VMware Seamlessly Migrates All Production Workloads to a New Data Center

INDUSTRY

CLOUD COMPUTING AND PLATFORM VIRTUALIZATION SOFTWARE AND SERVICES

LOCATION

PALO ALTO, CALIFORNIA

KEY CHALLENGES

- Migrate mission-critical workloads to a new data center with close to zero downtime
- Incorporate all relevant stakeholders in the migration process

SOLUTION

VMware IT was able to migrate workloads to a new data center with minimal downtime. This massive undertaking was only possible due to precise planning, seamless team collaboration, VMware products and multiple testing runs in non-production environments to finalize the ultimate live approach. And everything was successfully accomplished within the designated 12-month timeframe.

VMware IT needed a solution for migrating mission-critical workloads to a new data center.

VMware, a subsidiary of Dell Technologies, provides cloud computing and platform virtualization software and services. It was the first commercially successful company to virtualize the x86 architecture. Today, VMware software powers the world's complex digital infrastructure. The company's various offerings provide a dynamic and efficient digital foundation to more than 500,000 customers globally, aided by an ecosystem of 75,000 partners.

The challenge

VMware's production workloads, including the majority of mission-critical applications, were run out of a leased data center with low power density and high cost. Because more than half the gear was about to depreciate, VMware had the opportunity to build infrastructure in a new, modern data center and move its live workloads—more than 4,000 virtual machines (VMs) supporting more than 400 lines of business. This complex undertaking could also result in a significant negative impact on VMware's $10 billion business if the move failed. It would require intricate coordination between multiple IT teams. Even more pressing, the entire operation had to be accomplished with close to zero downtime for such a major infrastructure change.

The solution

From the start, clear and actionable guiding principles were put in place from both technology and human/personnel perspectives. This approach ensured all of VMware IT and the business units functioned as a single entity during every phase of the migration. The goal was to have no surprises at any stage, and to have zero business impact during migrations. Keys to success included identifying infrastructure owners and experts, building in enough time for change freezes and setbacks, defining deliverables, having clear and often communication, and tracking progress/monitoring critical resources.

The IT team migrated groups of applications and VMs together based on dependencies, starting with the simplest migrations and then moving on to the most complex. Nothing was left to chance as there were environment safeguards in place during every phase. For each part of the infrastructure migrated, the most important production application was migrated concurrently with the network connectivity.

BUSINESS RESULTS

- Expensive rack space and power was reduced by nearly 70 percent.
- Proper planning using VMware technology and complete team and leadership buy-in was required.
- By incorporating all relevant stakeholders during each phase, a seamless transition was achieved.

Another consideration was legacy systems. Although some of the infrastructure had depreciated and reached end of life, some assets were still not fully depreciated from a financial perspective. This made them ideal candidates for reuse. The new data center required less hardware as modern technology is both denser and faster—more is done with less.

Procurement of seed capacity was required to begin the migration, followed by a game of musical chairs—teams incrementally migrated some workloads before the underlying equipment could be moved and reused. Software licensing agreements tied to physical CPU cores or sockets were also a big consideration.

The migration strategy: A tale of two approaches

When it came to the network migration, there were two distinct choices. Both had challenges and benefits. The first was to take a VLAN-by-VLAN gradual approach. The intent was to avoid totally disrupting the ecosystem during the move, thereby easing into the transition. If one migrated component went down, the remaining infrastructure at the old data center could still function and not significantly impact the business. The second approach involved a comprehensive, one-time move of every element, including subnet gateways, firewall policies, internal summary routes, portable space and external route advertisements.

Ironically, the VLAN-by-VLAN approach that seemed the logical choice proved the opposite. Some network address translation (NAT) public IPs might change as they were being accessible from the new data center. This meant software-as-a-service (SaaS) provider whitelists would need to be changed, too. There were also valid concerns about handling the internal firewall traffic as there were legacy rules that would need to be vetted, which required a very fragile (and error-prone) construct. Both drawbacks meant the migration process would actually lengthen and jeopardize a clean migration of firewall policies.

Thus, the second approach became the obvious choice, despite its own set of mission-critical risks.

Ups and (a lot less) downs

Ensuring minimal downtime via the second approach required implementing an L2 network extension that leveraged VMware vSphere® Cross vCenter® vMotion® (and array replication) to move storage across vCenters. This tool allows VMs to be live-migrated from one vCenter to another, while simultaneously changing each VM's compute, storage and network resources.

To enable this to succeed transparently, it was necessary to extend the VM's Layer 2 subnets across to the new data center, which effectively allowed migrated VMs to continue operating without any change to their network configuration. When VMs were migrated and appeared on the other side of an extended subnet, a gratuitous Address Resolution Protocol (ARP) would be sent out for Layer 2 reachability update purposes. The vMotion subnets were also Layer 2 extended, which further improved vMotion speeds and decreased migration times. Because the Layer 2 extension was a foundational part of the multi-month migration, it was implemented with multiple high-bandwidth links and an auxiliary network backup path.

A separate network link exclusively for migrations was also created to prevent throttling of existing production traffic. Parallel project tracks for application, capacity and physical moves were also put in place, as was the network cutover implementation plan. The application moves required discrete parallel tracks for efficient IT planning and execution, and to minimize business impact. Additionally, VMware NSX® micro-segmentation remained intact during the transition, enforcing network security between applications.

VMs using core network services (such as DNS and NTP) were migrated with the settings untouched because reachability to these original services were required during the migration. When needed, these settings were changed by VMware's proprietary automation solution, Puppet, so the old service IPs could be retired. The DNS responder's IP was added onto the Infoblox in SC2, whereas NTP settings were changed due to a more scalable and secure NTP solution implemented during the migration.

From an Active Directory standpoint, lookups of the active domain controller continued in the normal way, finding the closest available and most responsive domain controller. The old data center domain controller was migrated to the new data center due to older configurations that still might be in use; some applications may directly reference a domain controller by name. And because part of the migration required active subnets to be migrated, some updating needed to be done to the configuration management database (CMDB) system, the IP address management (IPAM) system, and Active Directory Sites and Services.

An easily averted disaster

While the old data center had significant resiliency, high availability (HA) and disaster recovery (DR) protections in place, there was concern these would not migrate well. The answer came in the form of VMware Site Recovery Manager™, which offered both a multisite option and significant cost reductions over competing solutions. This allowed IT to share the same set of DR hardware by simply adding another pair of Site Recovery Manager server VMs. With this configuration, VMs migrated to the new data center would be protected by the Site Recovery Manager instance associated with the new data center.

Site Recovery Manager was also employed for the migration itself. For example, a very expensive storage array for the Apache Hadoop environment wasn't due for a tech refresh yet. So the team leveraged Site Recovery Manager to failover to VMware's DR site, physically moved the storage array to the new data center, and then synced the data back without any downtime or disruption.

Getting everyone on board

The human aspect of the migration program consisted of leadership and execution committees, monitoring and control of protocols, and associated strategies. Committees were tasked with ensuring any and all issues were dealt with in real time with buy-in from all applicable stakeholders. Monitoring and control changes were tracked by an in-house CMDB tightly integrated with the production application and infrastructure landscape. The communication strategy involved guaranteeing consistent and cohesive communication, as well as monitoring of major reports. Finally, the execution strategy encompassed management of all tracks in parallel to enable all teams to work as independently as feasible.

Solid plans for a solid foundation

Infrastructure preparation involved auditing and matching existing compute capacity in the new data center, refreshing old hardware with updated versions and repurposing existing hardware from the old data center. Data migration was accomplished using network extension (mandatory for any live workload), storage vMotion and replication. SAN-based replication was employed to replicate raw device mapping (RDM) hardware. DR and business continuity—the most important considerations—involved adherence to an extensive checklist for each application migrated.

Application and database migration

vMotion ensured that mission-critical applications and databases would not suffer any downtime, although the individual size of the app/database could affect response times. Overall migration was grouped into five different batches, with each batch containing different sets of applications. Less critical and independent applications were migrated first to reduce network chatter between data centers. A staging environment allowed for testing complex application stack behavior and performance before migrating to production. This ensured the least impact to production.

An on-time success

Despite the significant risks and the high price to pay if the migration failed, the chosen approach proved to be an unqualified success—it was even completed within the required timeframe. Business was minimally impacted, and the vast majority of those potentially affected were unaware of the data center migration at all. There was a 3:1 reduction in rack space and power (major cost centers), enabling VMware to do a lot more with a lot less. This was all due to a thoroughly planned/designed migration approach, seamless team collaboration and multiple testing runs in non-production environments to execute the ultimate live cutover.

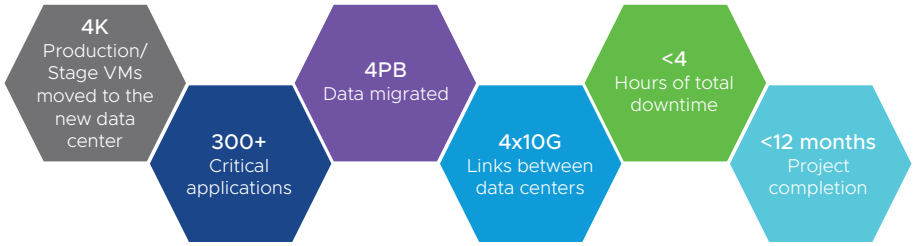

FIGURE 1: Stats and requirements for data center migration.

Products used:

- VMware vSphere, VMware vSphere vMotion, VMware PowerCLI, VMware NSX
- VMware vSAN™, Dell EMC VxRail, VMware Site Recovery Manager
- VMware vRealize® Operations Manager™, vRealize Log Insight™, vRealize Network Insight™
- VMware Horizon®