NETGEAR®

Networking Solutions for Storage

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Unified storage, supporting IP-based SAN (iSCSI) and Network-Attached Storage (NAS) protocols on 10 Gigabit Ethernet fabric, has emerged as a highly attractive storage option for mid-sized companies seeking an efficient, reasonably-priced solution to handle the flood of data generated by twenty-first century businesses. In fact, mid-sized companies can now take the same fundamental approach to storage as large enterprises, using a storage area network (SAN) to store data, but on a smaller scale than enterprises and without the expense and complexity of enterprise-scale fiber channel SANs.

Taking this approach may soon become a necessity, given the data challenges mid-sized businesses now face. There are several factors driving the trend towards NAS/SAN solutions for these companies.

- **Data volume**. Employees and applications alike are generating more data than ever before. Files themselves are becoming richer (and therefore bigger), as exemplified by today's elaborate PowerPoint presentations and the trend towards the increasing use of video. New versions of both applications and operating systems always require more disk space than the versions they replace.

- **Regulatory Requirements**. Government regulations – PCI for companies that handle credit card information, FISMA for companies doing business with the government, HIPPA for companies in the healthcare industry and Sarbanes-Oxley for all public companies – all compel businesses to maintain and back up data that previously would have been deleted.

- **Virtualization**. Economic pressure on IT departments is forcing them to abandon the old one-application-per-server paradigm in favor of server consolidation and virtualization. When multiple virtual machines (VMs) are running on the same server, that server cannot provide adequate storage. Centralized storage – either via NAS devices or dedicated SAN storage devices – is required to meet the needs of those VMs.

Mid-sized businesses not only need to address these issues from an architectural perspective. There are also performance issues. Virtualization depends heavily on reliable, high-speed communication between servers and storage devices. The new generation of processors designed for virtualization (e.g. Intel's Romley platform) will mean that servers will generate higher throughput than ever before, increasing the demands on the network infrastructure.

A SAN FOR MID-SIZED BUSINESSES

Enterprise-scale companies have met these challenges with fiber channel (FC) SANs. But while it's true that these FC SANs provide the capacity, flexibility and scalability needed to manage huge quantities of data, they are not appropriate for mid-sized businesses. They are complex, expensive to install and maintain, and they must be managed by experts with specialized training and skills. In short, most mid-sized businesses can't afford the benefits of an FC SAN.

The iSCSI protocol offers an alternative to FC SANs that is perfect for mid-sized businesses. iSCSI is an extension of the SCSI protocol used for block transfers in most storage devices and in fiber channel architectures. The Internet extension – the "i" in iSCSI – defines protocols for extending block transfers over IP, allowing *standard Ethernet infrastructure to be used* as a SAN interconnect fabric. Basic iSCSI is supported in most operating systems today, and its capabilities allow 10G Ethernet to compare very favorably to fiber channel as a SAN interconnect fabric.

Fiber Channel vs. iSCSI for mid-size storage SANs

Three types of storage
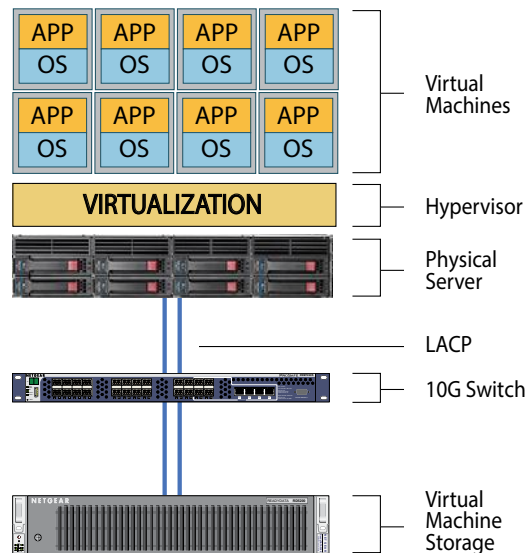- DAS, NAS, SAN

Fiber Channel SANs dominate enterprise data centers
- flexible and scalable, but...
- expensive and complex

The iSCSI SAN alternative
- 10 Gigabit Ethernet as a fabric
- reduced costs, excellent performance
- improved disaster recovery

| APP OS | APP OS | APP OS | APP OS | — Virtual Machines |

VIRTUALIZATION — Hypervisor

Physical Server

LACP

10G Switch

Virtual Machine Storage

Benefits of the iSCSI approach include:

- **Reduced equipment and management costs**. 10G Ethernet networking components are less expensive than highly specialized fiber channel components and do not require a specialized skill set for installation and management.
- **Enhanced server management**. iSCSI remote boot eliminates the need to boot each server from its own direct-attached disk. Instead, servers can boot from an operating system image on the SAN. This is particularly advantageous for diskless servers in rack mounted or blade server applications.
- **Improved disaster recovery**. All information on a local SAN — including boot information, operating system images, applications and data — can be duplicated on a remote SAN for quick and complete disaster recovery.
- **Excellent performance**. Even transactional virtual machines, such as databases, can run over 10G Ethernet and an iSCSI SAN without compromising performance.

A TOTAL STORAGE SOLUTION

The reference design that follows takes advantage of the iSCSI protocol with a 10G Ethernet fabric to provide a complete storage solution that's ideal for mid-sized businesses, medical offices and law firms, as well as branch offices in larger organizations. Its key components are a NETGEAR ReadyDATA™ RD5200 2U rack-mountable storage device and NETGEAR switches to ensure high performance data exchange.

THE NETGEAR READYDATA RD 5200

NETGEAR ReadyDATA 5200 is a unified storage (NAS/SAN) platform featuring enterprise-class technology designed for businesses of any size. The base system is a 2RU rack-mountable enclosure that supports 12 3.5-inch drives that provide 48TB of storage capacity, and can scale to 60 drives with two 4RU external disk arrays for 240TB capacity.

The ReadyDATA platform ships with ReadyDATAOS, which enables a full complement of enterprise capabilities as standard features. These include:

- Instant provisioning and instant expansion
- Thin and thick provisioning options for iSCSI
- De-duplication and compression for management of rapid data growth
- Unlimited snapshots and instant recovery options for data protection
- Real-time block level replication
- Support for a mix of SAS, SATA and SSD drives to meet varying performance needs and to control costs
- Hybrid volume support with SSD + SATA
- Simple, web-based user interface
- RAID 0, 1, 5, 6 and 10 support
- Redundant 10G Ethernet networking support (SFP+) and virtual networking for multi-VLAN support
- VMware certification for NFS and iSCSI
- Microsoft certification for iSCSI and clustering support.

REFERENCE DESIGNS
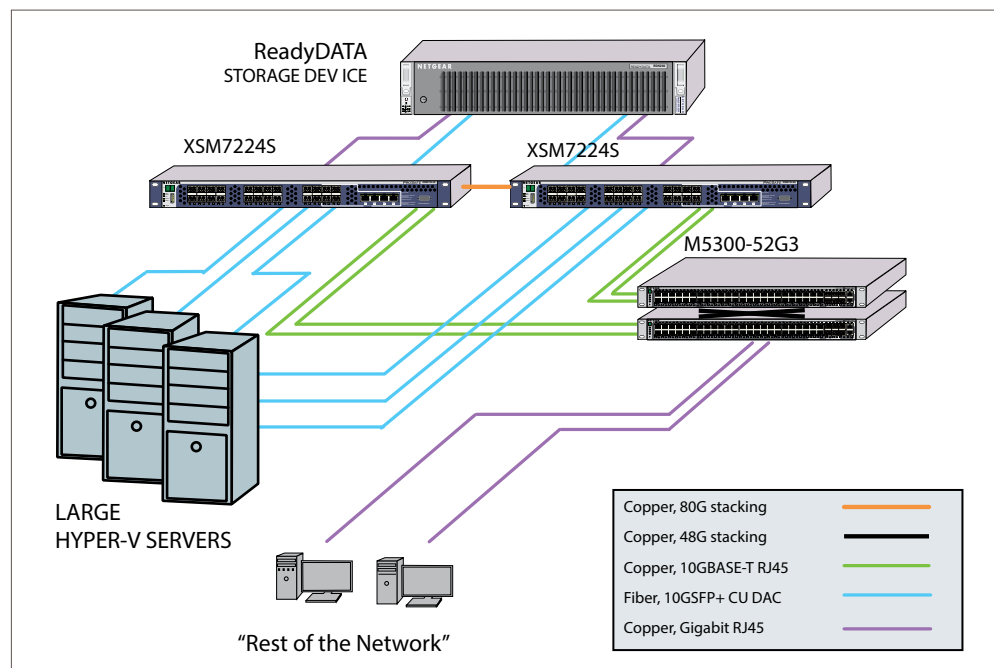
This reference design provides a low latency, high bandwidth, fully redundant storage solution for a mid-sized business or branch office of a larger enterprise. It includes the following components:

- multiple Hyper-V servers
- multiple file server clients distributed anywhere in the "rest of the network"
- one ReadyDATA 5200 storage device
- two NETGEAR access layer switches (M5300-52G3)
- two NETGEAR distribution layer switches (XSM7224S)

The ReadyDATA 5200 in this design incorporates a high performance storage volume with 15k RPM SAS drives for the Hyper-V servers, and lower performance SATA drives for file serving tasks for the "rest of the network." iSCSI traffic (high priority) and file server traffic (lower priority) are separated.

The ReadyDATA 5200 has two 10G ports and two 1G ports. The 10g ports are used for iSCSI connectivity to the Hyper-V servers. For fault tolerance and performance enhancement, multipathing is used between the ReadyDATA 5200 and the Hyper-V servers. (This is handled by the iSCSI initiator on servers. Note that multipathing requires different subnets between two paths.)

The 1G ports are used for file server functions. These ports are "bonded" using distributed link aggregation across the XSM switches for redundancy and dynamic load balancing. File sharing is governed by the SMB (CIFS) protocol. This provides redundancy and dynamic load balancing for serving clients located anywhere on the rest of the network.

Details for the distribution and access layers are described below.

Distribution Layer

At the distribution layer, two stacked XSM 7224S switches provide a virtual chassis for high performance and highly redundant aggregation.

The XSM7224S is a 24-port, 10 Gigabit Ethernet SFP+ top-of-rack L2+ switch with four 10GBase-T combo ports and Layer 3 upgradeability. Four SFP+ ports are used in this configuration for stacking to provide 80 Gbit/s bandwidth (4 ports x 10G x 2) in a dual-ring, resilient and load-balanced topology. Each switch features sub-second master failover. The switches each have a second, internal modular APS300W power supply for server-like PSU redundancy.

- Hyper-V servers in this design are assumed to be 10 Gigabit SFP+ equipped and use short, local Copper SFP+ DAC (direct attach) cables. For redundancy, these servers connect to two different XSM7224S switches - but without trunking (distributed link aggregation). Instead, multipathing is used to achieve an active-active server connection for load balancing with instant network failover. The two XSM7224S switches in the stack are equipped with a Layer 3 license upgrade (XSM7224L).
- The ReadyDATA 5200 connects to the 10G ports on both XSM7224S switches via one 10G SFP+ DAC (direct attach) cable on each switch, but without using link aggregation, i.e. with no bonding.
- The ReadyDATA 5200 connects to the 1G ports on both XSM7224S using regular Gigabit copper links, in this case using bonding (distributed link aggregation on the virtual chassis switch side).
- The XSM7224S virtual chassis uses distributed link aggregation (two 10G links per physical switch) for a 40 Gbit/s unidirectional connection to the "rest of the network."

Access Layer

At the access layer, two stacked M5300-52G3 (GSM7352S) form a virtual chassis with link aggregation across both switches to provide connectivity to clients. In addition, there is one 40 Gbit/s redundant connection to the distribution layer.

- All links are active, with load-balancing (unlike Spanning Tree technologies).
- Immediate network failover protection is provided in the unlikely event that one of the distribution switches should fail.
- The design has an overall 2.4:1 oversubscription to the distribution layer.
- Each switch needs power redundancy. In this design, this is accomplished with one RPS4000 Redundant Power Supply equipped with one APS1000W power module for the stack.

VLAN Routing

It is assumed in this design that the VMs will use several VLANS, and that traffic must be routed among them on the switch side. This inter-VLAN routing is accomplished by creating Layer 3 interfaces (IP addresses assigned to VLAN interfaces) and using straightforward static routing on the XSM7224S virtual chassis.

Virtual Network Interface Cards

In this design, Virtual Network Interface Cards (VNICs) are used for the virtualized environment. Their primary benefit is that they enable the ReadyDATA 5200 to service many separate networks. VNICs can be created and attached to both individual and bonded interfaces. In this design they facilitate multipath I/O for both 10G links to the ReadyDATA 5200.

The following parameters may be configured for each VNIC:

- VLAN membership
- bandwidth limits
- IPv4 or IPv6 settings
- DNS servers

Security

- This design has a dedicated management VLAN for access layer and distribution layer switches, with an additional control plane ACL to better refine the IP/MAC/protocol through which management access to the network is controlled.
- MAC-based port security (MAC address table locking) provides a minimum level of security.
- Assuming the endpoints support the IEEE 802.1x authentication standard for port-based Network Access Control, a higher level of security can be implemented using a RADIUS server or Windows Server 2008 Network Policy Server (NPS) with or without MAC authentication bypass (MAB). With this approach, access to ports can be blocked even if hackers succeed in spoofing and emulating MAC addresses during an attack.
- NETGEAR switches support MAB bypass for non-RADIUS-aware endpoints, and will authenticate such endpoints when they submit their MAC address to the RADIUS or NPS server.

MANAGED INFRASTRUCTURE

NETGEAR Managed Switches offer a secure, future-proof networking infrastructure for servers and storage deployments in mid-size organizations and campus networks. NETGEAR Managed Switches come with industry-leading lifetime warranties; lifetime advanced technical support; and included 3-year onsite advance replacement service in most of North America, Europe and Australia cities. More detailed information is available at www.netgear.com/managed.

L3	Chassis 1G/10G	**M8800** series	**Core**

L2+ **L3**	Stackable 10G	**M7300** series	**10G Aggregation**
L2+	Standalone 10G	**M7100** series	

L2+ **L3**	Stackable 1G/10G	**M5300** series	**Access**
L2+	Standalone 100M/1G	**M4100** series	

NETGEAR ProSAFE LIFETIME WARRANTY*

Lifetime Tech Support

NBD* 3-year on-site service

NETGEAR SWITCHING SOLUTIONS

Product Name	M8800-06	M8800-10	M7300-24XF	M7100-24X	M5300-28G	M5300-52G
Order Number	XCM8806	XCM8810	XSM7224S	XSM7224	GSM7228S	GSM7252S
RJ45 Ports	Up to 240 x 10/100/1000	Up to 432 x 10/100/1000	4 x 10GBASE-T	24 x 10GBASE-T	24 x 10/100/100 2 x 10GBASE-T (Max: 4)	48 x 10/100/100 2 x 10GBASE-T (Max: 4)
Fiber SFP+ (1000/10G)	Up to 40 x XFP	Up to 72 x XFP	24 x SFP+	4 x SFP+	2 x SFP+ (Max: 4)	2 x SFP+ (Max: 4)
Fiber SFP (100/1000)	Up to 128 x SFP	Up to 224 x SFP	–	–	4 x SFP	4 x SFP
Power over Ethernet	Up to 240 x PoE 802.3af	Up to 432 x PoE 802.3af	–	–	–	
PoE Budget (Watts)	Up to 5,000W	Up to 5,000W	–	–	–	
Redundant Power Supply	N+1 modular PSUs	N+1 modular PSUs	Dual hot swap PSUs	Dual hot swap PSUs	RPS + Modular PSU	RPS + Modular PSU
Feature Set	Full Layer 3 Optional Core License	Full Layer 3 Optional Core License	Layer 2+ (static routing) Optional Full L3 License	Layer 2+ (static routing)	Layer 2+ (static routing) Optional Full L3 License	Layer 2+ (static routing) Optional Full L3 License
Form Factor	Chassis 10U	Chassis 14U	Rack 1U Stackable	Rack 1U Standalone	Rack 1U Stackable	Rack 1U Stackable

Product Name	M5300-28G-POE+	M5300-52G-POE+	M5300-28G3	M5300-52G3	M5300-28GF3	M4100-D10-POE
Order Number	GSM7228PS	GSM7252PS	GSM7328S	GSM7352S	GSM7328FS	FSM5210P
RJ45 Ports	24 x 10/100/100 2 x 10GBASE-T (Max: 4)	48 x 10/100/100 2 x 10GBASE-T (Max: 4)	24 x 10/100/100 2 x 10GBASE-T (Max: 4)	48 x 10/100/100 2 x 10GBASE-T (Max: 4)	4 x 10/100/100 2 x 10GBASE-T (Max: 4)	8 x 10/100 2 x 10/100/1000
Fiber SFP+(1000/10G)	2 x SFP+ (Max: 4)	2 x SFP+ (Max: 4)	2 x SFP+ (Max: 4)	2 x SFP+ (Max: 4)	2 x SFP+ (Max: 4)	
Fiber SFP (100/1000)	4 x SFP	4 x SFP	4 x SFP	4 x SFP	24 x SFP	2 x SFP
Power over Ethernet	24 x PoE+ 802.3at	48 x PoE+ 802.3at	–		–	8 x PoE 802.3af
PoE Budget (Watts)	380W/720W EPS	380W/1,440W EPS	–		–	66W
Redundant Power Supply	RPS + Modular PSU	RPS + Modular PSU	RPS + Modular PSU	RPS + Modular PSU	RPS + Modular PSU	–
Feature Set	Layer 2+ (static routing) Optional Full L3 License	Layer 2+ (static routing) Optional Full L3 License	Full Layer 3	Full Layer 3	Full Layer 3	Layer 2+ (static routing)
Form Factor	Rack 1U Stackable	Rack 1U Stackable	Rack 1U Stackable	Rack 1U Stackable	Rack 1U Stackable	Desktop

Product Name	M4100-26-POE	M4100-50-POE	M4100-D12G	M4100-D12G-POE+	M4100-12GF	M4100-12G-POE+
Order Number	FSM7226P	FSM7250P	GSM5212	GSM5212P	GSM7212F	GSM7212P
RJ45 Ports	24 x 10/100 2 x 10/100/1000	48 x 10/100 2 x 10/100/1000	12 x10/100/1000	12 x 10/100/1000	12 x 10/100/1000	12 x 10/100/1000
Fiber SFP (100/1000)	2 x SFP	2 x SFP	2 x SFP	4 x SFP	12 x SFP	4 x SFP
Power over Ethernet (PoE/PoE+)	24 x PoE 802.3af	48 x PoE 802.3af		10 x PoE+ 802.3at out	4 x PoE+ 802.3at	12 x PoE+ 802.3at
PoE Budget (Watts)	380W	380W/740W EPS		125W	150W	380W
Redundant Power Supply	RPS	RPS	PD Mode	PD Mode	RPS	RPS
Powered by PoE+ (Passthrough)	–	–	1 x PoE+ 30W port in	2 x PoE+ 30W ports in Can redistribute 25W	–	–
Feature Set	Layer 2+ (static routing)	Layer 2+ (static routing)	Layer 2+ (static routing)	Layer 2+ (static routing)	Layer 2+ (static routing)	Layer 2+ (static routing)
Form Factor	Rack 1U Standalone	Rack 1U Standalone	Desktop	Desktop	Rack 1U Standalone	Rack 1U Standalone

Product Name	M4100-26G	M4100-50G	M4100-26G-POE	M4100-24G-POE+	M4100-50G-POE+	RPS/EPS Unit
Order Number	GSM7224	GSM7248	GSM7226LP	GSM7224P	GSM7248P	RPS4000
RJ45 Ports	26 x 10/100/1000	50 x 10/100/1000	26 x 10/100/1000	24 x 10/100/1000	50 x 10/100/1000	For up to 4 switches
Fiber SFP (100/1000)	4 x SFP	4 x SFP	4 x SFP	4 x SFP	4 x SFP	For up to 4 switches
Power over Ethernet (PoE/PoE+)			24 x PoE 802.3af	24 x PoE+ 802.3at	48 x PoE+ 802.3at	APS1000W combination
PoE Budget (Watts)			192W/380W EPS	380W/720W EPS	380W/1,440W EPS	Up to 2,8880W budget
Redundant Power Supply	RPS	RPS	RPS	RPS	RPS	RPS EPS
Feature Set	Layer 2+ (static routing)	Layer 2+ (static routing)	Layer 2+ (static routing)	Layer 2+ (static routing)	Layer 2+ (static routing)	Connects M4100 series and M5300 series
Form Factor	Rack 1U Standalone	Rack 1U Standalone	Rack 1U Standalone	Rack 1U Standalone	Rack 1U Standalone	Rack 1U Four Slots