EMC is migrating its corporate data center from Westborough, Massachusetts, to a new energy-efficient, Cloud Data Center in Durham, North Carolina.

The migration requires the relocation of more than 350 applications and six petabytes (6 PB) of critical data used by some 51,000 employees worldwide.

While the EMC® IT organization has gained considerable experience integrating applications, infrastructure, and operations from EMC acquisitions into its data centers, it has not previously managed migration on such a large scale.

To minimize risk and stay within budget and timeframe constraints, EMC IT engaged EMC Consulting to help plan and manage its data center move. EMC data center migration consultants bring experience, best practices, and tools that have been proven and refined in hundreds of client engagements.

EMC Consulting is working with EMC IT to discover, analyze, and plan the migration of applications and data from the source environment.

The high degree of virtualization and consolidation in the source data center and standardization in the target data center will streamline and simplify actual migration, but it also complicates planning and decisions about which applications and data need to move together—and in what sequence.

In an environment where “almost everything is connected to everything else,” the discipline of meticulous migration planning and proactive program management is proving more important than ever.
VIRTUAL DATA CENTER MIGRATION

Just as many organizations use the necessity for relocation to a new data center as an opportunity for transformation, EMC IT is leveraging migration to its new data center in Durham, North Carolina to accelerate its journey to the cloud.

The facility significantly reduces operating costs and environmental impact through energy-efficient design. Its location, some 600 miles from the EMC data center in Hopkinton, Massachusetts, provides greater resiliency in the event of regional disaster than the Westborough site, which is only about 10 miles away from Hopkinton.

The new Durham Cloud Data Center is fully standardized on a single version of the VMware® vSphere™ operating system (OS) on an x86 enterprise hosting architecture, built using the Virtual Computing Environment (VCE) Vblock™ Reference Architecture. This standardized virtual infrastructure provides the foundation for cloud that will enable EMC IT to locate and easily move workloads transparently within the Durham data center for maximum efficiency, performance, and utilization.

Currently, more than 75 percent of the applications in the Westborough data center are running on a virtual platform—and all applications moving to the Durham data center will be virtualized before migration.

No hardware is being relocated to the new facility as part of the data center migration. Instead, applications and data will be moved across a redundant 10-gigabits-per-second fibre optic Ethernet link, using EMC best practices, technologies, and tools.

MIGRATION THROUGH REPLICATION AND RECOVERY

EMC first evaluated the feasibility of direct virtual-to-virtual migration (V2V) between the sites. However, given the volume of applications with high-availability requirements in the corporate data center—and after testing—EMC IT and EMC consultants determined that a V2V migration would take too long and would not be feasible.

Instead, the applications and data associated with each move bundle will be moved using a combination of VMware and EMC technologies, including: VMware Storage VMotion™, staging/swing arrays in the source and target sites, EMC SRDF® data replication, and VMware Site Recovery Manager (SRM) software.¹

The advantage of this scripted, staged, and automated approach is that it enables much of the work of preparing applications and data for each move event to be done—and tested—beforehand, without impact on the production environment.

As a result, application downtime, migration complexity, and the risk of unknowns occurring during the live cut-over event can be dramatically reduced.

PLANNING BECOMES EVEN MORE IMPORTANT

While the combination of EMC and VMware replication and recovery technologies brings many advantages to migration execution, each move event requires meticulous planning and the coordination of many moving parts to identify dependencies and address potential problems.

The EMC Consulting Migration Methodology applies disciplined discovery and analysis, group planning methodologies, and proactive program management to ensure a smooth, on-schedule migration without disruption to the business.

¹ To learn more about the technologies and processes enabling the actual migration of application and data during the move events, please refer to the EMC Durham Cloud Data Center: Application & Data Migration strategy brief.
Experience has shown that the most common reasons that data center migrations run into trouble are:

- Inaccurate and/or incomplete information about the IT environment
- Lack of understanding about how applications and data are actually used by the business and service-level requirements
- Lack of application-centric planning to identify interdependencies among applications, databases, and infrastructure
- Under-estimation of internal effort and resources required from the IT organization, which remains responsible for day-to-day operations in addition to migration planning and preparation tasks
- Inability to track changes to applications and infrastructure in a highly dynamic environment and integrate these changes into the migration planning effort
- Lack of active participation, buy-in, and sign-off by business functions and application owners to overall migration and specific move event plans

These issues are exacerbated in a highly virtualized and consolidated environment, making the full discovery of IT assets, analysis of their interdependencies, and planning even more important.

For example:

- **Configuration and change management has not kept up with virtual infrastructure**—The very advantages of virtual infrastructure—the ease of provisioning virtual machines (VMs) and the ability to move workload to optimize efficiency and performance—encourage a kind of “virtual sprawl” that is difficult to manage using traditional configuration and change management processes. In addition, reconciling and validating configuration information and sources of record is more difficult and time-consuming in a highly virtualized and consolidated environment than inventorying physical assets with their 1:1 application-to-server ratio.

- **Increasingly “everything is connected to everything”**—Identifying the interdependencies among applications and infrastructure becomes more difficult in consolidated and virtualized environments. In a highly virtualized and consolidated environment, many applications are dependent on the same database and running on the same application tier hardware.

- **Continuous change in a highly dynamic environment**—Business demands—and the increasingly virtualized IT that support them—are both, by their nature, dynamic. Changing business conditions, requests, and timelines, new applications, workload balancing, resource provisioning, and changes in the underlying infrastructure—all make keeping up and adapting to changes that will impact migration planning and execution a big challenge.
EMC DATA CENTER MIGRATION METHODOLOGY: MINIMIZING RISK AND COST

Over the years, EMC Consulting has developed and refined a rigorous data center migration methodology that reduces risk, cost, and timeframes through the application of defined best practices and specialized, automated tools.

Program Management: A Program Management Office (PMO) oversees all aspects of planning and migration. It works with business and IT stakeholders to determine acceptable levels of application availability and risk, to balance risk and cost, and to align migration strategy with data center and business strategies. It sees that all necessary roles and responsibilities are defined, agreed to, and committed to implement the strategy. It sets up the appropriate governance structure and keeps all workstreams in sync throughout the migration.

Discovery and Analysis—It is a core EMC migration principle to “discover everything before planning to move anything.” EMC Consultants use interviews, workshops, and proprietary discovery and data management tools to discover all existing IT applications and assets, how they’re used by the business, their dependencies, and their availability requirements. This focus on applications—and how the business uses each application—differs considerably from traditional migration planning, which looks primarily at the servers running in the environment. All requirements and interdependencies are documented and validated with all business, application, and technical stakeholders. Then “move bundles” are defined and a high-level move schedule is developed.

Planning—Group planning sessions tie all workstreams—for both business application and IT teams—together into one detailed migration plan. Plans are reviewed in live “table top” sessions with the full participation and sign-off of all impacted business and IT stakeholders to ensure that both the business and technical teams are prepared and agree to the plan. Comprehensive workbooks are prepared for each workstream that document prerequisites, process steps, and contingency plans. A final master runbook is created and, once approved, again by the relevant business and IT teams, is used to create an online, hour-by-hour dashboard of all migration tasks and their status during execution.

Execution—After a final review of all plans, a final table top session is held and a GO/NO-GO decision is made. With GO, the migration is executed as planned. Planned and actual status for all workstreams is displayed via web-accessed dashboards.

DURHAM CLOUD DATA CENTER MIGRATION PLANNING

EMC IT formally engaged EMC Consulting as ground was being broken for construction of the new data center in Durham in January 2010.

EMC IT personnel did the bulk of the migration planning and execution work, with EMC consultants driving discovery and analysis, helping develop a migration strategy, guiding and documenting the detailed planning process, and providing the over-arching program management required for EMC IT to:

- Successfully migrate about 350 mission- and business-critical applications and 6 PB of data with minimal disruption to both business and IT and zero unplanned downtime
- Begin using the new data center as soon as possible to enable the business and IT to start to realize return on the investment in the new EMC Cloud Data Center
- Complete migration on schedule and decommission and restore the old data center facility to pre-lease condition before the lease expires at the end of 2012

EMC consultants are also contributing to aspects of Application Rationalization, Platform Re-Architecture, Business Continuity and Disaster Recovery BC/DR Planning. Solution architects from the EMC Global Services organization work with EMC IT on the replication architecture. Resources in the EMC Virtual Services Delivery (VSD) organization in India are also part of the Durham Data Center migration team, enabling a 24-hour work cycle.
EMC MIGRATION APPLICATION DATABASE (MAD)
In support of its methodology, EMC Consulting has developed and uses integrated discovery, data collection, validation, analysis, planning, documentation, and program management tools that help to further reduce time, cost, and risk in all phases of migration.

One of the cornerstones of the EMC Consulting data center migration methodology is the Migration Access Database (MAD). MAD provides a single, central repository for all application and asset data collected through automated discovery tools, interviews, workshops, and systems of record. It includes tools to validate data and to link information about interdependencies and service-level requirements to each asset. MAD analysis tools help automate the process of creating move bundles (groups of applications and infrastructure that for business, application, or infrastructure reasons must be migrated together). The data in MAD is used to help create workbooks that document in detail how all assets will be migrated and this information is fed into an online dashboard to show the planned and actual status of all tasks during move event execution. MAD also uses tools to maintain strict change control. With most migrations extending over many months or even years, MAD helps ensure that planning stays in sync with any and all changes in the existing IT environment or target facility and infrastructure.

PMO: KEEPING EVERYTHING IN SYNC FOR TWO AND A HALF YEARS
All teams report into the EMC Consulting Program Management Office (PMO), which coordinates and synchronizes activities through all phases of the migration.

Keeping dozens of interdependent migration workstreams and teams coordinated is critical in a dynamic data center environment with hundreds of projects in flight—and a migration effort spanning more than two and a half years.

- **Migration Strategy**—The PMO worked with EMC IT to develop a migration strategy, identify and gain the buy-in of stakeholders, and set up and manage governance, communication, and escalation processes that are critical to keeping the many moving parts of a large data center migration in sync.

In addition to addressing the known challenges involved in any large data center migration, the PMO and EMC IT worked together to try to anticipate new kinds of issues that might arise in the migration of a highly virtualized and consolidated IT environment. By identifying unknowns and possible issues upfront, they are able to build in contingencies to isolate and limit the impact of any potential problems and keep them from cascading to other parts of the migration.

- **Realistic Resource Commitment**—The PMO helped EMC IT to realistically estimate the resource commitment required from their organization for a successful on-schedule migration. Based on experience with migrations of similar scope, the PMO provided EMC IT with concrete time commitment estimates for different types of resources (e.g., application SMEs, developers, DBAs, and security, server, storage, and network administrators) in terms of hours per week during different phases of the program. As is often the case, initial EMC IT estimates were significantly lower than what, in practice, is required.

- **Governance**—An EMC IT Program Leadership Team was formed to drive the overall migration effort. It reports into an Executive Steering Committee at the VP level, which was set up to review progress and approve decisions at key milestones. The Steering Committee reports to the EMC CIO, CFO, and CEO on a quarterly basis. Infrastructure leads manage facility and infrastructure design and build projects (e.g., Core Network, Data Center Network, Foundation Applications and Services, Backup/Recovery, Security, Virtual Infrastructure). Move event leads are responsible for driving all activities required to successfully migrate a specific group of applications.

- **Escalation**—Workstream leads escalate any issues to the PMO, which documents them, makes recommendations, and is charged with resolving 80 percent of escalated issues within two business days. Unresolved issues are escalated to the Program Leadership team, which has committed to resolution within one business day. Any remaining unresolved issues are escalated to the Executive Steering Committee.

- **Communication**—A data center migration portal was set up for teams to share and store information and regular reporting to and by the PMO. The Program Leadership Team holds regular, live “Town Meetings” with the EMC IT global community. Business owners are apprised of progress, schedules, and issues affecting their applications. As the migration proceeds, some Town Meetings will be expanded to include the greater population of EMC employees.

- **Change Control**—With technologies evolving rapidly and the Cloud Data Center migration spanning two and a half years, change—both unavoidable and desired—will happen. The PMO uses meticulous planning documentation, communication, and tracking tools to understand and fully adapt to unexpected changes. It also helps EMC IT weigh the potential cascading impact of a change, so decision makers are fully informed of the ramifications across the migration as a whole.

- **Tracking Value**—The PMO worked with EMC IT to define the ROI metrics for its data center migration. It tracks and reports on actual value realized at key milestones and compares it to expectations.
The EMC IT Program Leadership Team was skeptical that the Discovery and Analysis phase of the migration would take the nine months allotted to it in the initial program plan.

As the Discovery and Analysis process moved forward, however, the team came to appreciate the value in “discovering everything before planning to move anything.” Intensive effort was necessary to be sure that potential issues were identified, documented, and planned for upfront to avoid surprises and complications later, when the impact on ever more tightly meshed move event plans and schedules would be far reaching; or worse, cause an application to go offline unexpectedly and disrupt a critical business function.

In fact, the high degree of virtualization, database consolidation, and tiered, shared infrastructure in the existing EMC data center required more than the nine months initially allotted to ensure accurate, validated data—and carefully define move groups in such an environment. As a result, finalization of a high-level move event plan was delayed by more than a week.

• Data Discovery—EMC data center migration consultants conducted workshops and used automated tools to help discover and collect data from existing systems of record on assets supporting about 350 applications. Move event leads spent about three months interviewing business owners and technical experts to collect information on each of their assigned applications. This data included availability and performance requirements, how the business uses the application, and interdependencies with other applications, databases, and infrastructure. As is commonly the case, configuration and change management processes and systems in the existing EMC data center had not kept up with the growth of virtual environment, increasing the effort required to ensure data was complete and accurate.

• Validation and Analysis—All discovery data was transferred to the Migration Access Database (MAD) repository, where it was validated and analyzed by EMC consultants using MAD tools. EMC IT, like many IT organizations, had long relied on multiple, siloed systems of record, with information about different technologies stored in different systems by different groups. Over the years, a number of “band-aid” tools and processes had been developed to try to keep configuration data up to date, including a home-grown application to map back information from physical inventories, maintenance contracts, and license agreements. Nevertheless, the validation process revealed that the data in the systems of record was not accurate or complete.

• Accelerating CMDB—EMC IT had already recognized the importance of consolidated configuration management to its cloud computing strategy—and it had already begun to move to a single configuration management database (CMDB) and rigorous change management process as part of its journey to the cloud initiative. This work contributed to the migration Discovery and Analysis effort—and the validated information in MAD on assets and the relationships among applications, databases, servers, and storage infrastructure is helping EMC IT to consolidate and reconcile its multiple systems of record.

• Defining Move Bundles—Once discovery data had been validated and analyzed, EMC consultants worked with EMC IT to create application move bundles—groups of applications that needed to be moved together to maintain the dependencies and integration required to deliver services. This effort, too, was complicated by the high degree of virtualization and consolidation in the existing data center environment. For example, EMC IT was able to achieve a database server consolidation ratio of 71:4 in its Oracle business-critical database environment and 77:21 in its Oracle mission-critical database environment. These and similar consolidations across the SQL database environment have significantly enhanced agility and cut infrastructure and operational costs. But they have also resulted in many more applications relying on fewer databases and sharing the same grid infrastructure, complicating the defining and sequencing of move bundles. Because, in effect, “almost everything is connected to everything” in such a virtualized and consolidated environment, separating out and defining bundles became more difficult. To address the issue, EMC IT and EMC Consulting decided to make move events database centric. That is,
application bundles would be defined by database grid dependency. Practically speaking, this means larger bundles of applications, but fewer move events. It also enables clean, efficient array-to-array migration of data.

• Move Event Schedule—Once bundles were defined, the migration team developed a Move Event Schedule. In addition to the bundles themselves, the Move Event Schedule factors in the timing of business events (e.g., quarterly financial reporting, the build-out and readiness of target infrastructure in the new data center, and other factors, such as “go live” dates for new applications being built in the new data center, such as a new enterprise SAP ERP v6 system). The Durham Cloud Data Center Move Event Schedule outlines 23 database-centric move events for moving eight database grids (Oracle and SQL mission-critical and business-critical grids for production, disaster recovery, test and development, and business intelligence/data warehouse). It also incorporates seven “contingency move events” to get back on schedule, in the event of a problem, without unraveling the entire plan.

PLANNING: T-MINUS 10 WEEKS FOR BUSINESS AND IT

The Move Event Schedule is a key milestone, marking the end of discovery and analysis and the beginning of a more detailed planning process, in which all business, technical, and operational people and processes must be “marching in lockstep” going forward. Any change to the plan from this point on can be serious, because as move dates approach, unplanned changes can have a domino effect on other events.

Planning starts with notification to the business application owners and move event teams to review and confirm information about their application, database, and infrastructure mapping—and to be prepared to participate in final, detailed planning 10 weeks before their move event is scheduled to occur.

• Table Top Sessions—All of the key business and IT people impacted and involved in each move event—application owners, EMC IT executives, IT operations resources, and migration consultants—participate in a series of three live Table Top sessions to ensure complete understanding and buy-in to what has to happen when—and who will do what.

The first Table Top focuses on how applications are going to be shut down, prepped, brought back up, and tested. The second Table Top session focuses on contingency planning and includes vendors that are involved. The third Table Top includes a complete review and walk through of the detailed Move Event plan.

• Run Books—in coordination with the Table Top sessions, teams develop detailed migration plan “run books” that document every step, in 15-minute increments, of precisely who needs do what when, to make the migration successful. This includes: readiness of the target infrastructure, preparation of the applications, procedures for shutdown, startup, and testing of networks, servers, storage, and databases, and contingency plans outlining the steps to be taken if something goes wrong—with precise instructions for troubleshooting and/or a rollback. Final run book data is loaded into an online, web-accessible dashboard, which is used during execution.
EXECUTION
The execution phase for each move event begins with a final review target infrastructure and move event readiness—including a final Table Top exercise to confirm agreement with the approach, planning, and timing.

• Go/No-Go—with a Go decision, the event begins and everyone plays their part in executing the choreographed plan. Conference bridges are set up for technical discussions among teams. Every step is monitored, and multiple levels of dashboard views provide executives and teams with minute-by-minute status.
• Decommissioning—all migrations are scheduled to be complete by the end of summer in 2012, with build out of the new ERP system in Durham expected to be ready for cut-over in late autumn. Once all move events are complete and all business owners certify acceptance, decommissioning of the Westborough facility can begin. EMC Consulting will oversee efforts—such as the removal, re-use, and recycling of old equipment and wiring and clean up—to bring the old site to its pre-lease, agreed-upon condition, before the lease expires in December 2012.

LESSONS LEARNED
With move bundles defined, the Move Event Schedule completed, and final detailed planning underway, EMC IT and EMC Consulting have gained valuable experience in the planning of migrating a highly virtualized and consolidated environment to a new virtual infrastructure in a new, energy efficient and resilient data center designed for cloud.

The primary lessons to date are:

• Virtualization opens new possibilities and promises greater ease of actual migration of applications and data
• The traditional IT challenge of maintaining accurate, up-to-date information on all applications, infrastructure, and interdependencies is exacerbated by the ease of provisioning and moving VMs in a highly virtualized environment
• Consolidation of databases and application tiers necessitates a new look at how best to bundle and sequence applications
• The discipline and principles of program management, discovery and analysis, and meticulous planning of migration events becomes even more important in a virtual IT environment

T-MINUS 10 WEEKS
Week 10: Kick-Off Meeting with Business and IT Stakeholders
Review/Confirm Application and Infrastructure Mapping
Week 8: Approval/Event Freeze
Table Top #1—Application Shutdown/Startup
Week 7: Contingency Plans Collected
Week 5: Table Top #2—Contingency Plans, Vendors, Roles, Availability
Week 4: Confidence Reboots and Issue Resolution Complete
Week 3: Table Top #3—Full Plan/Runbook Review & Walk-Through
Week 1: Confirm Pre-Migration Readiness
Review Backup Status
Final Go/No-Go

0:00:00 MIGRATION EVENT—Started/Completed/Accepted
+1 Week Review/Lessons Learned
BACKGROUND:

EMC IT: THE JOURNEY TO THE CLOUD

EMC Global IT delivers services to more than 51,000 internal users across 400 corporate offices in 80 countries. Operations span five data centers and host 500 applications and ten petabytes (PB) of data.

To reduce costs, improve services, and enable business innovation and competitive advantage, EMC IT embarked on a journey to the cloud to move from a physical to a virtualized IT infrastructure with more automated processes to deliver IT-as-a-Service (ITaaS). EMC’s vision is to offer the entire IT-Stack-as-a-Service through on-demand, self-service provisioning with metered usage for chargeback. As such, ITaaS capability spans server, storage, and network infrastructure; enterprise applications; databases; security services; virtual desktop services; and more—with the ability to draw Infrastructure-as-a-Service and Software-as-a-Service from a shared pool of virtual resources in EMC data centers and/or partner data centers across the globe.

To share its experience and lessons learned, EMC introduced the EMC IT Proven™ program to chronicle its journey to the cloud.

REFERENCES

Read the following for more information:

www.emc.com/EMCITProven

EMC IT’s Journey to the Private Cloud blog at http://itblog.emc.com/

EMC IT’s Journey to the Private Cloud white paper series; topics include:

EMC IT’s Journey to the Cloud: A practitioner’s guide
Backup and Recovery
Applications and Cloud Experience
Virtual Desktop
Server Virtualization
ESG IT Audit: EMC’s Journey to the Private Cloud

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