Cost-Effective 10GbE Accelerated VM Migration for Small to Medium-Sized IT Organizations

Like many moderate-sized organizations, the IT department of the City of Albany, Oregon had to postpone its desire to migrate from Gigabit Ethernet (1GbE) to 10 Gigabit Ethernet (10GbE), due to budgetary constraints on buying the necessary switching infrastructure. However, at a meeting of the Portland Area VMware User Group, they learned of a potential solution, in the form of a simple “back-to-back” configuration that Intel engineers had demonstrated.

In this scenario, a 10 Gigabit Intel® Ethernet Converged Network Adapter is installed in each of two servers, and cables are connected directly from one adapter to the other, without a 10GbE switch. Using network adapters furnished by Intel, Albany’s IT department reports that implementing this topology, which Intel refers to as a “departmental private cloud” infrastructure, was simple and yielded results that exceeded their expectations.

Today, the City of Albany uses this approach to perform live migration between its two production servers that use VMware View* Enterprise Edition to host virtual desktops. This project has enabled the city to take its first steps toward a broader 10GbE implementation, which would otherwise not have been possible in their current budget environment.

CHALLENGES
- Reduce time requirements for VMware vMotion* in large-host-memory environments, increasing routine and emergency live-migration efficiency.
- Begin migration from 1GbE to 10GbE, in an environment that lacks the necessary switching infrastructure.

SOLUTIONS
- Intel® Ethernet Converged Network Adapters X520-DA2 accelerate live migration using 10GbE to replace 1GbE connectivity.
- Departmental private cloud infrastructure based on back-to-back connectivity enables 10GbE connectivity without a 10GbE switch.

RESULTS
- A greater than 80-percent reduction in live migration time, from more than five minutes to under one minute for the vMotion process.¹
- Usage models based on live migration become very attractive, such as load balancing of running virtual machines (VMs) between hosts.
Innovation Amid Challenge for a Small IT Department

Albany is a city of about 50,000 people in western Oregon. The IT department provides technical services such as network administration and project management for the city’s 400 users across 15 sites, including a typical set of departments such as police, fire, parks, public works, and community development. Each of those departments requires its own applications, many of which are bought off the shelf and then customized to the city’s unique requirements. In all, Albany’s IT department supports about 200 applications.

The primary location within the IT infrastructure is at the city hall, which houses a server room and the bulk of the city’s hub-and-spoke architecture. Key locations are connected with 1GbE traffic running over fiber cabling; while that media supports 10GbE, upgrade plans will require investments in switches and other hardware that budgetary constraints make unfeasible in the near term. Therefore, no specific timetable has been set for that migration, although Public Works and library facilities have been identified as early candidates for a rolling upgrade.

The IT organization has realized significant cost savings through the use of virtualization in the past several years, including separate virtual infrastructures for the application-server environment and virtualized desktops. The organization has consolidated 50 physical servers onto six virtualization hosts. The virtualized remote desktop environment uses two servers to support Microsoft Windows* XP, Windows 7, Windows 8, and Linux* desktops using VMware View Enterprise Edition.

The desktop virtualization environment evolved in response to performance deficits associated with the use of roaming profiles over wireless connectivity by remote users. Albany uses client PCs to connect remotely to virtual desktops in the VMware View environment. The connections support only Keyboard-Video-Mouse (KVM) functionality, while the actual desktops run as VMs on the servers, dramatically reducing the burden on the wireless links.

While desktop virtualization helped Albany address the performance issues that users had been experiencing, the only path for VMware vMotion live migration between the hosts was by means of 1GbE, which proved to be relatively slow, as well as being limited to four simultaneous VM migrations. The IT organization recognized that upgrading to 10GbE would increase the number of simultaneous possible live migrations from four to eight, enabling the VMs to get off the machine faster. This ability is particularly valuable in emergency situations. The use of 10GbE would also help ensure that larger VMs could be successfully migrated, if needed.

A GRADUAL INDUSTRY TRANSITION

In recent years, the cost of 10 Gigabit Ethernet (10GbE) adapters has decreased significantly, and integrated 10GBASE-T LAN on motherboard (LOM) connections will continue to drive down deployment costs. Still, 10GbE switches are prohibitively expensive for many organizations, slowing their adoption. The back-to-back topology that underlies departmental private clouds as described in this study provides an alternate approach that can deliver many of the benefits of 10GbE to organizations that would otherwise have to wait.
A Low-Cost Approach to 10GbE Networking

Back-to-back networking based on the Intel Ethernet Converged Network Adapters allowed VMware vMotion live migration over 10GbE without a switch, as shown in Figure 1. Two direct connections between the hosts provide dedicated connectivity for vMotion, while IP traffic for the virtual desktop VMs, management, and iSCSI SAN traffic continues to be passed over 1GbE connections.

City of Albany Database and Virtual Infrastructure Administrator Russell Pearson reports that implementing the solution was fast and easy: “It was a very simple solution to put in place. We dropped the new cards in, attached the cables, VMware vSphere 5.0 discovered them, and VMware Update Manager updated the drivers. In just a few minutes, we had 10 Gigabit connectivity for live migration with eight vMotion instances instead of four.”

To test the value of the new solution, the Albany IT team set up performance testing by putting one of the two hosts in maintenance mode, with all running VMs on the remaining host. Initiating maintenance mode on the host that held the running VMs, then releasing the other host from maintenance mode, triggered a vMotion event to migrate all of the VMs. Live migration using 1GbE required five minutes, five seconds, while the same operation using 10GbE was accomplished in 52 to 55 seconds, as shown in Figure 2—a time reduction of more than 80 percent. That performance benefit is being realized today in the production desktop-virtualization environment running at the Albany City Hall.

Not long after deploying and testing the back-to-back 10GbE configuration, a hardware issue on one of the VMware View servers required moving all the desktop VMs off the server in order to shut it down and replace hardware components. The greater bandwidth of the 10GbE connection made the task fast and simple, and Pearson considers using 10GbE for live migrations a best practice.

“In a critical environment, I’d want to have 10GbE connections for vMotion in order to get the VMs off of a failing physical host as fast as possible,” said Pearson. “I wouldn’t want to experience the bad things that could happen if 40 virtual servers went silent on a host known to be failing. I’d expect there are many environments where this is the case—where IT doesn’t wish to implement High Availability or Fault Tolerant technologies, but wants to evacuate a host in minutes, not hours, when needed.”
Conclusion
A growing number of organizations such as the City of Albany, Oregon are realizing the cost-effective performance advantages of back-to-back server networking topologies using 10 Gigabit Intel Ethernet Converged Network Adapters. This simple option offers a transitional step on the path toward 10GbE for the entire data center, with the flexibility of standard and custom PCI Express* form factors, as well as LAN on motherboard (LOM) designs. As a result, today's virtualized server deployments have new cost-effective options for meeting their performance goals, even in these budget-constrained times. The successful implementation of back-to-back networking described in this paper is a solid first step in preparation toward wider deployment of 10GbE in the future.

To learn more about Intel® Ethernet Converged Network Adapters, visit www.intel.com/go/ethernet