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White Paper

EMC IT's Journey to the Private Cloud: A Practitioner's Guide

Best Practices Planning

Abstract

This white paper is the first in a series of EMC IT Proven papers describing EMC IT's initiative to move toward a private cloud-based IT infrastructure. EMC IT defines the private cloud as the next-generation IT infrastructure comprising both internal and external clouds that enables efficiency, control, and choice for the internal IT organization.

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Executive summary

EMC is transforming its IT operations to improve its customer focus, create business transformation, and deliver operational efficiencies. To achieve these goals, EMC IT has embraced the private cloud approach to IT infrastructure. EMC IT defines the private cloud as the next-generation IT infrastructure comprising both internal and external clouds that enables efficiency, control, and choice for the internal IT organization.

By transitioning to a private cloud-based IT infrastructure, and using the advanced capabilities that such an infrastructure provides, EMC IT's ultimate goal is to enable end-to-end, on-demand self-service provisioning of IT services to its customers—the business units at EMC.

EMC IT has been concentrating first on its internal infrastructure to prepare for the transition to the cloud—and virtualization is at the core of this effort in shaping the new infrastructure. EMC IT has defined six key programs, introduced in this white paper, that are focused on the various components of the enterprise data center. Each initiative's goal is to move EMC further along on its vision to build integrated infrastructures for virtualization at scale. Separate papers describing each initiative in detail are currently being developed to provide more information on EMC IT's respective strategies in moving toward a cloud-based IT infrastructure.

In parallel, EMC IT is developing policies and governance mechanisms for managing the new IT services paradigm. EMC IT has also designed frameworks for preparing the organization at various levels to achieve the transition to the private cloud.

EMC IT's structured approach helps accelerate its journey to the private cloud by enabling the organization to get started with cloud initiatives versus waiting for complete solutions to emerge. By building solutions using existing technologies—in line with global trends—EMC IT hopes to adapt them to new technologies when they become available.

All told, EMC's journey from 2004 through 2009 resulted in savings of $104.5 million, including an estimated $88.3 million in capital equipment cost avoidance and $16.2 million of operating cost reduction due to increased data center power, cooling, and space efficiency.

In addition, EMC expects to increase its storage utilization rate from 68 percent to 80 percent and avoid the purchase of more than 1.5 petabytes of storage over five years.

Introduction

This white paper includes the following sections:

This white paper is the first in a series describing EMC IT's initiative to move toward a private cloud-based IT infrastructure. It describes EMC IT's cloud computing strategy, how the strategy evolved, and the three steps in transitioning to the cloud.

The paper also introduces the six key programs and the use case that helped EMC move toward an integrated infrastructure for virtualization.

Audience

This white paper is intended for IT program managers, IT architects, and IT management.

An introduction to EMC IT

EMC, the world's leading developer and provider of information infrastructure technology and solutions, has a large, internal IT organization that supports the business operations of its global workforce. EMC IT supports more than 48,000 users across over 80 countries and in excess of 400 business applications. Like

all IT organizations, EMC IT faces the challenge of balancing cost, risk, and agility in its operations. The functionality, interoperability, and performance requirements of its internal customers must be satisfied—without compromising the security and manageability of IT systems and processes. EMC IT must also justify all of its investments with strong, metrics-based business cases that demonstrate return on investment (ROI) and total cost of ownership (TCO) before receiving management approvals.

Principles and priorities

EMC IT's vision is based on three guiding principles: operational efficiency, business transformation, and customer focus. Making that vision a reality requires attention to the following priorities:

- **Reduce operational costs**—Helping business units lower the overall cost of operations by reducing IT operational costs.
- **Improve agility of IT delivery**—Increasing the flexibility of IT systems and processes to meet the changing needs of business units in the shortest possible time.
- **Drive workforce productivity**—Increasing global employee productivity through innovative applications, and investing in communication and collaboration technologies such as social computing and telepresence.
- **Architect for the future**—Making IT investments toward architecting the desired future state—as well as future-proofing solutions so they accommodate future requirements and changes.
- **Implement IT-proven solutions**—Enabling the development of the highest-quality EMC products by serving as a live production testbed for EMC technology and driving customer orientation through use of the technology being developed. EMC IT also publishes documents internally that describe the challenges faced in using new EMC technology and how users have overcome these challenges.

EMC IT believes a key component of satisfying its priorities is the private cloud.

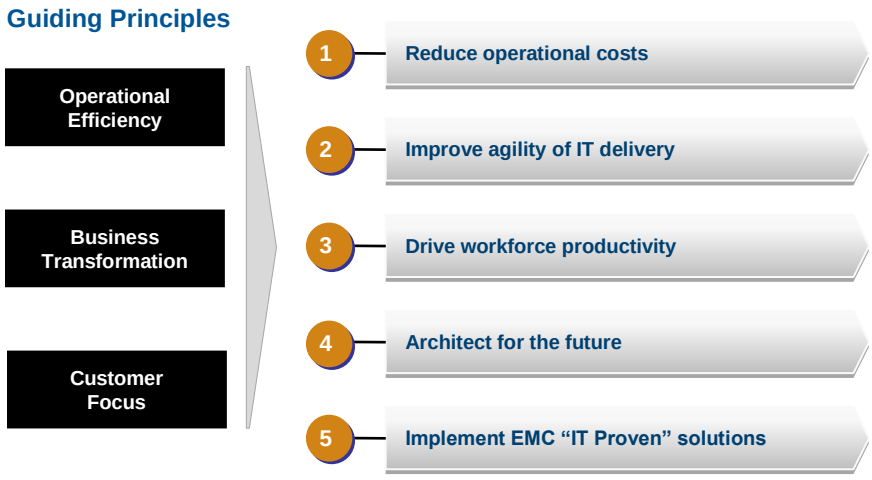

Figure 1. EMC's guiding principles and top IT priorities

EMC IT's cloud computing strategy: a key to realizing IT priorities

EMC IT has embarked on a bold mission to move to a private cloud-based infrastructure. EMC defines the private cloud as the next-generation IT infrastructure that provides all of the benefits of cloud-based IT systems (for example, quality of service (QoS), performance, scalability, security, and management) even as it retains complete control of the IT infrastructure. A private cloud may use internal resources (internal cloud), external resources (external cloud, delivered via service providers in the public cloud), or a combination of both, as shown in Figure 2.

Cloud computing enables EMC to create an elastic, agile environment that provides business units with the ability to scale their IT resource requirements based on actual needs. Resource utilization is improved by provisioning the infrastructure for normal rather than peak loads with greater agility. By using the services of external cloud service providers and third parties, cloud-based IT can transform fixed costs into variable costs. This model also offers the benefits of increased choice, self-provisioning, and utility-based chargeback models as well as the benefits of next-generation security, compliance, and service delivery management.

EMC IT believes cloud computing has a few differentiating characteristics:

- **IT is built differently** using pooled architectures with defined service catalogs for each IT service and the ability to partition/move workloads to where they can best run.
- **IT is run differently** by using low- and zero-touch modes for IT operations, provisioning, and management.
- **IT is consumed differently** where end consumers of IT services can benefit from on-demand provisioning of IT, based on immediate requirements, and from multiple IT service providers.
- **IT is governed differently** from QoS for services to security as new sets of rules and roles emerge.

Transitioning to a cloud-based model provides the IT organization with the benefits of flexibility, efficiency, and dynamic, on-demand resource allocation. However, the IT organization may need to divest some of the control and choice of IT components to a third-party provider of cloud services, if external service providers are involved. It is in this context that EMC's governance model in the cloud environment becomes more significant.

EMC believes that the capabilities of the private cloud will first evolve in the internal cloud and then federate out into the external and partner clouds. The private cloud has to integrate with the public cloud (for example, Salesforce.com), and thereby EMC IT's cloud strategy includes private as well as public cloud.

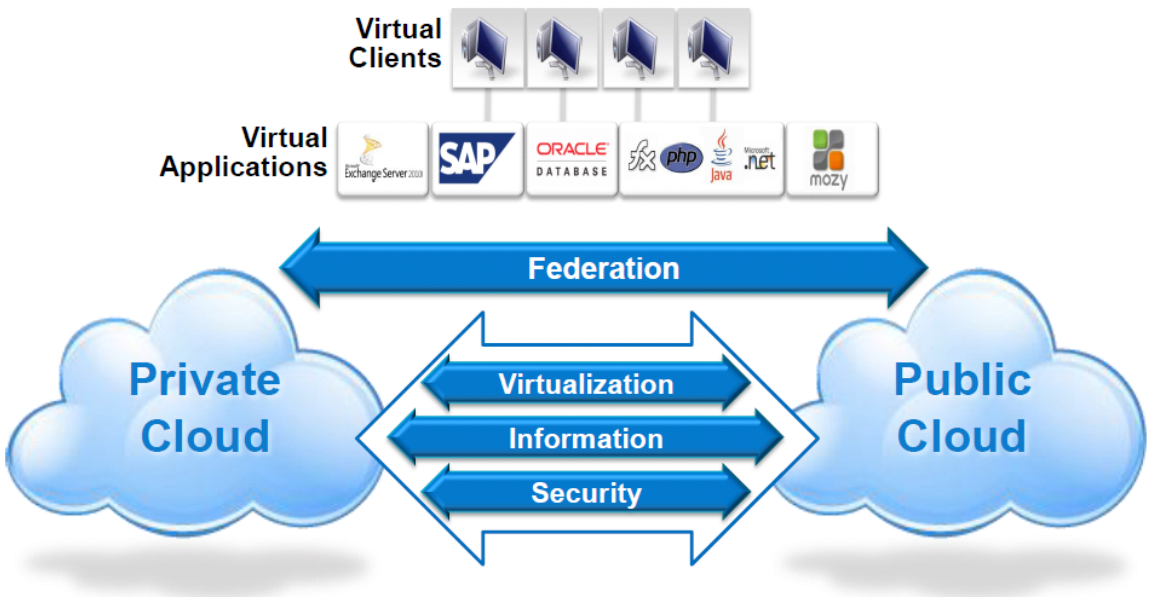

Figure 2. EMC IT's cloud strategy

EMC IT's evolution in the journey to the private cloud

The internal data center is at the core of EMC's vision of the private cloud. Virtualization is a key enabling technology of the private cloud. Virtualization is the ability to increase the utilization of physical resources through techniques such as pooling and multiplexing. The evolution to the cloud begins by using virtualization effectively across all components of the data center infrastructure, namely systems, storage, network, security, monitoring and management, the application stack—all the way up to the desktop.

Figure 3 illustrates this evolution, which involves redefining the IT organization's mandate from being a provider of stand-alone components to being a provider of fully integrated, tested, validated, and ready-to-grow infrastructure and application packages that contain best-in-class components for a data center. The platform adopted by EMC IT is based on the x86 architecture, with 100 percent virtualization leveraging VMware vSphere™.

The end goal of EMC IT's transition to the private cloud is to achieve the ability to offer IT as a service to internal customers—the business units at EMC—with options for self-provisioning through a portal interface.

In this model, IT is more than a supplier—IT becomes a business partner—and both IT and the business benefit. With access to IT as a service, the business benefits from the following:

- Simplicity of self-service access
- Alignment of costs with utility with a pay-for-use utility model
- Agility for faster time-to-market and the flexibility to change
- A user-centric, outcome-based approach to supporting business goals

The benefits for IT include efficiency through automation of tasks to do more faster; elasticity to acquire, deploy, change, or release on-demand; greater visibility into costs and control over service levels for better responsiveness; and greater control over the IT environment.

EMC IT is starting to offer services at various levels:

- **Infrastructure as a Service (IaaS)** offers EMC business units the ability to provision infrastructure components such as network, storage, compute, and operating systems as a service.
- **Platform as a Service (PaaS)** provides the application and information frameworks on top of application server, web server, and database components as a service to business units from which to develop solutions.
- **Software as a Service (SaaS)** provides applications and tools in a services model for business enablement.

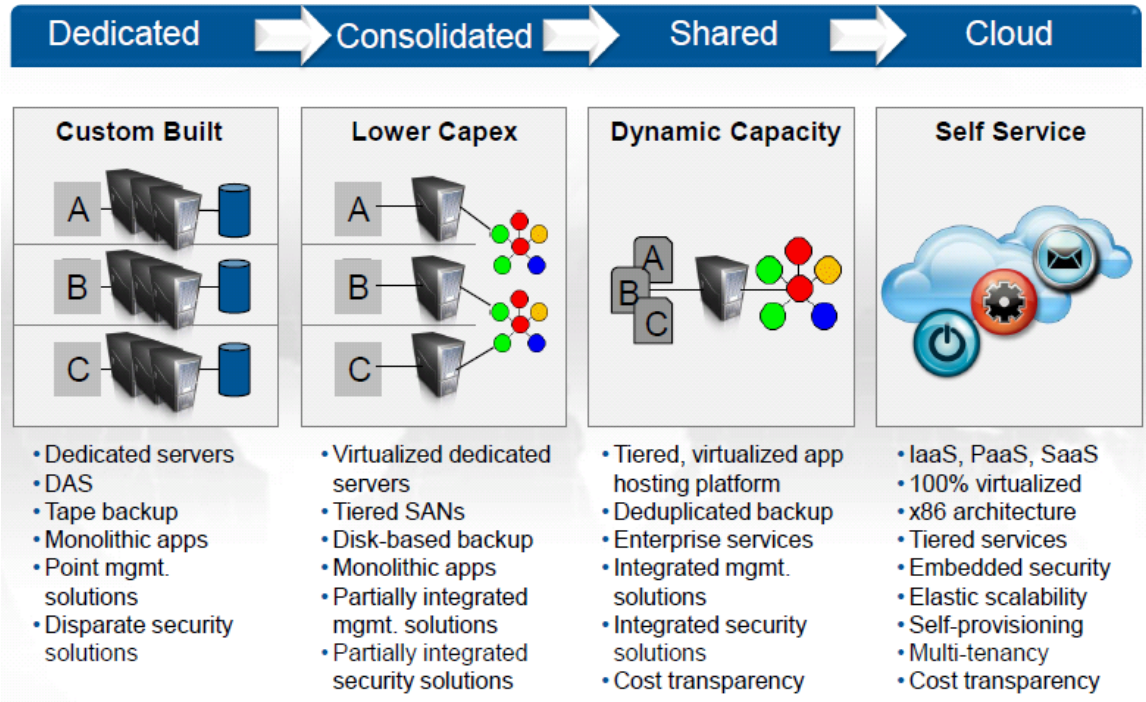

Figure 3. EMC IT's evolution in the journey to the private cloud

The next step in the journey is the ability to achieve federation of data and resources between data centers, beginning with internal virtual data centers and going on to federation between internal and external clouds. The aim is to equip the IT organization with the capabilities to move data and resources between internal and third-party data centers to achieve the real benefits of elastic IT provisioning. EMC IT recommends that to manage the progression shown in the previous figure, it is necessary to set up a roadmap, as shown in Figure 4, that further develops the components of the ecosystem.

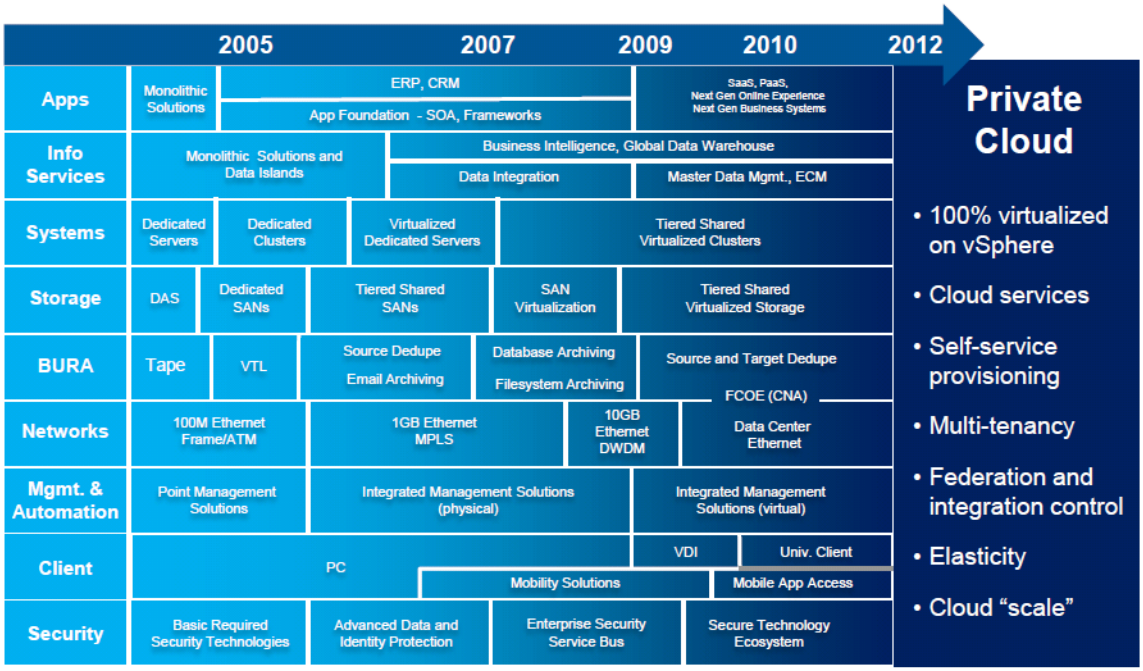

Figure 4. EMC IT's roadmap of the transition to the private cloud

Planning the transition to the cloud

EMC believes that in order to transform the IT organization, it isn't enough to just concentrate on changing the technology aspects. An IT transformation initiative must address five perspectives:

- Technology
- Business capabilities and experience
- People
- Operations
- IT policies/process/governance

Moreover, it is essential not to just consider these elements in isolation but to assess and plan for the complex interactions among them. In line with the components of an IT transformation initiative, EMC believes there are essentially three stages of adoption for organizations that are considering a private cloud strategy at the enterprise level and are at various stages. They are as follows:

- The IT Production stage, which targets dev/test/IT applications for virtualization to achieve cost efficiencies. Key capabilities leveraged include shared resource pools and elastic capacity.
- The Business Production stage, which enables business applications, including mission-critical applications with an emphasis on high QoS. Key capabilities leveraged include a zero-touch infrastructure and increased control combined with service assurance.
- The IT-as-a-Service stage, which emphasizes business agility. Key capabilities include service definition, service catalog, self-service, and chargeback.

Each stage is characterized by business drivers and triggers, level of sponsorship for virtualization, types of applications virtualized, percentage of the x86 server infrastructure virtualized, and the IT competencies acquired along the journey. Success is measured by tracking business value realized (the value path). Examples include the areas of ongoing financial and productivity results achieved along the journey to the cloud, such as Capex and Opex savings and improved business agility.

When considering these three stages of adoption, it is important to plan the transition in measured steps as follows.

Step 1: Build the foundation

As a first step, EMC has been working on building the foundations at the technical level. This involves reaching out to technology practitioners in the IT organization to share information on basic cloud enabling technologies, their operations, and their integration methodologies. As virtualization is a key enabler of the transition to a cloud-based infrastructure, it is critical that IT practitioners learn and understand the impact of applying virtualization. Given the rapid pace of technology developments and extensions in the areas of virtualization and cloud computing, it is important that these discussions cover the current state of technology as well as trends, scenarios, and alternatives that might emerge in this vibrant segment of the IT landscape.

It is also critical to encourage technologists to look beyond individual pieces of the technology and look toward an integrated view of how the various components work together. This involves a number of domain-crossing discussions that bring together experts from different fields such as storage, network, backup, and server among others. This requires investments in hiring and cultivating specialists who can provide an overall solution view of cloud-based IT offerings and ensure the dissemination of information, reference architectures, and product and solution documentation to the technology audience.

Step 2: Accelerate change

The next step in this process, from EMC IT's experience, consists of bringing discussions to the operations level with the delivery audience—those people focused on delivering IT services to the business. These discussions should focus on the two clear agendas of IT operations personnel:

- Leveraging new technologies to better meet key performance indicators used to measure IT effectiveness
- Making organizational and process changes, including the policy and governance mechanisms needed, to fully leverage the capabilities of the new technologies

Changes in technology can provide only limited benefits to businesses unless accompanied by process and organizational change. Therefore, challenging standard operating procedures, default assumptions around service levels and IT provisioning, and even the way IT is accounted and paid for, are essential to these discussions. These conversations may also result in the development of new operational roles, metrics, and service delivery models patterned around the concept of delivering IT as a service. However, during discussions at this level, EMC has found that it is critical to recognize the close links between people and processes, and pay careful attention to the complex interplays between operations, processes, and organizational change.

Step 3: Focus on the advantages of service management

Business units may not fully understand the advantages in migrating to a private cloud-based IT infrastructure beyond IT cost reduction. Therefore, EMC IT discovered that it is critical to educate businesses leaders about the additional value that EMC IT can create for them by leveraging the benefits of the cloud infrastructure. Discussions with business units must focus on the enhanced service management benefits the new infrastructure offers, such as:

- Introducing new services that can drive value to business units (for example, truly elastic IT provisioning, choice of service providers, and utility chargeback models)
- Reducing the cycle time for businesses through self-service IT provisioning, choice of multiple providers, and service level agreement-based IT service delivery

- Providing customers, clients, and employees with better user experiences through optimized IT infrastructures

EMC IT recognizes that an important transformational initiative of this nature brings with it the need for organizational change as well as a change in behavior from its employees. Continuous education and communication are crucial to getting the organization ready for this journey.

Building EMC's private cloud infrastructure

At the heart of EMC's transition to the private cloud is EMC IT's "Virtualize Everything" strategy, which focuses on virtualizing all elements of a data center: systems, storage, network, security, monitoring and management, application stack (applications, databases, middleware), and even the desktop.

EMC IT identified six key programs along with a use case (virtual desktop), referenced in Figure 5 and described next, to make the transition to a private cloud-based IT organization.

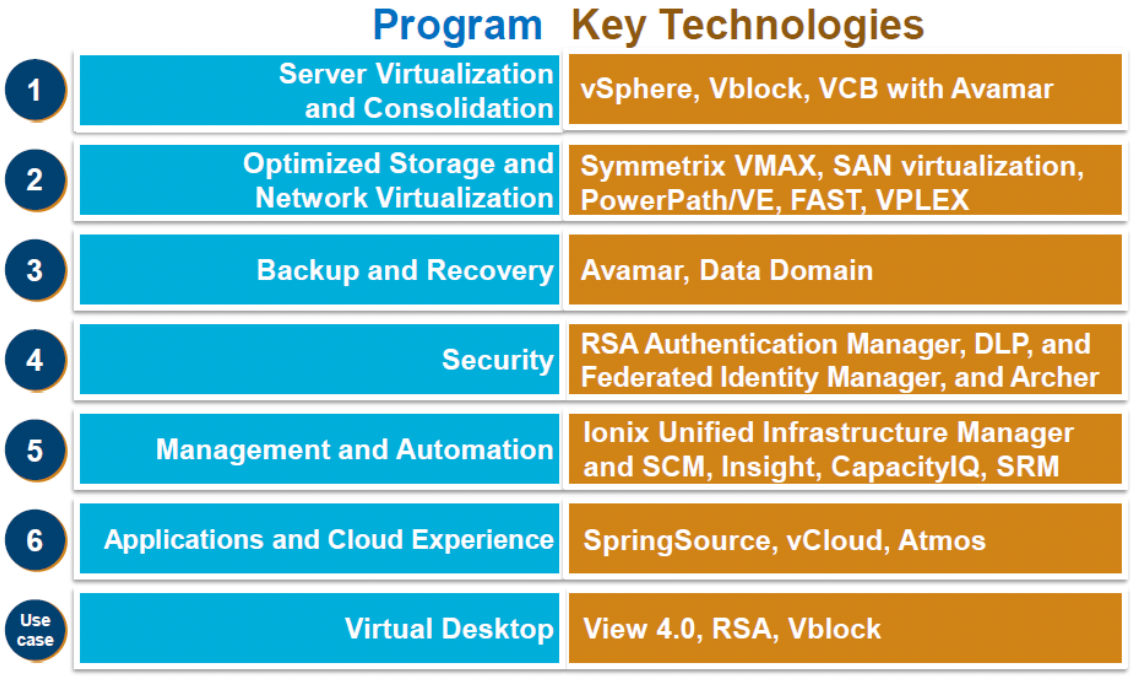

Figure 5. Key programs leading to private cloud

1. Server virtualization and consolidation

With the goals of improving the utilization of IT resources in data centers and reducing the footprint of physical machines, EMC IT embarked on a server virtualization and consolidation exercise across all of its enterprise data centers. By 2008, EMC had consolidated 1,250 servers into just 250 machines, a transition that has reduced space requirements by 60 percent and power and cooling costs by 70 percent. By ensuring that all new solutions are VMware-compliant, and by following an aggressive plan to consolidate 1,600 additional servers to 40 servers over 2009-2010, EMC expects to save $13 million in costs and save an additional $10 million over the next five years, as well as dramatically reduce its carbon footprint and improve CPU and memory utilization rates. EMC's vision is also in line with its commitment to the Virtual Computing Environment (VCE) coalition's Vblock™ vision for building integrated infrastructures for virtualization at scale.

2. Optimized storage and network

EMC is a world leader in information infrastructure. By leveraging EMC's own experience and comprehensive product portfolio in the storage and information lifecycle management (ILM) space, EMC IT is working on further optimizing information storage for a cloud-based storage design. With technologies such as Fully Automated Storage Tiering (FAST), Virtual Provisioning™, and tiering, EMC

IT separates information based on its criticality to the business. EMC IT has moved to a five-tier configuration from a two-tier storage model and has also increased the utilization of its storage infrastructure by 19 percent.

EMC expects to increase its storage utilization rate from 68 percent to 80 percent, thereby avoiding the purchase of more than 1.5 petabytes of storage over five years. EMC expects to achieve the goal of 100 percent virtualized storage by 2011. EMC VPLEX™ is a key enabling technology that will enable EMC IT to virtualize and move workloads and associated information around data centers, and across internal and external clouds.

On the network side, EMC is leveraging its alliances with VMware and Cisco in achieving network virtualization. Using technologies like IP-based storage and Fibre Channel over Ethernet (FCoE), EMC is focused on reducing cabling while increasing the speed and efficiency of data transfer.

3. Backup, recovery, and archiving

By using best-in-class EMC solutions such as Avamar®, Data Domain®, and NetWorker® for replication, backup, recovery, and archiving, EMC facilitates complete and highly effective information management from a virtual cloud-based infrastructure. In addition, data deduplication capabilities increase the efficiency of EMC's growing backup-to-disk policy. Key benefits include reducing overall backup by 50 percent; decreasing backup time by 75 percent; using Avamar data deduplication capabilities to back up remote users; and increasing remote backup and recovery success rates from 38 percent to 98 percent.

4. Security

EMC's private cloud vision involves the ability for IT managers to freely move and federate data and resources across internal and external clouds. Therefore, it is critical to enhance security to support multi-tenancy; data leakage protection; governance, risk, and compliance (GRC); and carrier security requirements. EMC collaborates with divisions such as RSA and Archer to virtualize security components and develop governance, risk, and compliance tools to monitor and manage the challenges related to transitioning IT to a private cloud-based infrastructure.

5. Management and automation

As private cloud-based IT management becomes a reality, it is imperative to track IT resources and information using an integrated tool suite. EMC's Ionix™ suite of IT management software provides a single-pane-of-glass view of all of the IT resources across the virtualized data center. Using the advanced integrated IT management capabilities of Ionix tools such as Ionix Unified Infrastructure Manager (UIM) and Server Configuration Manager (SCM), and virtualization management tools from the VMware family such as VMware vCenter™ and vCloud™, EMC IT is working on solutions to accelerate self-provisioning of IT services, reduce time-to-market, and support innovative chargeback models.

6. Applications and cloud experience

EMC's vision for the virtualized data center and the transition to the private cloud is to enable its IT organization to offer platforms and applications as services (for example, IaaS, SaaS, and PaaS). EMC is moving application servers, databases, and middleware to a virtualized platform, with the goal to provide them as on-demand infrastructure services to business units for their development activities. And EMC IT has been on the path to providing database grids on Oracle and Microsoft SQL Server to enable virtualized functionality. EMC IT also views the cloud model as a mechanism to support the movement of currently business-supported applications such as vApps into a controlled IT-supported model. EMC is working on enabling infrastructures based on vCloud to provide IT in a self-service model to its business units. In addition, EMC IT is looking to leverage Atmos® as an internal platform for offering compute and storage solutions as a public cloud service to its customers.

Virtual desktop infrastructure—an implementation use case

Using the power of VMware's Virtual Desktop Infrastructure (VDI), EMC is working on desktop virtualization approaches to simplify and lower the cost of IT management, increase IT security, optimize

information storage, and provision IT resources based on the needs, requirements, and profiles of its workers. The goal of EMC IT is to provision the user and not the device, hence the implementation of VDI will provide the ability for IT to enable different devices used by the end user. This would include the usual company-issued desktop or laptop but extend to a bring-your-own-device (BYOPC or BYOD) model in addition to thin clients and mobile devices.

EMC plans to have 100 percent virtualized desktops by 2012, resulting in improved and simplified security, lower client TCO, rapid deployment, reduced support costs, and user-based provisioning.

Making the transition to the private cloud

Before transitioning existing IT resources to a private cloud-based infrastructure, EMC IT performs the following key activities.

Ensure basic enabling technologies work

The first activity is to ensure that the basic enabling technologies work, as advertised, in EMC's own IT environment. This requires rigorous testing of all infrastructure components within the virtualized data center—compute, storage, network, and orchestration—to ensure that their performance is in line with requirements and established benchmarks. Next, EMC IT configures and tests all software components for the required performance levels. Focused attention on security requirements and issues relating to federation between locations is critical during this phase.

Create use cases and assess capabilities across requirements

The second general activity involves creating a high-level framework of use cases within the business and assessing the current capabilities across those requirements. The objective of identifying the use cases is to match the business needs to the appropriate cloud model for providing IT services. The high-level use cases are based on parameters such as time-to-market, demand predictability and IT elasticity, integration needs, network bandwidth and latency, security, risk and compliance, and business impact. The requirements across each of these parameters are dynamic and vary significantly across applications, affecting the choice of internal and external cloud resources required.

Define policy and governance mechanisms

The third activity is to define policy and governance mechanisms to manage and operate the private cloud-enabled IT organization. It is essential to define robust mechanisms to handle critical issues around technical characteristics such as security, bandwidth, and integration, followed by performance, which encompasses service delivery aspects such as IT management.

EMC IT's private cloud policy and governance framework

The transition of IT to the private cloud directly impacts the revenue, operational and business costs, and risks faced by the organization, as described next:

- **Impact to revenue**—The transition to the private cloud helps IT organizations provide improved services to business units. These IT services help business units find new customers, enhance quality while lowering the cost of goods and services delivered, and sell more successfully to existing customers.
- **Impact to costs**—Transitioning the entire IT infrastructure to the private cloud calls for large organizational investments upfront, resulting in significant savings at the end of the transition. Therefore, it is essential to make adequate budgetary provisions initially to receive rewards later.
- **Impact to risks**—A private cloud infrastructure uses both internal and external cloud infrastructures. This calls for new approaches to manage the business and information risks for the organization.

Therefore, it is essential to establish a governance body (involving people from business, finance, legal, and IT disciplines from within the company) for evaluating the migration of IT to a private cloud-based infrastructure.

EMC IT has developed a high-level policy and governance framework to move applications, platforms, and infrastructures to the external and public cloud. EMC has defined lead criteria that decide the policies and governance frameworks for an application:

- **Application classification**—Classifying applications as mission-critical (directly affecting customer service delivery, or affecting EMC's revenue or its reputation), business-critical (critical to the operations of a business unit), or business supporting (a supporting application)
- **Security**—The information security requirements necessary for the application
- **Risk and compliance**—A profile of the risks of incidents, from outages to information leaks, and the required compliance requirements
- **Connectivity**—Bandwidth and performance requirements for globally distributed applications and users
- **Integration**—The requirements to ensure that tightly coupled applications can work together
- **Performance**—Service delivery requirements such as availability, service level agreements, and IT service management
- **Time-to-market**—Rapid provisioning requirements
- **Demand elasticity**—Ability to deal with changes in the requirements of business units, as well as scale-up and scale-down needs

EMC IT has created a set of business use cases, such as those mentioned in Figure 6, for various profiles of services requested by business units with policies and small-scale governance functions for each use case.

The transition to the private cloud will enable EMC IT with a transparent method for tracking the usage of IT resources by business unit. This empowers EMC IT with the capability of constructing new chargeback models.

	IT Services that will be required to implement Business Unit use case							Policy	Governance mechanism
Business Unit use cases for Public Cloud	Security (Perimeter security, identity mgmt., authentication)	Risk and Compliance assessment	Connectivity (bandwidth, latency)	Integration	Incident response	Management and monitoring	Application classification (mission-critical, business-critical, business)	Confidential data	Joint Review Board
Engineering labs	✓	✓	✓					• Confidential data • Connectivity requirements	Risk and Compliance assessment by IT security and network teams
Large non-production workloads	✓	✓	✓						
Backup, archive, content mgmt., collaboration - latency tolerant apps	✓	✓	✓	✓	✓	✓	✓		
Other production BU applications	✓	✓	✓	✓	✓	✓	✓	• Non-mission-critical • Non-business-critical	IT Solution Desk process

Figure 6. A high-level abstraction of EMC IT's policy and governance model for external cloud usage

Conclusion

EMC's cloud computing strategy is designed to completely transform its IT organization and operations. Such a transformation means making changes in the way IT is built, run, consumed, and governed at the company. The goal of this strategic initiative is to make EMC IT a customer-centric provider of end-to-end IT solutions to meet the business needs of EMC business units.

Leveraging the power of the private cloud, EMC IT is introducing innovative services such as on-demand IT infrastructure provisioning and self-service options for IT service enablement. To facilitate this transition, EMC IT has concentrated its efforts on the definition of a clear strategy for internal cloud implemented through six programs, which focus on transitioning its IT infrastructure to the virtualized data center model. This initiative is in line with EMC's vision for the Virtual Computing Environment, which it shares with its partners VMware and Cisco.

To prepare the organization for a new paradigm of IT operations, EMC IT is also educating stakeholders at various levels on the new IT service paradigms, as well as developing a strong policy and governance framework for managing the new IT infrastructure. Working closely with partners and product divisions, EMC IT is concentrating on maximizing the business benefits of technology that can move its existing IT infrastructure to the private cloud.

EMC's structured approach helps accelerate its journey to the private cloud. It provides the company with the opportunity to begin cloud initiatives without waiting for complete solutions to emerge even as it moves from the Business Production stage to the IT-as-a-Service stage (Figure 7). This enables EMC IT to more easily leverage these solutions as technologies evolve.

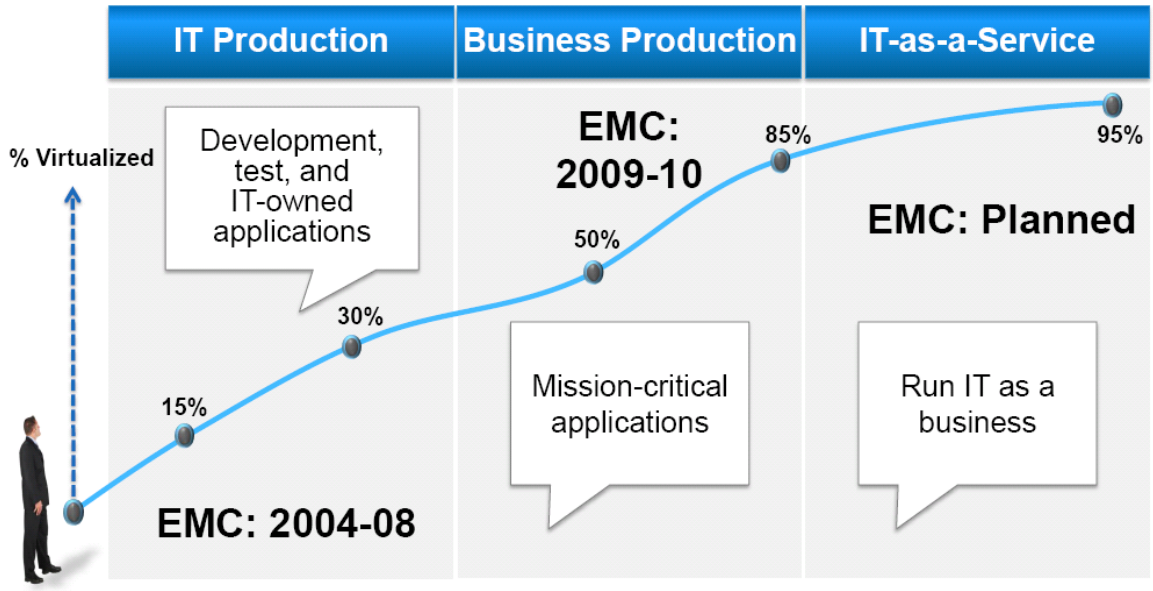

Figure 7. EMC IT's progression to the private cloud-based infrastructure

The Enterprise Strategy Group has published a white paper called *ESG IT Audit: EMC's Journey to the Private Cloud*, which examines EMC IT's journey to date. Looking forward, EMC expects to increase the storage utilization rate from 68 percent to 80 percent and avoid the purchase of more than 1.5 petabytes of storage over five years.

All told, EMC's journey from 2004 through 2009 resulted in savings of $104.5 million, including an estimated $88.3 million in capital equipment cost avoidance and $16.2 million of operating cost reduction due to increased data center power, cooling, and space efficiency.

By having "risk versus reward" conversations with stakeholders at each level, EMC IT has been successful in accelerating the adoption of private cloud-based technologies within the company. This approach enables EMC to better structure discussions with partners and external IT cloud service providers. EMC IT

is able to provide vendors with the granular details of candidate workloads and the solution requirements they seek.

References

Read the following for more information:

- EMC IT's Journey to the Private Cloud blog at http://www.emc.com/emcit
- *ESG IT Audit: EMC's Journey to the Private Cloud* ESG white paper
- The following can be found on Chuck's Blog, an EMC insider's perspective on information, technology, and customer challenges:
  - "Not All Clouds Are Private Clouds"
  - "Private Clouds and the Fixed Vs. Variable Discussion"
  - "Private Cloud – The TOS Model"
  - "Private Cloud Adoption Models"
  - "Good Governance Equals Good IT?"
- Announcement of the VCE coalition
- Vblock Infrastructure Packages
- *EMC IT, A Blueprint for Data Center Efficiency* white paper
- Learn more about these EMC offerings on EMC.com:
  - EMC Atmos
  - EMC Symmetrix Virtual Provisioning
  - EMC FAST
  - EMC Ionix
  - VCE Cloud Computing Strategy Service

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