



The Power of We™

Cloud-Optimized Storage Solutions

Creating cost-effective scale-out storage optimized for the next-generation data center

Avaya and Coraid are optimizing the new paradigm of highly scalable Storage Area Networking; future-ready and cost-effective, leveraging the advantages of proven and interoperable technology

Storage Area Networking in Evolution

Virtualization has brought undeniable benefits to enterprise IT – reduced costs, server consolidation, increased flexibility, automated management and more. Coupled with powerful, scalable x86-based server platforms, virtualization enables enterprises of all sizes to move toward cloud architectures that achieve massive scale using commodity hardware, multi-tenant segmentation, elastic expansion, and automated self-service. But, because traditional storage area networking technologies (Fibre Channel, FCoE, & iSCSI) are too expensive, too complex, and poorly adapted for the emergence of dynamic virtualization workloads, the cost and agility benefits of enterprise virtualization can come to a screeching halt when data reaches the storage network.

Avaya and Coraid can help. Able to extend the storage area network over a services-optimized fabric that can scale from along the aisle to across the globe, the Avaya portfolio of data center-grade Switching products support the Ethernet-based storage area networking architecture, delivering lightning-fast performance, low latency, future-ready scalability, and agility. Redefining the fundamental economics of storage with Ethernet storage area networking solutions, Coraid provides enterprises with EtherDrive storage arrays that enable a scale-out architecture ideally suited to dynamic, high-performance computing, video, virtualization, and cloud environments.

Storage Technology in Evolution

It may appear to be stating the obvious, but it's worth emphasizing that Ethernet storage area networks run on the same standard Ethernet technology that IT departments have used for decades. Fibre Channel Storage Area Networks utilize a specialized Fibre Channel network, and operate at port speeds ranging from 2 to 8Gbps. And, while there is talk of moving towards 16Gbps, the situation is unclear. Fibre Channel Storage Area Networks are implemented with arbitrated loops or expensive proprietary infrastructure with a protocol consisting of several complex software layers that force users through mandatory configuration procedures for each network path on all storage logic units. In contrast, Ethernet storage area networking is a connectionless protocol that allows servers to directly access storage, across Layer 2 Ethernet, without requiring TCP/IP or user-configured multi-path I/O (MPIO) software. A simpler approach for storage networking, Layer 2 Ethernet sends packets automatically over every available network path between server and storage without MPIO configuration.

Delivering a robust solution with acknowledgement, and checks of each packet for bit errors, Ethernet storage area networking support speeds of 10Gbps today, with 40 and 100Gbps now on the horizon. Dropped packets are retransmitted immediately helping to ensure high throughput and reliability. And, because Ethernet storage area networks don't need TCP/IP, they have less overhead, lower latency and utilizes all network paths automatically; all part of a package that delivers an extremely fast and simple method for sharing disk drives through the network. Leveraging the simplicity of Ethernet storage area networking, Coraid's EtherDrive storage products deliver storage that can outperform Fibre Channel at a fraction of the cost.

Powered by ATA-over-Ethernet

The Coraid EtherDrive family of storage area networking products is built on ATA-over-Ethernet (AoE), an open lightweight storage area networking protocol that runs on Layer 2 Ethernet. Designed for simple,

high performance access of SAS, SATA and SSD storage drives over Ethernet, AoE enables enterprises to build storage area networks with low-cost, standardized technologies. A thin protocol layer sitting directly on top of Ethernet, AoE delivers packets to devices based on MAC Address

and, because AoE is a Layer 2 protocol, TCP or IP layers are not required thereby eliminating unnecessary processing and latency. Secure, direct, and with fencing and reservation capabilities, AoE is the perfect technology for building storage area networking solutions for

the virtualized environment that are fast, simple, and affordable.

Think “Solution”...

By eliminating protocol layers and utilizing the Ethernet congestion avoidance algorithms supported by Coraid’s Host Bus Adapter (HBA), Coraid EtherDrive storage enables near-bare-metal performance and leverages high-speed Avaya Ethernet Switches to deliver substantial advantages over traditional alternatives:¹

- Coraid’s Storage Area Networking can deliver higher performance comparable to Fibre Channel solutions (hardware and connectivity) at approximately 20% of the cost
- Able to configure, provision, and use an EtherDrive in less than two minutes from power on
- Validated throughput performance of over 1800 MB/sec per shelf on Coraid EtherDrive SRX-Series storage arrays for large-block sequential workloads
- Individual EtherDrive arrays running SATA, SAS or SSD drives can deliver higher performance than Fibre Channel at over 1,800 MB/sec and overall system performance can be scaled up inexpensively by adding more Ethernet HBAs and spindles



No more complex storage area networking topologies, no more forklift upgrades, no more esoteric Fibre Channel issues. Able to deploy arrays in minutes, Coraid’s CorOS sets the benchmark in simplicity. Utilizing ubiquitous Ethernet, Coraid solutions vastly simplify the deployment and scaling of storage systems, making it possible to manage Terabytes or Petabytes without the need for a dedicated storage area networking administrator.

Creating a potent tool for optimizing both interactive and storage flows, the next-generation top-of-rack Avaya Virtual Services Platform 7000 couples low latency with a multi-terabit virtual backplane.² Designed to scale proportionally, the Avaya Fabric Interconnect technology scales

performance capacity and overall solution responsiveness as new devices are added. Optimizing local traffic flows by ensuring that data is always forwarded along the shortest path, Fabric Interconnect technology uses embedded high-speed interconnects that span multiple racks to create an extended switching fabric. Crucial in high-performance data center environments, Fabric Interconnect technology enables a flatter, low-latency network encompassing rack after rack of virtualized servers and storage devices.

¹ Enterprise Strategy Group, Coraid Lab Review, March 2011

² Forecast to be delivered as a software-only upgrade as part of the v10.1 feature release

The Not-so-Quiet Revolution

Today's enterprise network must be flatter, less tree centric, and able to support sustained east-west flows between multiple servers, in addition to traditional client/server transactions. Factors driving the transformation of enterprise networks include the transition to composite application architectures, an adoption of business operations intelligence applications (based on communications-enabled business processes and complex-event processing), and an increase in live virtual machine migrations. With each factor creating a unique challenge for the data center network, ranging between sensitivity to latency and loss, increased traffic levels (background noise), and risk of extended saturation of the common I/O connection, what's required is an agile, high-performance, latency-optimized networking solution that delivers exceptionally high performance.

Combining non-blocking wire-speed I/O with ultra-low port-to-port latency (approximately 500 nanoseconds), the Avaya Virtual Services Platform 7000 is such a solution. Its embedded Fabric Interconnect technology provides 640Gbps of resilient, lateral, non-blocking capacity per switch, enabling the Avaya Virtual Services Platform 7000 to scale to multiple terabits of much-needed east-west capacity; ideal when deployed in a top-of-rack scenario. Future-ready, the Avaya VSP 7000 is designed to handle high-capacity technologies such as 40 and 100Gbps Ethernet, advanced data center-centric functionality such as lossless Ethernet, and will be capable of interconnecting directly with the services-optimized network fabric.

Knowledge is Power, Power is Progress

Inefficient in dealing with server virtualization, traditional data center networks have no visibility into the lifecycle of a virtual machine (VM) and, when it comes to troubleshooting and managing VMs in the network, few tools, if any, are available. Dynamic movement of VMs from server to server also create serious challenges to provisioning a network in terms of security and application performance optimization.

When moving away from the mass of isolated, application-specific servers that characterize the traditional data center, significant milestones must be achieved; they include highly efficient management, troubleshooting, provisioning, and securing multiple VMs. Reaching these milestone requires network-level insight and visibility into virtual machine lifecycle, application of appropriate network and port-level configurations at the individual VM level, dynamic tracking of VMs as they move throughout the data center, and enforcement of network attributes for VMs, no matter where instances migrate.

The Avaya Virtualization Provisioning Service solves challenges like these. A virtualization management solution, it delivers automation, visibility, and reporting that spans network infrastructure, servers, storage and applications, across physical and virtual environments. Providing a wealth of reporting options, it gives network operators a clear view of virtual machine lifecycle and activity (activations, deactivations, changes), detail on network changes (by user, device, time, access type, etc.), and the option to customize alerts by device type, port groups, or even server type. The Avaya Virtualization Provisioning Service also provides a relay mechanism that creates end-to-end server and network device provisioning in a fully virtualized data center environment. The mechanism learns dynamic virtualized server topologies and updates Avaya devices, enabling them to react to, and appropriately reflect, these changes in real-time.



The Power of Network Virtualization

Enabling enterprises to build a private cloud infrastructure that is extensible from data center to campus to branch office; end-to-end network virtualization is an important element of the Avaya Virtual Enterprise Network Architecture (VENA). Designed for next-generation networking, Avaya VENA is a flexible solution that can be tailored to fit current business needs while providing a smooth migration path that accommodates business evolution. Addressing crucial data center requirements, Avaya VENA creates self-aware network infrastructures that simplify the logical provisioning of network services and provide the components required to create an Ethernet fabric featuring active/active connectivity for all attached servers, and service-orientated networking from top-of-rack to core. Among Avaya VENA components are our innovative Switch Clustering and the IEEE's 802.1aq Shortest Path Bridging virtualization technologies - enhanced with enterprise-friendly, Layer 3 functionality, authenticated network access, and a network management toolset that simplifies deployment, monitoring, and troubleshooting.



Thinking outside the Boxes

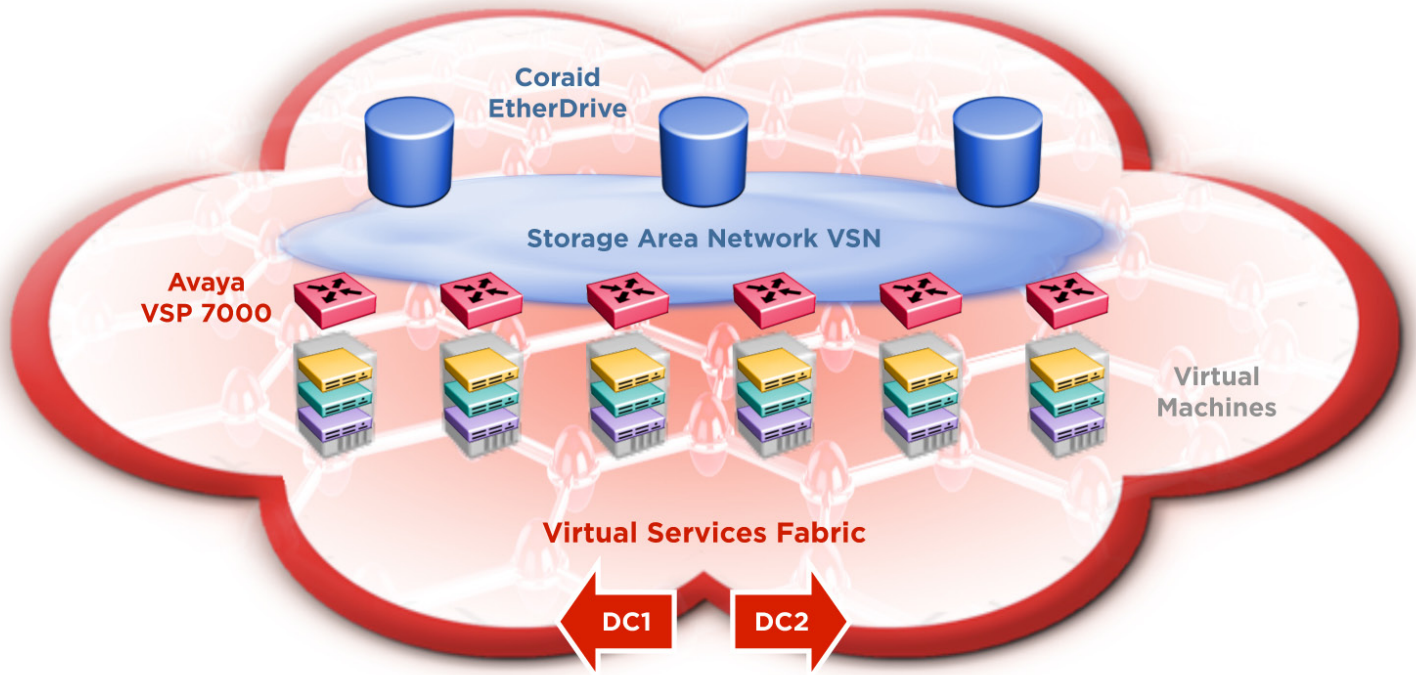
Creating a simplified solution, Avaya offers a services-optimized network fabric that virtualizes elements dynamically, making provisioning and resource utilization more efficient and alleviating strain on the network and personnel. Based on Shortest Path Bridging (IEEE 802.1aq) and augmented by Avaya enhancements optimized for the enterprise context, this network fabric offers a robust, resilient alternative to competitive offerings. Delivering innovative services and solutions, it maintains Ethernet's simplicity and cost-effectiveness while adding new capabilities that enhance scalability, performance, reliability, and service orchestration and abstraction.

Because storage flows can be transported across this extended virtual services fabric, storage area networking is no longer limited to the capabilities of a single switch or network of co-located switches. Empowered by Avaya's services-optimized network fabric and given mission-specific consideration, Coraid's Ethernet-based storage has a networking solution it can leverage across the extended data center. Scale-out becomes a simple matter of supplementing existing Coraid EtherDrive arrays and the transparency offered by the Avaya virtualized network means capacity is

easily addressed from any point. Genuine time-to-service savings can be realized and accessing spare capacity, no matter where it happens to be located, can be leveraged efficiently and quickly.

As virtual machine migration becomes the preferred technique for workload balancing, patch management delivery, and disaster recovery, networks will need to accommodate the seemingly conflicting demands of transferring an entire memory state between physical servers while maintaining a consistent relationship for storage. Requiring a combination of brain and brawn, meeting these demands calls for a solution that not only reconfigures appropriate I/O connectivity automatically but also optimizes virtual services networks for both interactive and storage traffic.

Providing high-capacity shortest-path connectivity during the actual migration phase is crucial, and Avaya offers such a solution. Given the potential for large transitional virtual machine footprints (up to 16 Gig per machine) that would saturate even 10 Gigabit Ethernet links (negatively impacting stationary applications and sessions), a high-performance device is not enough. Meeting this challenge requires a services-optimized, end-to-end network fabric implemented using data center-class products with



Highly virtualized data center environment featuring contiguous end-to-end storage area networking

embedded lateral capacity that can handle next-generation application architectures in a highly virtualized server environment.

Summary

Storage solutions combining Coraid and Avaya technology provide cost and performance advantages that pave the way for a “Storage-in-the-Cloud” environment. Performance, energy, and storage efficiency, along with reduced operational complexity, drive the Avaya-Coraid solution. Eliminating performance issues

associated with latency and inadequate packet buffering, Avaya’s state-of-the-art Ethernet Switching portfolio creates an infrastructure that can optimize storage traffic. Coraid redefines storage area network economics, providing advantages for high-performance, affordable, scale-out network storage. Avaya and Coraid offer exceptional performance, service automation, and truly boundless scalability enabling creation of a genuine cloud storage infrastructure.

About Coraid

Coraid is a leading developer of Ethernet storage area networking solutions that provide enterprises of all sizes with flexible, high performance, scale-out storage. Coraid uniquely delivers the fundamental building blocks necessary to build the next generation storage area networking infrastructure for a range of applications including, server virtualization, high-performance computing, video, and cloud storage. For more information please visit www.coraid.com.

About Avaya

Avaya is a global provider of business collaboration and communications solutions, providing unified communications, contact centers, data solutions and related services to companies of all sizes around the world. For more information please visit www.avaya.com.

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