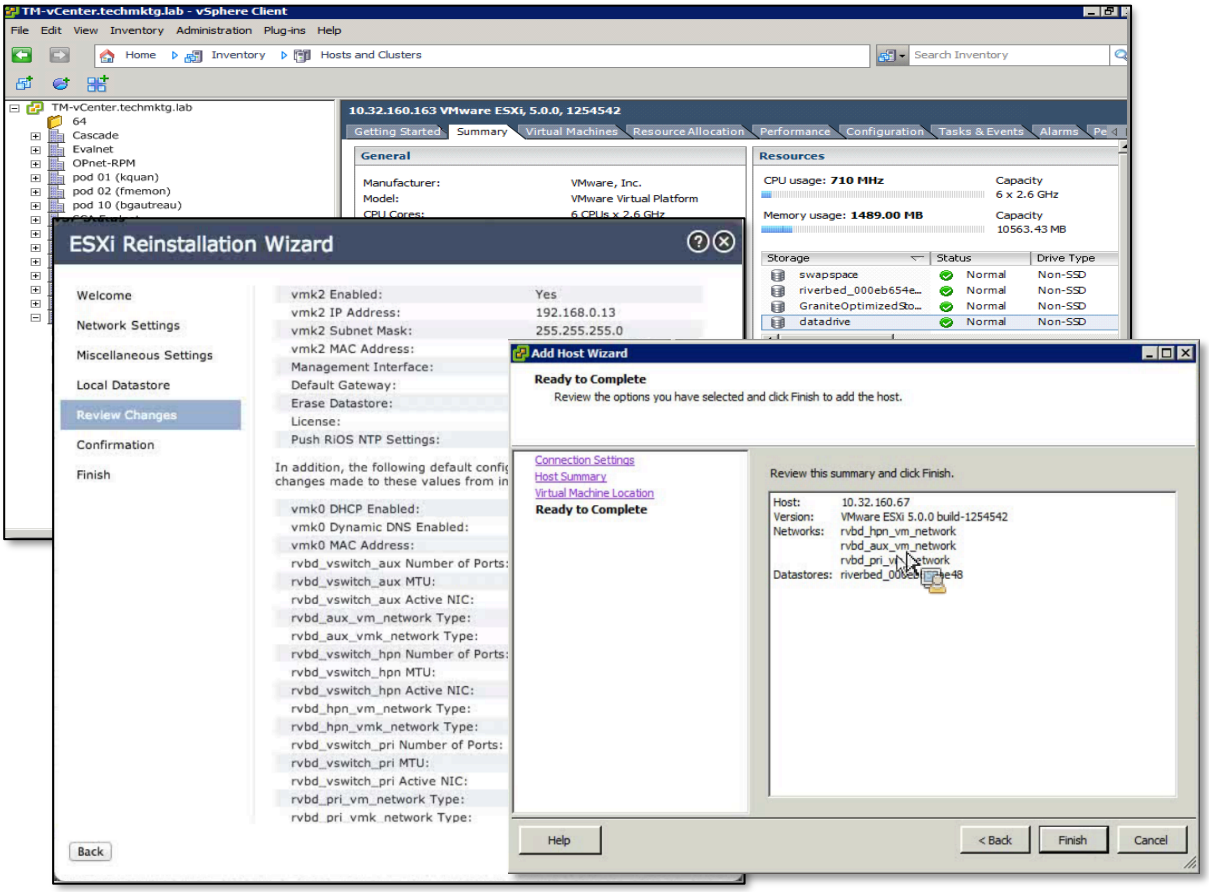

Figure 6: VMware host details showing the 6 CPU cores, 10GB of memory, and a "projected" SteelFusion data store alongside local datastores.

SUPERIOR GOVERNANCE, PROTECTION, AND RESILIENCY (4 PAGES)

In addition to enhancing capability, it became evident during testing that SteelFusion also stands to significantly transform branch office protection across multiple dimensions. First, as we've pointed out SteelFusion can wrap branch office data with the full capabilities of datacenter storage. This stands to help the business better manage distributed data by centralizing information for search and eDiscovery, enabling datacenter deduplication technologies to yield maximum efficiency, and applying storage system capabilities like snapshots to the branch office. Second, SteelFusion integrations with datacenter storage enable synchronized and highly granular snapshot execution that protects fully consistent branch office servers, and managing this protected data on the datacenter storage system enables the business to more rapidly and effectively recover data at remote locations. Third, Riverbed SteelFusion's architecture teams were attentive to resiliency well beyond just protecting data, and SteelFusion brings to bear a couple of architectural elements that allow it to tolerate WAN link irregularities or outages, as well as provide high levels of fault tolerance for more critical branch office environments. Finally, when a disaster does strike, SteelFusion's design as a stateless extension of the datacenter means that a SteelFusion appliance can be easily replaced and recovered with no data loss, making branch office recovery faster and more efficient than ever before.

BEYOND CONSOLIDATION – ENHANCED BRANCH PROTECTION

While we've discussed the datacenter consolidation benefits of efficiency technologies such as deduplication and protection technologies like snapshots, SteelFusion moves beyond simply

RPO and RTO

Backup practitioners use two acronyms to identify the key metrics associated with backup and recovery operations – Recovery Point Objective (RPO) and Recovery Time Objective (RTO).

Recovery Point Objective is the point in time to which data can be recovered. For example, if a backup executes every 15 minutes, a data loss could occur right before the next backup – at 14 minutes and 59 seconds – losing all of the data since the last backup. In this case, the Recovery Point Objective would be 14 minutes and 59 seconds.

Recovery Time Objective is the amount of time it takes to restore data and return to normal operations with the data. For example, when a server is lost in a traditional branch office, it may require several hours to obtain a tape from an offsite vault (too often a branch manager's house), and a couple of hours for administrators to work with branch office personnel to load boot media and complete a bare metal recovery of the server.

consolidating data. SteelFusion also tightly integrates with datacenter storage systems to orchestrate data synchronization and allow application consistent snapshots to be taken in the datacenter. SteelFusion does this in typical virtualization protection fashion – SteelFusion first quiesces the VM using VMware APIs for Data Protection or a technology like Microsoft Volume Copy Shadow Services (VSS). SteelFusion then marks this data, and it is synchronized with the datacenter array. Once this data is fully synchronized, a snapshot is executed in the datacenter, and optionally, SteelFusion can orchestrate the mounting of this snapshot to a proxy server for datacenter backup by VMware VDP or other backup solutions. Riverbed claims that their BlockStream technology can perform this synchronization so rapidly that snapshots can be used with great frequency to enhance branch office RPOs (see sidebar), and allows scheduling down to 1 hour intervals. We put just such a policy in place on our test VM, and other than the quiesce period for snapshots, we saw no alteration in on-going performance (even while benchmarking).

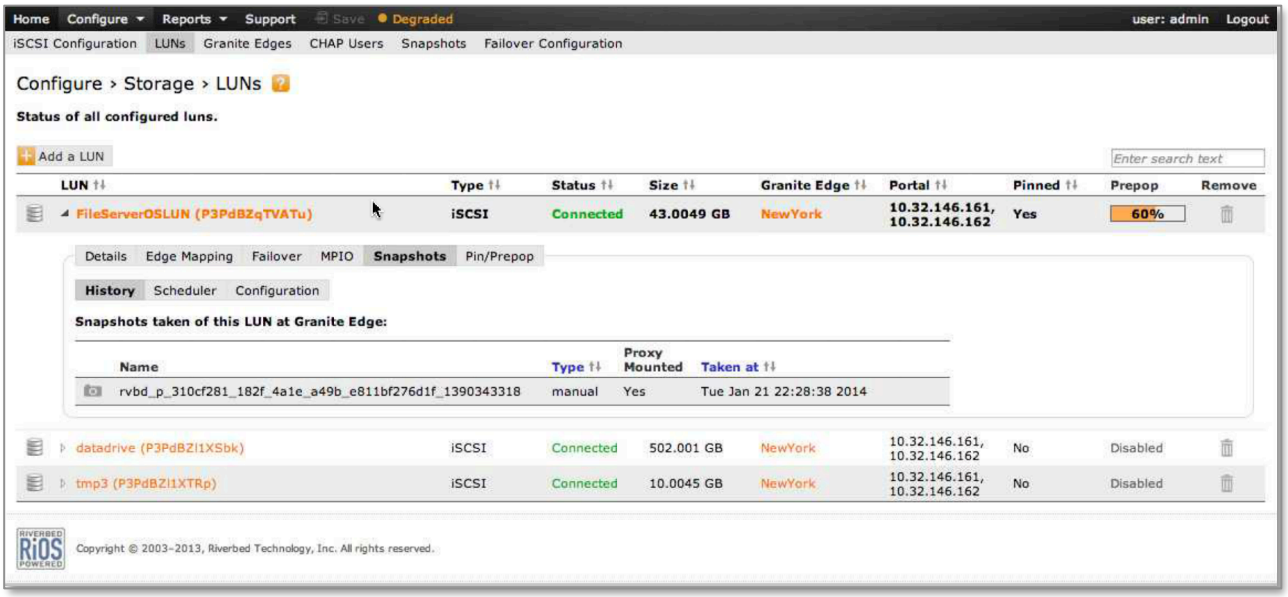

Figure 7: Looking at snapshot history for our SteelFusion Edge appliance. From this screen, snapshots can be configured, executed and scheduled.

To evaluate how effectively this worked over our remote branch office link, we populated our branch office with a non-dedupeable set of 10 large PNG images, and executed a snapshot. In another

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exercise, we deleted this data at the branch and then re-provisioned a snapshot of the original volume that contained the original data in order to recover these files. The recovery operation took less than 5 minutes, and data could be immediately browsed and transferred to the original volume thereafter. Moreover, since this data still matched original data patterns that were recently accessed, we saw this non-dedupeable data still receive the benefits of WAN optimization and transfer much more rapidly than expected.

THE HIGHLY AVAILABLE STATELESS BRANCH OFFICE

Just as importantly though, our testing confirmed that Riverbed SteelFusion delivers all of this functionality while elevating branch office resiliency. Not only is datacenter protection and data management improved, but the SteelFusion appliance can also operate in a disconnected mode – useful in case the WAN link fails – and can further enhance availability by leveraging vSphere HA for truly critical branch offices.

First, Riverbed delivers disconnected operations with two approaches. For highly sensitive workloads, customers can choose to "pin" a workload to local disk. This doesn't put a stop to synchronization with the datacenter, but rather ensures that a copy of all data blocks for that workload are resident on the branch office SteelFusion Edge. In turn, any data an application could possibly need is available even when a WAN link is down, but that data is still synchronized and protected on datacenter storage when connectivity is available. The downside is that the pinned volume takes up additional space on the SteelFusion Edge appliance. But as a second and more typical approach to disconnected operation, Riverbed also effectively caches sufficient local data to tolerate most WAN outages without the unnecessary step of "pinning" a storage volume. For our hands-on experience, see the sidebar Disconnected Operation.

Disconnected Operation – The Highly Available Branch Office

While we tested SteelFusion's pinned volumes and found no surprises, we thought it would be more interesting to also test how well SteelFusion faired during a WAN link outage when a storage volume was not pinned. What we found pleasantly surprised us. We started with our Windows 2008 R2 VM that we had already booted on our SteelFusion Edge and from which we had also run IOMeter. We also used Internet Explorer during the course of initial testing. With the VM powered off, we shutdown our WAN link, and attempted to boot the VM. The VM successfully booted and allowed us to run in and start both IOMeter and Internet Explorer. We could not start other programs (not even the calculator) that we had not run before, but we were able to start programs that we had previously run. In our view, this is likely to mean that regularly running applications will be able to operate uninterrupted during WAN link outages even if they are not running from a "pinned" volume.

Moving beyond disconnected operations though, SteelFusion also allows organizations to architect for increased local resiliency – two SteelFusion Edge appliances can be configured as a cluster, running vSphere HA at the hypervisor level, and mirroring the datastore between both SteelFusion Edge appliances. In the case of a failure, the alternate appliance assumes control of all iSCSI sessions to the datacenter, and vSphere restarts any workloads that were running on the failed appliance. Note, similar functionality is also available for the SteelFusion Core running in the datacenter. We tested setup, use, and failure in this HA configuration, and found setup to be simple and straightforward. We completed setup in approximately 10 minutes, with SteelFusion automating all of the configuration for the second ESXi installation and setup of vSphere HA, using a wizard very similar to the initial setup wizard.

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WHEN DISASTER STRIKES – THE SPEED OF INSTANT RECOVERY

Finally, after evaluating all of these data protection and resiliency features, we turned to examining one other tremendous benefit of SteelFusion – when disaster does strike, the stateless SteelFusion Edge appliance makes branch office recovery as easy at it could possibly be. Since SteelFusion Edge appliances are completely stateless, they can be replaced and returned to the last running configuration in a very straightforward manner, and this should drastically simplify and speed up recovery exercises and improve branch office recovery time objectives.

To evaluate this functionality in our hands-on exercise, we simulated the catastrophic failure of our Riverbed SteelFusion Edge by powering it off. Since we had previously configured automated snapshots to take place every 15 minutes, we took no further action to prepare for this power off event.

Following this failure, we used an additional available Riverbed SteelFusion appliance to simulate a hardware replacement, reconfiguration, and recovery exercise. We started by running the initial web configuration wizard once again, and entering appropriate IP addresses, etc.. (for even higher speed of recovery, this setup process is fully scriptable). Following that initial configuration wizard, we then manually adjusted our ESXi host settings to match those of our prior SteelFusion Edge, and this took some additional time versus a new setup of a SteelFusion Edge. We then reconnected the SteelFusion Edge to our SteelFusion Core, and "rescanned" for storage devices in the VMware vCenter GUI. The data store was immediately detected, mounted, and browseable for our recovery. Finally, we booted our VM, and measured total recovery time as approximately 15 minutes.

Recovering a Riverbed SteelFusion Appliance	
Time to run initial setup wizard on SteelFusion Edge	6:32
Time to boot ESXi and rebuild configuration	7:30
Time to boot VMs	2 to 3 minutes depending on configuration

Table 4: The total time required to recover our SteelFusion Edge installation on a new SteelFusion Edge appliance.

Since Riverbed offers customers a rapid support program that guarantees device replacement within 4 hours in most locations, this means that SteelFusion makes it quite likely that any branch office can be fully recovered from a catastrophe – even to an entirely new location – within 4 hours. Moreover, for even more rapid recovery, all of the SteelFusion Edge workloads could be immediately recovered to any available ESXi host in the datacenter, allowing the branch to immediately access these recovered services across the WAN. When a SteelFusion Edge is once again available in the branch office, the storage volumes behind the VMs can be projected to the branch once again. This is a tremendous improvement over traditional recovery capabilities, and changes what could be multiple day outages into multiple hour outages. As indicated below, even for enterprises with significantly advanced branch office capabilities, we believe this recovery time marks a 96X improvement in typical recovery times. Given the increasing criticality of branch office operations, we believe this transformation has the potential to have significant cost impact.

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Typical Traditional Protection versus Riverbed SteelFusion		
	Traditional Hardware	**Riverbed SteelFusion**
Better Recovery Points		
Frequency of Data Protection	Nightly (24 hours)	Hourly (typical, but flexible)
Time Required for Backup	Hours	None
Potential Data loss	**24 hours+**	**1 hour**
Advantage		**24X**
Better Recovery Times		
Locate Data	Hours	Minutes
Obtain Tape/Copy	Hours	Minutes
Restore Data	12 – 18 Hours	Instant
Time Required for Recovery	**24 Hours**	**Minutes (15)**
Advantage		**96X**

Table 5: Our testing suggests Riverbed SteelFusion may reduce the recovery time for branch offices experiencing a complete failure by 96X or more. Note, our table above has factored in only the time required for data retrieval and recovery, but does not factor in any possible requirements for pre-loading and shipping of systems from company datacenters, which is a frequent practice.

TANEJA GROUP OPINION

In this Technology Validation, we've focused on a set of disruptive changes that Riverbed SteelFusion stands to bring to the branch office by changing the way that IT is architected, delivered, and managed. Those changes include a radical reduction in the complexity of provisioning the branch and a significant leap forward in protection, resiliency and availability for the branch. We've articulated and put a measurement framework on these impacts. More subtly, SteelFusion looks poised to have just as big of an impact on on-going management.

Riverbed has created a unique and powerful offering for branch offices by introducing a synchronized projection of datacenter storage volumes, coupled with built-in network and storage optimization and a hypervisor layer that virtualizes compute. But where the underlying storage technology significantly alters protection, resiliency, and availability, it shouldn't be missed that the virtualization layer similarly advances management. By combining virtualization with SteelFusion's BlockStream, the branch office can be managed as just another hypervisor host in the datacenter, with access to the full breadth of datacenter resources (including images, data copies, and more) despite a potential separation of thousands of miles. While we've demonstrated the impact on some management practices like provisioning, this "virtual" consolidation of the branch office with the datacenter stands to change every management task associated with the branch – even down to routine monitoring and health checks. With a simple shutdown and change in access, VMs can

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potentially be "pulled back" to the datacenter for any type of modification, including patching and testing or even just configuration and settings changes, and then they can be nearly instantaneously restored to the branch office. On another front, the nature of provisioning and configuring branch offices stands to potentially change; by coupling virtualization with branch projection, instantaneous snapshot-versioned copies of a single master VM image can be used across all branches, potentially creating hundreds of gigabytes or more of space savings as such snapshots store only the unique data from each copy on disk. The list of potential capability improvements is enormous. In essence, SteelFusion Edge redefines the branch office, by enabling the enterprise at will to define and deploy the services for the remote branch through Riverbed SteelFusion appliances and software. As we've seen, these tasks can be done in a fraction of the time required to configure and deploy traditional hardware.

Perhaps of equal importance, those fairly impressive capabilities come without consequence in the datacenter. Since SteelFusion Edge effectively offloads the application IO from that centralized storage, all of these centralized storage array features are made available to the branch office without creating significantly more load.

In sum, we can see these capabilities shaving several hours per site off of the monthly time that administrators invest in routine configuration changes, especially when considering the reduction in potential error and rework that some of these capabilities will likely yield. When this impact is considered using roughly estimated numbers and only a focus on a few processes, we see sufficient evidence to conclude that the impact for Riverbed SteelFusion customers will be quite significant.

Impact on Annual Time and Effort		
Deployment	5 hours	10 minutes
Routine configuration changes – once monthly	50 hours	6 hours
Deployment of new services – twice annually	10 hours	20 minutes
Total	65 hours	6.5 hours
Reduction in Annual T&E		**10X**

Table 6: When we examine the time and effort expended on routine branch office operational IT tasks for a single branch, examining tasks where we've identified Riverbed SteelFusion having significant impact, our comparision of traditional architectures versus SteelFusion indicates a 10X impact on time and effort.

When the data in this table is considered at scale the differences in numbers become quite large very quickly. For example, the above numbers for a 50 branch office business total up to 3,250 hours versus 325 hours. That is easily the difference between a dedicated team of branch office IT specialists, and the ability to support the branch office with more broadly tasked IT teams. But while these numbers are large, it shouldn't be missed that they do nothing to identify the value of other capabilities unleashed by Riverbed SteelFusion. Such features, as we've reviewed, include a significant reduction in branch office data and productivity risks – whether from theft, deletion, or damage – and vastly improved recovery capabilities when outages do happen.

While the idea of convergence is running wild among IT marketeers today, we certainly agree with Riverbed that they have defined a new type of convergence for the branch – one with all of the simplicity, consolidation, and capability improvements of the datacenter convergence solutions being

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introduced. But with Riverbed SteelFusion, branch office convergence is quite likely to have more immediate and tangible benefit for many more customers, by fundamentally changing one of the riskiest and most burdensome IT practices that is a common denominator in almost every business in operation.