Coraid EtherDrive — The Shortest Path to Low-Cost Enterprise SAN Storage

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Management Summary

One of the first things you learn in geometry is that the shortest distance between two points is a straight line. It is relatively easy to find that line on a blank sheet of paper with a ruler and pencil in hand. However, finding something approximating a straight line between two points in a city like Boston with curvy, convoluted streets and dizzying traffic is much more difficult, unless you know the city well. This is why visitors to Boston are prone to getting lost or off-track while driving to their destination. However, if you can find the shortest path, you arrive as fast as possible, saving time, hassle, and gasoline.

In a similar way, you could say the Redwood City, CA, company Coraid Inc. (pronounced "Co-raid") set out to simplify SAN storage by finding the "shortest path" between a server's CPU and a storage device connected over a network. Conceptually, a straight line is simple, but finding it between two points in a complex datacenter can be difficult. It requires understanding the entire system and its interrelated components, down to the minutia, and then stepping back and thoughtfully answering the question: Which pathways and parts are nonessential? After stripping away the unnecessary complexity – the detours, doodads, and diversions – what is left is the simplest possible solution. It is clean, elegant, efficient, and, speaking in practical terms, faster and less costly.

We dare say Coraid has succeeded remarkably. It developed a lightweight protocol for storage networking called *ATA-over-Ethernet* (*AoE*) that runs over standard Ethernet switches. AoE is now published as an open standard. Then Coraid developed its *EtherDrive* line of scalable, high-availability SAN storage solutions based on the AoE protocol. The result is networked storage with solid performance at a price point 5-to-8 times less than Fibre Channel SAN storage. (Yes, that is nearly an order of magnitude less.) Read on for details.

ATA-over-Ethernet

ATA-over-Ethernet or AoE is a lightweight, open protocol for disk sharing over a network. It was developed by a team of engineers at Coraid (led by CTO Brantley Coile) as an efficient, cost-effective alternative to Fibre Channel and iSCSI block storage protocols. The constituent technologies are ATA, the standard way a computer CPU communicates with a disk drive, and Ethernet, the standard networking technology for local area networks that is available in 10 Gbit/s speeds and moving to 40 and 100 Gbit/s. Both technologies are mature and mainstream and benefit from massive economies of scale, facilitating a low price point for systems based on ATA-over-Ethernet.

AoE encapsulates ATA commands and sends them over Layer 2 Ethernet. Packets are addressed to devices using their MAC addresses. It does not use the high-level TCP and IP protocols with their associated high overhead, so it is streamlined and fast. AoE is also non-routable, which confers a degree of security because the data packets lack an IP address and cannot travel beyond the local SAN.

A SAN based on AoE is easy to implement. In this case, it requires an EtherDrive storage system, a standard Ethernet switch, and a standard Ethernet NIC and software driver (i.e., an AoE initiator) on the host server. Software drivers are OS-specific and currently available for VMware *ESX* and *ESXi*, *Linux*, *Windows*, *Mac OS X*, *FreeBSD*, and *Solaris*. The software driver automatically discovers AoE storage LUNs attached to a server. Since Ethernet is a datagram protocol as opposed to a connection-based protocol (like Fibre Channel), the driver sends datagrams to all available ports on the server and targeted storage to maximize throughput, minimize latency, and provide fault tolerance. Additional software for port bonding and multi-path I/O are unnecessary. The best performance is achieved if the Ethernet switches and NICs support jumbo frames.

iSCSI is the closest mainstream competitive alternative to AoE. While both are based on Ethernet, iSCSI uses the TCP and IP protocols and requires more processing and latency. In the analogy of straight line between two points, AoE is the shortest route while iSCSI takes a couple extra loops along the way.

EtherDrive SAN Storage

Coraid developed its EtherDrive line of SAN storage solutions based on the AoE protocol. The EtherDrive storage appliances are densely scalable, offer good throughput performance, and are relatively easy to install and manage. Most impressive of all is a price tag that starts under $600 per raw terabyte – 5-to-8 times less than competitive Fibre Channel storage systems (some of which are even more costly).

The *EtherDrive SRX-Series* is the highest performing with throughput speeds up to 1,800 MB/s. These appliances scale to 36 drives in either 3.5" or 2.5" form factors in a 4U chassis – which is up to 72 TB of raw capacity per system when using 2 TB SATA drives. Multiple units can be deployed to scale capacity well beyond the petabyte range. They support SATA drives for capacity storage, SAS drives for performance, and SSD drives (i.e., flash memory) for ultra-fast performance. RAID 0, 1, 5, 6, and 10 are available for data resilience. Connectivity options include multiple GigE or 10GigE ports.

The EtherDrive SR-Series is the low-cost option. These appliances support 3.5" SATA drives and scale to 24 drives in a 4U chassis, 16 drives in 3U, or 8 drives in 2U, depending on the model.

RAID configurations and two GigE ports are supported.

Coraid provides AoE host drivers for Linux, Windows, VMware ESX, *XEN*, *OpenSolaris*, and *Solaris*. Drivers for other operations systems are available from third parties. EtherDrive supports MAC address filtering for restricting logical volume access to host servers with specific MAC addresses. Similar to LUN masking in Fibre Channel SANs, it prevents the possibility of a host server overwriting another's data by mistake.

For high availability configurations, the *EtherDrive EMX Mirror Appliance* creates synchronous mirrors between EtherDrive systems.

For centralized management, the EtherDrive *SAN Manager* appliance provides a GUI client for discovering, monitoring, and managing all EtherDrive storage on a SAN. A *RESTful* control interface is available for HTTP scripting in cloud applications.

Founded in 2004, Coraid has accumulated a long list of notable EtherDrive customers, including Ford, Dunkin Donuts, MIT, NASA, U.S. Navy, and Lockheed Martin.

Conclusion

EtherDrive and the AoE protocol are disruptive technologies – disruptive in a good way because they facilitate a new low-cost point for SAN storage. If simplicity is the new sophistication, then AoE will be the next storage chic because it charts the most direct, efficient and inexpensive route between servers and storage over a network. Think of it as iSCSI, but without the *SCSI* or the *i*, because they found a way to network storage without the overhead of SCSI and TCP/IP. After all, who needs the complexity?

Coraid EtherDrive is suitable for a range of applications from backup and archiving to e-mail, file servers, and server virtualization. If your enterprise has a shared storage requirement where price per unit capacity is a critical factor, but you cannot sacrifice availability and throughput performance, then you should consider Coraid.

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