John Rowell co-founded OpSource in 2002 and helped the company carve out a niche as a hosting company that catered to software vendors. OpSource specialized in working with software companies of all sizes that were ready to move from a “ship the disk” method of product distribution to a Software-as-a-Service (SaaS) model with a monthly recurring revenue stream.

Rowell, the company’s CTO, was intrigued when Infrastructure-as-a-Service (IaaS) entered the market a few years later. He and many of OpSource’s clients investigated the IaaS providers, and Rowell even considered using an external service for some of OpSource’s own nonessential functions. But he wasn’t satisfied that those services were ready for enterprise computing.

“When we looked at those other clouds, they weren’t secure,” Rowell recalls. “You had a single user name and password on the account, so there was no way of identifying specific users and tracking their activity. Everything was shared on a single flat network, so you didn’t know if you were surrounded by good citizens or sitting next to ‘Hackers-R-Us.’ There wasn’t any way to show compliance. There just was not enough control for business clients.”

Instead, Rowell led OpSource’s technology team as the company created its own cloud. OpSource released the product to beta in 2009 and offered it as a production service in early 2010. Today, it runs full production applications for a number of clients, using enterprise-level technologies and a layered approach to security. His team’s challenges and experiences offer practical lessons for enterprise IT managers who are standing up an internal cloud, moving workloads onto a public cloud, or looking to burst into the cloud during periods of peak demand.

“Virtualization is not the cloud...The cloud is the flexibility, the economy of scale, the burstable, on-demand delivery model with immediate use of compute, RAM, storage, and network components. The cloud is the ability to perform all those different functions against the hardware so you get the flexible usage that you want.”

John Rowell, Chief Technology Officer, OpSource
JOURNEY TO TOMORROW’S CLOUD

Get the Building Blocks Right: Designing for Performance, Power Efficiency, and Confidence

Rowell’s first challenge was to create technology infrastructure that matched the company’s business plan. That plan called for cloud services aimed at software vendors, telecommunication companies, and other enterprise segments. In many cases, OpSource would resell its cloud platform to service providers who would use it as the basis for their own cloud offerings.

The technology team knew OpSource would need dense, scalable, and power-efficient technologies to operate a profitable service at a competitive price. Clients would obviously need enterprise-level performance and availability. Raising the stakes for the infrastructure, OpSource decided to guarantee 100 percent availability for its cloud network and for individual servers within its cloud. “Our base premise was to build a cloud that would run enterprise workloads, provide enterprise capabilities, and remove objections that enterprise clients expressed about coming into the cloud,” Rowell says.

The team chose technologies from Intel, Dell, Cisco, EMC, and VMware. “We knew they could do the job, and clients have them in their own data centers,” says Rowell. “Nobody would ever say that they’re not enterprise-ready technologies.”

After performance and sizing studies, Rowell’s team chose Dell PowerEdge* R810 and R910 rack-mount servers based on the eight-core Intel® Xeon® processor X7560. “We get more bang for the buck out of higher-performance cores since we can fit more virtual machines (VMs) on them and have less unused capacity than with lower-performance cores,” says Rowell. “We can run enterprise workloads, and we have a very power-efficient foundation, which is essential for operating our data centers on the scale that we do.”

OpSource deploys infrastructure in pods designed to support more than 5,000 virtual CPUs and 15 to 20 TB of memory, with multiple pods at each data center. Under this model, network and storage face heavy demands. “Network speed and resiliency, and the ability to avoid latency are very important to the client experience,” Rowell says. “There’s a lot going on when you have as many systems as we do.”

His team chose a Cisco-based unified switching fabric based on the 10 Gigabit Ethernet (10 GbE) standard. They decided on EMC VNX5500* unified storage platforms with controllers based on the Intel Xeon processor 5600 series. To optimize storage performance, they developed proprietary software that uses the processor to sweep disks for storage hotspots and remEDIATE them.

Implement a Comprehensive Security Strategy

In the critical area of security, Rowell’s challenge was to provide the flexibility that enterprise IT managers want from the cloud along with pervasive security. The team examined security at every level and entry point and designed a multilayered, defense-in-depth security architecture.

At a Glance

Project
- Expand from SaaS and managed hosting services to IaaS

Accomplishments
- Designed and implemented a commercial cloud environment serving enterprises, services providers, and SaaS ISVs worldwide

Lessons Learned
- Base your cloud on power-efficient server and storage platforms. Minimize latency by deploying 10 Gigabit Ethernet networks, and use the Intel® Xeon® processor E7 family or Intel Xeon processor 7500 series to minimize wasted VM capacity.
- Ensure orchestration and automation technologies provide the flexibility, responsiveness, and ease of use that make cloud investments pay off.
- Implement a multidimensional security strategy and use new security technologies to create a chain of trust.
- Design internal clouds to expand into the public cloud. Work with your cloud vendor to connect securely and manage internal and public resources in an integrated, transparent manner.
Orchestration provides the flexible access and control that separates cloud computing from virtualization.

cloud environment. His team implemented network security within the switching fabric rather than on top of the virtualized servers. They chose configurable Layer 2 virtual LANs (VLANs) to improve elasticity and physically isolate network types and segments.

Another important design choice was the use of Cisco technology to allow customizable firewalls based on an access control list (ACL). Enterprise IT clients can configure and lock down their compute, network, and storage environments. They can also configure VLANs between servers, configure their firewalls, and control and track their administrative usage. “Clients know where their servers sit, and they know what other servers sit around them,” Rowell states. “They have full security around their servers. They have a firewall, and they can do network address translation access control.”

To address data security, Rowell’s team implemented a cloud file system that stores data with 128-bit SSL encryption while in transit and 256-bit encryption at rest. He’s looking at Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI) to accelerate the encryption process going forward.

Rowell stays on the lookout for new security technologies and confesses to being downright excited about the Intel Xeon processor E7 family because it includes new Intel® Trusted Execution Technology (Intel® TXT). Intel TXT helps guard cloud infrastructures against malware by providing a hardware root of trust and validating the behavior of server components such as the BIOS and firmware at start-up time. It also provides a geo-tagging capability that Rowell says his team can use to give enterprise users added assurance that regulated workloads remain in designated environments.

“How often do you get excited about a new processor?” Rowell asks. “I mean, it’s a processor, right? But Intel TXT looks like it will give us some really nice capabilities around being able to segment and isolate virtual servers that sit on top of the hypervisor. We see a lot of value in that capability, and we’re pushing the vendor community to provide broad support as soon as possible.”

Provide Automated, Granular Control and Flexibility

While infrastructure and security are critical, Rowell says his team’s biggest challenge has been orchestration: provisioning, coordinating, and managing cloud resources so enterprise IT managers get immediately available resources along with the desired flexibility and control.

“We wanted to give clients very granular control of the cloud’s resources and provide an interface that would let them specify exactly what they want and in five minutes have it available for use,” Rowell states. “We also had a big ‘aha’ moment in realizing that people love the flexibility and the billing model of IaaS. Even if they’re using the cloud in a static fashion, they like being able to pay by the hour.”

To meet those requirements, the team created a custom orchestration engine. A dozen developers spent six months on the orchestration layer, building on software OpSource had developed or acquired for its SaaS and managed hosting services. The resulting solution lets enterprise clients do self-service provisioning of cloud-based CPU, memory, storage, and networking. It also provides the structures OpSource needs to deliver hourly, subscription-based services with sign-up, metering, billing, and reporting.

Recognize the Difference Between Virtualization and Cloud

What insights can Rowell share with enterprise IT managers? A good starting point is to make sure you understand what the cloud is. “Virtualization is not the cloud” Rowell says. “We talk to a lot of people who don’t understand that, and they get burned. They buy the infrastructure, they buy the virtualization software, and they think that gets them the cloud, but it doesn’t. End users can’t access the system directly. There is no user access and control, no auditing, no billing, no chargeback.”

Orchestration is the missing element in that scenario, according to Rowell. “The cloud is the flexibility, the economy of scale, the burstable, on-demand delivery model with immediate use of compute, RAM, storage, and network components,” he says. “The cloud is the ability to perform all those different functions against the hardware so you get the flexible usage that you want. Orchestration is the key to pulling that off and being able to consume cloud-based

“What you want is to have essentially a single pane of glass that shows your internal resources as well as the public cloud, and lets you move back and forth between them.”

John Rowell, Chief Technology Officer, OpSource

Key Technologies

- Dell PowerEdge* servers with the Intel® Xeon® processor X7560; preparing to test platforms based on the Intel Xeon processor E7 family
- Cisco Data Center Business Advantage solutions: Cisco Catalyst® 6500 Series Switches, Cisco MDS® 9000 Series Multilayer Directors, Cisco ACE® Application Control Engine Modules, and Cisco Firewall Services Modules to provide multiple layers of defense
- EMC VNX5500® unified storage platforms with the Intel Xeon processor 5600 series
- Red Hat Enterprise Linux®
- VMware vSphere® 4.0

OpSource
“Build your private cloud and deploy it with the capabilities you need to service your end clients, but design it in a manner that lets you utilize public cloud capabilities too, because there will be times where you’ll need additional processing power and you’re not going to want to go out and buy systems for it.”

John Rowell, Chief Technology Officer, OpSource

services or cloud types of capabilities. Orchestration gives you what you need as an enterprise to be successful, so if you’re developing an internal cloud, you need to find an orchestration solution that gives your users that control.”

Ask Questions About the Public Cloud
For IT teams that are considering external cloud services, Rowell recommends looking for a public cloud that mimics the controls and security you have within the enterprise. “The public cloud should look like your own internal base,” he says. “You should be able to segment types of servers, traffic, and applications in a secure, multi-network fashion. You also need to make sure your users will have a secure connection into that public cloud, either through a site-to-site VPN or through a client other than VPN.”

Not surprisingly, Rowell suggests scrutinizing the cloud’s automation and orchestration services. How fine-grained are the controls? How easy is it to use the self-service capabilities? How automatically—meaning, how rapidly—does the service implement your self-service provisioning changes? How much visibility do you have into your cloud operations? “What you want is to have essentially a single pane of glass that shows your internal resources as well as the public cloud, and lets you move back and forth between them,” he states.

If you’re establishing an internal cloud, Rowell advises incorporating the public cloud into your plans. “Build your private cloud and deploy it with the capabilities you need to service your end clients, but design it in a manner that lets you utilize public cloud capabilities too, because there will be times where you’ll need additional processing power and you’re not going to want to go out and buy systems for it,” says Rowell. “As you expand and grow, it’s important that you design your cloud for that eventuality.”

©2011, Intel Corporation. All rights reserved. Intel, the Intel logo, and Intel Xeon are trademarks of Intel Corporation in the U.S. and other countries.