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ACCELERATE AND SECURE DELL EQUALLOGIC iSCSI REPLICATION WITH THE F5 BIG-IP WAN OPTIMIZATION MODULE

Combining Dell™ EqualLogic™ PS Series Internet SCSI (iSCSI) arrays with F5® BIG-IP® application delivery systems and WAN Optimization Module™ technology can have significant performance and security benefits for iSCSI replication over wide area networks (WANs)—accelerating and encrypting traffic between sites, decreasing data transfer times and recovery times, and helping reduce WAN-related costs.

Application availability, data center capacity, and business continuity can all depend on the timely movement of applications and data between remote sites. The low throughput and long data transfer completion times typical of wide area networks (WANs) can make remote WAN replication difficult or even impossible. Additionally, the need to meet regulatory and compliance standards—including controlled access to and encryption of replicated data—is often a paramount consideration for enterprise storage administrators.

With these challenges in mind, Dell and F5 have completed proof-of-concept (POC) lab testing to demonstrate how organizations can help accelerate and secure Dell EqualLogic PS Series Internet SCSI (iSCSI) storage area network (SAN) replication over WANs using version 10.1 of the F5 BIG-IP WAN Optimization Module (WOM). By overcoming the effects of limited bandwidth, high latency, and packet loss, WOM technology helps to dramatically increase throughput, reduce replication completion times, and enhance bandwidth utilization and efficiency. When taking into account the costs of WAN bandwidth, equipment, and administration, these performance advantages can quickly lead to bottom-line savings.

F5 BIG-IP WAN OPTIMIZATION FEATURES

F5 BIG-IP application delivery controllers provide the flexibility to support multiple feature sets on a single platform. For example, a BIG-IP device providing high availability, traditional load balancing, and Secure Sockets Layer (SSL) offload can also incorporate WAN optimization, Web acceleration, application security, and other features without the need for additional dedicated appliances—helping to simplify management and save on hardware, rack space, and power consumption.

F5 BIG-IP WOM technology is designed to accelerate TCP traffic for data center applications, with the ability to scale to meet high bandwidth requirements. The module includes special acceleration profiles for Common Internet File System (CIFS) and Messaging Application Programming Interface (MAPI), and supports Web Cache Communication Protocol version 2 (WCCPv2); because it must be deployed symmetrically, it requires two or more BIG-IP devices.

A variety of features help to boost performance, secure communications, and manage traffic, including the following:

- **iSessions:** The F5 iSessions network tunneling feature integrates security, acceleration, and traffic

management. This feature is designed to work through firewalls: for example, iSCSI requires only TCP port 443 for the secure control channel and TCP port 3260 for iSCSI, and iSessions encryption can be enabled without changes to the port assignments.

- **Symmetric encryption:** iSessions can be secured by controlling access, encrypting the control channel, and optionally encrypting the iSCSI replication traffic; the SSL encryption is designed to operate with only minimal impact on performance. Administrators can easily enable encryption by modifying the iSCSI virtual server using the Web browser-based BIG-IP management interface.
- **Symmetric data deduplication:** In the WOM context, deduplication means preventing redundant data patterns from crossing the WAN. A cache is built on the device at each end, and when a duplicate pattern in the network traffic is found, a small reference to the cache is transmitted instead of the entire pattern—an important way to help reduce the amount of WAN traffic. The Dell and F5 POC testing used a memory deduplication data store, an approach well suited for replication traffic. The deduplication cache can also be stored on disk to support increased cache sizes.
- **Symmetric adaptive compression:** As with symmetric deduplication, compression helps to reduce the amount of WAN traffic and increase bandwidth usage efficiency. *Adaptive* means that BIG-IP devices can intelligently select compression based on the type of data. Compression can also be offloaded to hardware compression cards on high-end F5 platforms to help reduce processor usage and increase throughput. The Dell and F5 POC testing used adaptive compression, yielding a combination of LZO and Deflate (level 1) compression. Volume data set characteristics such as compressibility influence the performance gains associated with WOM technology.

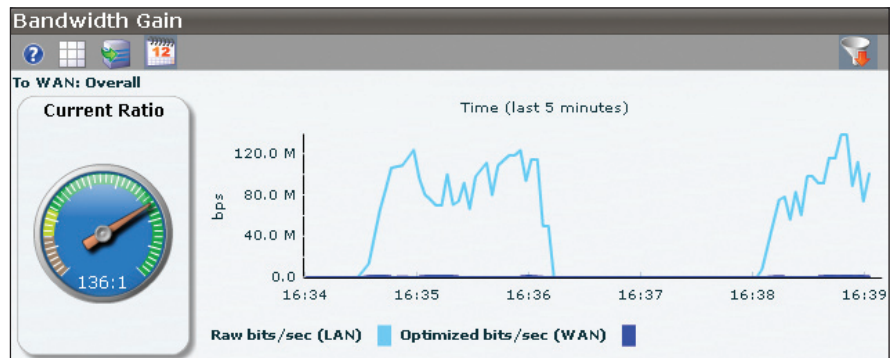


Figure 1. F5 BIG-IP WOM performance dashboard

- **TCP Express:** The BIG-IP network stack implements a variety of TCP optimization techniques and performance-related IETF Request for Comments (RFC) enhancements designed to offload and optimize TCP network traffic, helping to reduce TCP overhead and increase network performance and reliability.
- **Layer 7 (L7) quality-of-service (QoS) rate shaping:** L7 QoS rate shaping allows for the enforcement of bandwidth minimums and maximums per application, including burst control, and supports terms-of-service and differentiated services code point (DSCP) features. For example, the bandwidth associated with an iSCSI BIG-IP virtual server can be limited, helping prevent iSCSI replication from affecting other critical applications that share the same WAN link.

The WOM performance dashboard offers integrated monitoring and reporting tools, providing administrators with a quick

look at real-time data, performance, and bandwidth gains for WOM-optimized traffic (see Figure 1).

PROOF-OF-CONCEPT TEST ENVIRONMENT

The goal of the Dell and F5 POC testing was to demonstrate Dell EqualLogic iSCSI SAN replication throughput and completion times when using F5 BIG-IP WOM technology to accelerate and encrypt iSCSI traffic as it crossed a WAN. The tests were performed in November 2009 at the Dell Interoperability Lab in Round Rock, Texas.

As shown in Figure 2, the lab configuration included two EqualLogic PS6000XV iSCSI SAN arrays with sixteen 420 GB, 15,000 rpm Serial Attached SCSI (SAS) hard drives in a RAID-50 configuration connected by two Dell PowerConnect™ 6248 L3 switches. F5 BIG-IP 3600 appliances with WOM technology were connected to the switches at each simulated site. A WAN emulator interconnected the switches; the emulator functions included

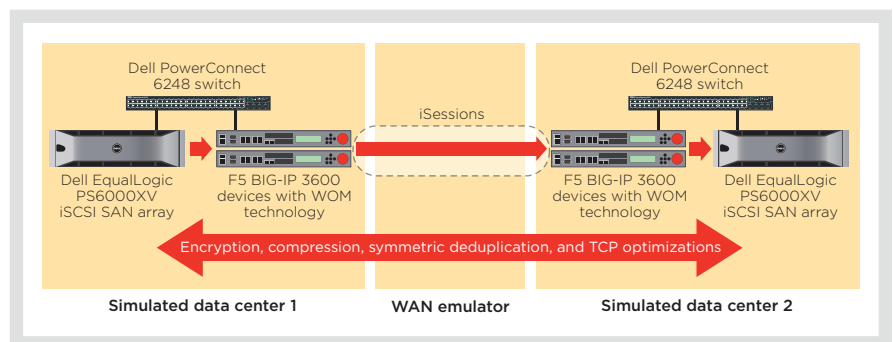


Figure 2. Proof-of-concept test environment incorporating F5 BIG-IP WOM technology

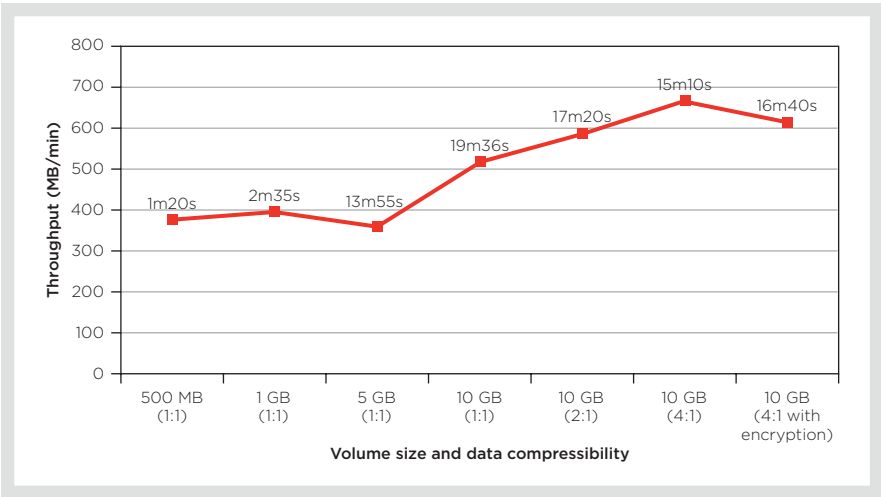


Figure 3. Dell EqualLogic replication throughput and completion times with F5 BIG-IP WOM acceleration over a 45 Mbps WAN with 100 ms latency and 1 percent packet loss

	Typical latency range	Typical average latency
Regional within the United States or Europe	10–40 ms	30 ms
U.S. East Coast to West Coast	80–120 ms	100 ms
South America to North America	90–170 ms	150 ms
Asia Pacific to Europe	250–400 ms	300 ms

Figure 4. Typical latencies that might be expected across a variety of WAN link distances

limiting bandwidth, injecting latency, and dropping packets to simulate two remote data centers connected over a WAN. The two arrays then replicated volumes over the emulated WAN, benefiting from WOM acceleration and encryption.

The test team used the Web browser-based EqualLogic Group Manager user interface to configure the volumes, manage the replication jobs, and report throughput and completion times. The test runs included asynchronous full-volume replication jobs, with no incremental replications, and each run was limited to single-volume replications.

Similarly, the Web browser-based BIG-IP management interface was used for WOM configuration, including end-points, virtual servers, encryption profiles, and acceleration profiles and routing, as well as an iSCSI acceleration policy. The performance dashboard was monitored

to observe WAN optimization statistics, network throughput, and processor and memory utilization during the test runs.

F5 BIG-IP WOM ACCELERATION TEST RESULTS

The goal of WAN optimization is to increase performance by minimizing latency—helping to increase the perceived

bandwidth, seamlessly recover from packet loss, and enable WANs to provide performance characteristics similar to LANs. Figure 3 shows Dell EqualLogic iSCSI replication throughput and completion times with F5 BIG-IP WOM acceleration over a 45 Mbps WAN with 100 ms of latency and 1 percent packet loss (10,000 packets per million) across a variety of volume sizes. The WOM-accelerated tests for the 10 GB volume additionally show the throughput and completion times for 2:1 and 4:1 volume data compressibility as well as 4:1 compressibility with encryption.

To put these results in context, using WOM technology enabled the WAN link at 45 Mbps with 100 ms of latency and 1 percent packet loss to provide results roughly comparable to what could be expected of a 100 Mbps LAN with no latency or packet loss, even when using encryption—helping make remote replication of large data volumes possible in a much shorter period of time than they would otherwise require. As an additional point of reference when evaluating the results, Figure 4 shows typical latencies that might be expected across a variety of WAN link distances.


Organizations can further increase iSCSI WAN data transfer throughput by configuring concurrent replication of more than one volume at a time, helping maximize overall bandwidth utilization. They can also enhance network efficiency by using remote point-in-time replication, which helps minimize the amount of data

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crossing the WAN by transferring only the changed volume data to the replication partner.

REDUCED COSTS THROUGH WAN ACCELERATION

Because bandwidth, equipment, and administration for WAN operations can represent significant costs over time, the performance advantages of F5 BIG-IP WOM technology with Dell EqualLogic storage demonstrated by the Dell and F5 POC tests can lead to bottom-line savings. By accelerating data transfer times over WANs, enabling encryption with minimal performance overhead, and providing an easy-to-use management interface, F5 BIG-IP WOM technology can help organizations avoid the need to purchase additional bandwidth and decrease administration costs while continuing to meet overall organizational and compliance requirements. Combining WOM

technology with Dell EqualLogic iSCSI SAN arrays enables organizations to create a shared storage solution supporting accelerated and encrypted site-to-site data transfers over WANs. 

Fred Johnson is a strategic partner engineer with F5 Networks dedicated to Dell Labs. He works closely with Dell development and services groups on POCs, benchmarks, technical publications, and training involving Dell, F5, and third-party products. Fred has 20 years of experience in IT and has a B.A. in Psychology from the University of Texas at Austin.

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