

EMC IT's JOURNEY TO THE PRIVATE CLOUD: APPLICATIONS AND CLOUD EXPERIENCE

A series exploring how EMC IT is architecting for the future and our progress toward offering IT as a Service to the business

Abstract

This white paper focuses on EMC IT's applications and cloud experience to enable a seamless transition to the private cloud. EMC IT's vision is to provide IT as a Service in a self-service mode to EMC business units. It also examines EMC IT's approach in offering Platform as a Service and Software as a Service.

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Executive summary

As a large, globally dispersed business, EMC relies on fast turnaround, consistent high performance, and rapid scalability for its IT requirements—regardless of work location or complexity of the IT infrastructure. While point and custom solutions can address business needs, they typically result in higher license costs, inefficient utilization, and increased total cost of ownership (TCO). Tasked with delivering enhanced efficiency and cost savings to the company, EMC® IT has embraced virtualization and cloud computing.

By virtualizing its environment, EMC IT is facilitating an on-demand platform where IT resources can be made available from a virtual pool either within EMC or from any globally located partner data center.

By leveraging cloud computing's multi-tenancy and elasticity, EMC IT has begun to offer constructed IT solutions as on-demand, scalable services that provide high availability, self-service provisioning, metered usage, and chargeback.

Through these technologies, EMC IT envisions a cloud-based architecture that will reduce TCO through consolidation, while offering a higher ROI, improved effectiveness, and better service. It will also increase EMC's agility.

This white paper is one in a series describing EMC IT's initiative toward a private, cloud-based IT infrastructure. To learn more on the background of this initiative, read the white paper [EMC IT's Journey to the Private Cloud: A Practitioner's Guide](#).

Introduction

This white paper details EMC IT's applications and cloud experiences, and focuses on the company's investment in providing IT as a Service (ITaaS) through the private cloud. It covers the following sections:

- [Background](#)—Explains why EMC IT embarked on ITaaS.
- [EMC IT's strategy of applications and cloud experience](#)—Describes the three types of IaaS services that EMC IT provides to business units.
- [Platforms as a Service](#)—Encompasses the objectives and principles of offering [Database Platforms as a Service](#), focusing on [Oracle as a Service](#), [Microsoft SQL Server as a Service](#), and [Greenplum® as a Service](#). [Application Platforms as a Service](#) offers brief insight into providing applications tailored to a cloud-based operating environment, along with the platforms needed to support them.
- [Software as a Service](#)—Describes the objectives and advantages of offering Software as a Service, including a glimpse of business intelligence ([BI](#)), enterprise resource planning ([ERP](#)), and customer relationship management ([CRM](#)) as a service.

Audience

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

Terminology

- **Force.com:** This is a leading cloud platform for business applications that offers developers a platform to create rich, collaborative, custom cloud applications.
- **Oracle Real Application Clusters (RAC):** Oracle Corporation provides software for clustering and high availability in Oracle database environments.
- **SecurID:** RSA® SecurID® performs two-factor authentication for a user accessing a network resource.
- **SpringSource:** VMware® SpringSource® offers a comprehensive suite of products for powering the entire *build, run, manage* enterprise Java application lifecycle and breaking down the barriers between application development and operations.
- **VMware ESX:** VMware ESX® is an enterprise-level virtualization product.

Background

As a leading global enterprise, EMC requires the infrastructure agility and dynamic scalability to meet changing application and business needs. Like many companies, EMC is faced with increasing application complexity, which increases the time and cost to provision infrastructure, platforms, and applications.

Although a large number of point solutions exist, and custom solutions can be developed, EMC wanted to reduce complexity and optimize its IT infrastructure wherever possible.

In addition to building and deploying applications in the cloud, EMC IT's developers needed to adapt applications to run in a cloud-based operating environment, while providing the security necessary to protect information, rapidly recover from security events, and address compliance and regulatory requirements.

Hence, EMC IT chose cloud computing as the ideal solution to address its challenges and drive business transformation. The goal is to transition the company away from the traditional silo-based environment to a cloud that offers efficiency, flexibility, and scalability.

Offering IT as a Service (ITaaS) encourages cost savings, reduces energy consumption through shared resourcing, and enables a rapid and agile deployment of customer environments or applications. Additionally, ITaaS offers many other benefits including:

- **Agility**—Masking underlying infrastructure complexities, ITaaS enables business users to browse and select relevant services and IT personnel to quickly and easily provision, configure, and monitor virtual applications, databases, and platforms.

It also helps deliver a 50 percent reduction in software platform provisioning time.

- **Architect for the future**—With an ITaaS foundation in place, EMC IT can seamlessly provision for the future with infrastructure, platforms, and applications that scale up and out to meet fluctuating demands.
- **Cost savings**—ITaaS will also help EMC IT reduce real estate, energy, and maintenance costs. By deploying a shared database infrastructure, EMC projected it could save as much as \$7 million over five years. By deploying information lifecycle management (ILM) it could save another \$3 million over three years.

EMC IT's strategy of applications and cloud experience

By virtualizing its entire infrastructure, EMC IT will be able to allocate IT resources (infrastructure, platforms, and applications) on-demand from a virtual pool of components that can be dispersed from within EMC or from partner data centers located anywhere in the world. This enables EMC IT to allocate or move in response to changing business requirements, as well as to increase efficiency and utilization.

EMC IT is working to provide its business units with three types of ITaaS services, including:

- **Infrastructure as a Service (IaaS):** EMC IT will offer compute, storage, backup and recovery, and networks, individually or as an integrated service.
- **Platforms as a Service (PaaS):** The PaaS initiative includes providing databases and application platforms such as development tools, runtime environments, application frameworks, ILM, and enterprise content management (ECM) as services. These offerings will be tailored to a cloud-based operating environment, founded on the principles of simplicity and elasticity, to ensure self-service and efficient use of IT resources. They will be offered on a number of platforms including SpringSource, and Force.com for application development.
- **Software as a Service (SaaS):** EMC IT will offer widely used applications to business units including BI, ERP, CRM, and master data management. By consolidating and standardizing its infrastructure, streamlining services to internal departments, and providing a more efficient working model, EMC IT will deliver enterprise applications to business units with a high degree of agility. Additionally, decreased provisioning time will give EMC IT a way to reduce costs.

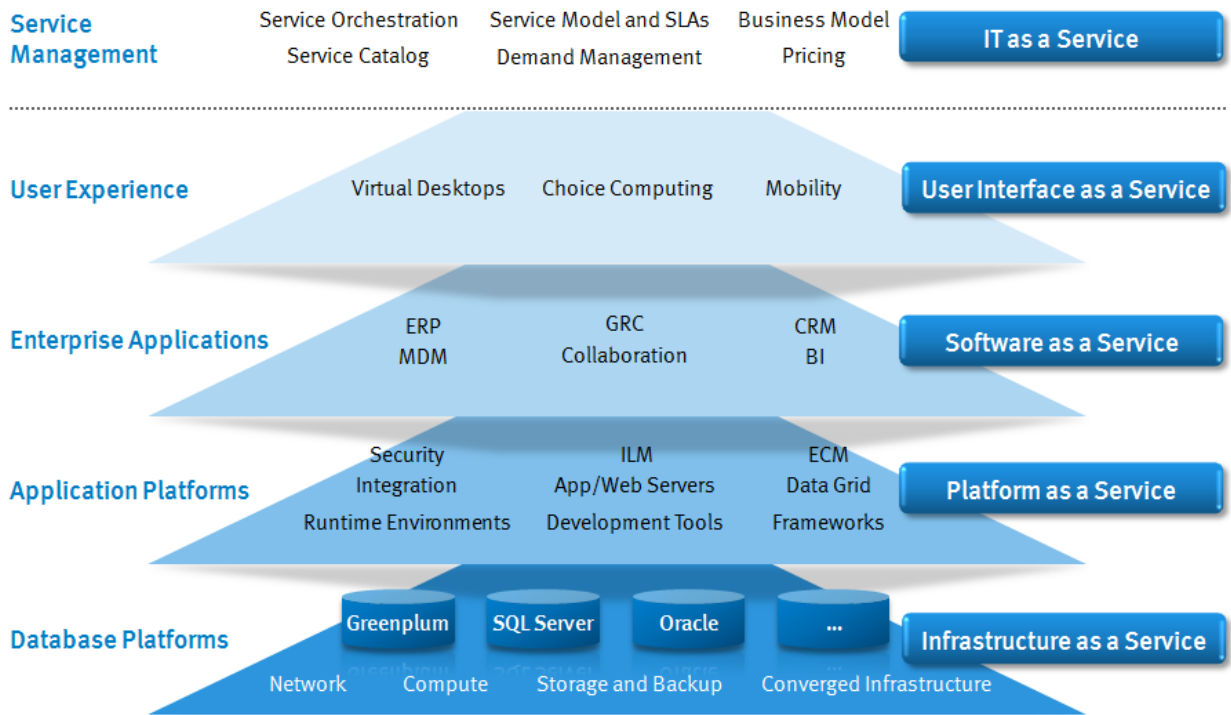


Figure 1. EMC IT's vision of ITaaS is to deliver all IT components, from infrastructure to enterprise applications, as a service to EMC business units.

Platforms as a Service

EMC IT has begun to provide two principal categories of platforms as a service:

- [Database platforms](#), including:
 - [Oracle Database as a Service](#)
 - [SQL Server as a Service](#)
 - [Greenplum as a Service](#)
- [Application platforms](#), including:
 - [Application Development as a Service](#)
 - [Enterprise Content Management as a Service](#)
 - [Information Lifecycle Management as a Service](#)
 - [Security Platform as a Service](#)
 - [Integration as a Service](#)

Database Platforms as a Service

Database as a Service offers business units several benefits including reduced TCO, improved service levels, more efficient management, easier administration, and much stronger compliance. EMC IT's design principles in setting up its Database as a Service include:

- **Database consolidation**—Disparate databases were consolidated into tiered clusters based on business criticality, required availability, and I/O profile.
- **Information optimization**—Using effective information monitoring tools, EMC reduced duplicate data to optimize the databases.
- **Standardization**—By standardizing hardware and database footprints, EMC achieved consistency, easier management, lower costs, and better performance.
- **Compliance**—EMC embraces common management, administration, and compliance-related policies and procedures.

To provide Database as a Service, EMC IT adopted both the grid-based and the virtualization-based approach toward database virtualization and consolidation. EMC has two principal database platforms, Oracle Database and SQL Server, along with an emerging database platform in Greenplum.

Oracle Database as a Service—EMC IT created a foundation that offers Oracle Databases as a Service by tiering databases on a consolidated and optimized infrastructure based on the criticality and importance of applications to the EMC enterprise. All mission-critical applications have been consolidated on an eight-node RAC architecture by leveraging Oracle 11g.

EMC IT also virtualized a number of production and non-production databases. The Oracle consolidation and virtualization efforts have helped EMC IT reduce database servers from 55 to four, and databases from 51 to six. This has enabled EMC IT to ensure enough system capacity to run 55 applications within the consolidated Oracle-based grid environment.

Figure 2 illustrates EMC IT's tiered and consolidated Oracle Database architecture.

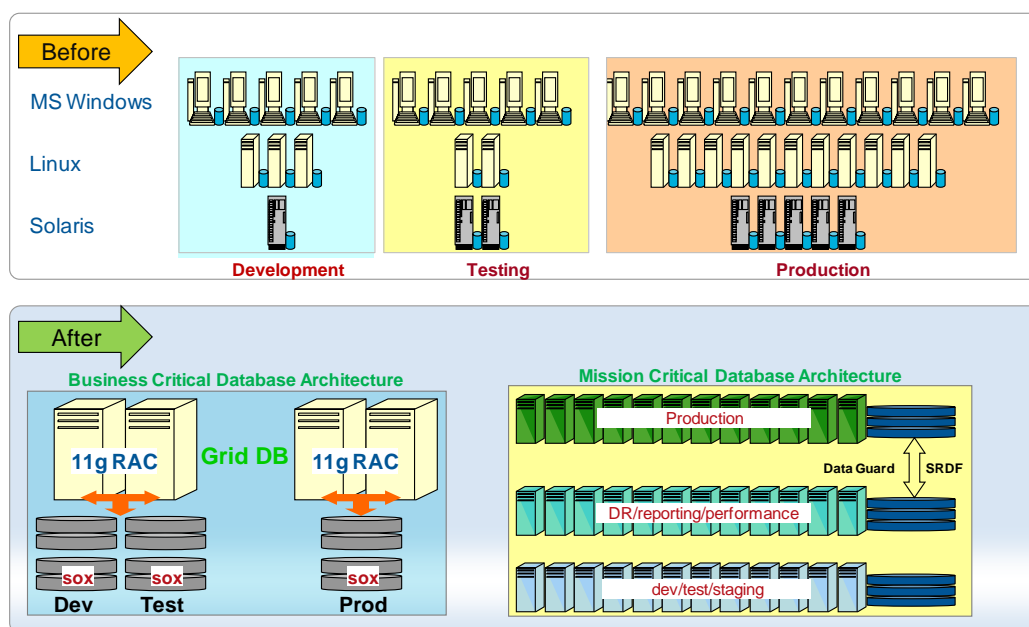


Figure 2. EMC IT's Oracle consolidation reference architecture

EMC IT realized several benefits from implementing Oracle Database as a Service, including more than \$2.5 million in overall cost avoidance and labor cost reduction. The company also achieved an additional savings of over \$1.4 million in cost avoidance related to server replacement costs and decreased need for new capacity additions.

EMC IT has also realized a number of operational and service advantages. For example, implementing Oracle Database as a Service has significantly increased the speed at which EMC IT can provision services to internal departments and business units. Additionally, EMC IT increased its transparency by providing scalable database services against standardized, published service levels. Database as a Service also reduces internal project lifecycles and gives businesses the advantage of a faster turnaround. Another benefit is that it helped EMC IT ensure high availability while reducing data discrepancies, support, and run costs.

SQL Server as a Service—To offer SQL Server as a Service on demand, EMC IT has adopted the dual approaches of grid-based consolidation and database virtualization.

The consolidation of the SQL databases enabled EMC IT to offer a more efficient service, including the ability to support mission-critical applications for the business and rapid application development with the integrated Microsoft platform.

EMC IT is pursuing a SQL Server consolidation and virtualization initiative based on the principles of tiered storage, where the clustering of databases is performed in relation to the importance of the information to the business.

In the first phase of this initiative, EMC IT migrated all mission-critical and business-critical applications to a consolidated cluster-based platform, guaranteeing high

availability and reducing downtime. Starting with medium-critical business-supporting applications, EMC IT is currently moving more SQL applications to a virtualized platform. The end goal is to have all SQL databases on a consolidated and virtualized platform, providing EMC IT with the ability to offer SQL Server as a Service to business units.

EMC IT has experienced a number of benefits by consolidating its SQL Server infrastructure. While SQL databases grew more than 30 percent in the past three years, EMC did not have to increase support staff. EMC IT was also able to reduce its software licensing costs to Enterprise Editions, and significantly lower its database storage requirements. Through the use of compression, the SQL Server 2008 environment could potentially yield 50 percent (approximately \$1 million) in savings in overall labor and infrastructure costs.

Greenplum Database as a Service—EMC IT is starting to use Greenplum, a parallel database explicitly meant for large-scale analytical processing, as its next-generation analytical database, with the ability to partition and provide sandbox instances for use by business units.

Application Platforms as a Service

EMC IT is also providing its IT workforce with tools to design and build applications tailored to a cloud-based operating environment. This is being achieved by using EMC and partner technologies to provide a platform for developing secure next-generation applications. Applications built on this platform are optimized for virtual, self-managed operating environments. EMC IT's objectives for this initiative include:

- Leveraging the power of the next-generation cloud platform for application development
- Reducing the footprint of physical machines and simplifying system architectures needed to run and manage business-critical next-generation applications
- Reducing development time and time-to-market for applications by enabling development teams to use rapid and flexible development methodologies

EMC IT's cloud-based application platforms are being designed for simplicity and flexibility to ensure self-service and efficient use of IT resources. The guiding tenets in building this platform are:

- **Lightweight framework**—The platform must have interfaces and frameworks that have lightweight, reusable, agile, and aspect-oriented programming.
- **Agile development**—The application development must be optimized with testing and production platforms that scale up or down and shift loads physically and geographically.
- **Service-based**—Most applications need to be redesigned as a service using multi-tenant and usage-based costing methods that can be self-managed and provided on-demand.

- **Efficiency**—The platforms that host the applications must increase the efficiencies of system management by using efficient programming methodologies.

EMC IT is working toward offering a number of Platforms as a Service including VMforce.com, SpringSource, and Microsoft .NET for application development, to make runtime environments more lightweight and simplify application programming. Other platforms provided to users as a service include application development, ECM, ILM, information security, and IT integration.

Application Development as a Service—To effectively leverage the advantages of the private cloud, applications need to be built and deployed into the cloud. EMC IT is working on various methods in which application developers leverage application development platforms to easily build and deploy applications into the cloud. EMC IT is also building these platforms to help business units benefit from private and public cloud services.

Enterprise Content Management as a Service—EMC maintains and manages large amounts of unstructured data in various formats including images, documents, audio, and video that must be classified and stored, and that also allows for easy and rapid access by business units. Traditionally, this has been satisfied by siloed content management platforms that were provisioned separately by business units. However, this approach does not facilitate optimal storage utilization or effective or easy access and retrieval across business units.

To address this, EMC IT built a consolidated, scalable platform for hosting unstructured content using tiered storage and centralized management, which supports more efficient provisioning and reduces management costs. The company is currently working on offering this platform with chargeback based on usage and governance frameworks.

Information Lifecycle Management as a Service—EMC IT is focusing on providing an efficient and cost-effective data storage platform by reducing infrastructure, resources, and maintenance costs. EMC IT's ILM as a platform enables end-to-end information optimization throughout the lifecycle of the data. This ensures the right level of performance for applications at the lowest cost. This also enables EMC IT to retire read-only or unused applications' mask and subset data in non-production environments to further optimize and secure information.

To accomplish all of this, EMC IT has deployed the data ILM service.

Security Platform as a Service—Recognizing the importance of security on the journey to the private cloud, EMC IT developed a number of solutions for implementing information security. For example, EMC IT developed a Secure Managed Infrastructure (SMI) to help administrators securely administer and monitor public networks while keeping them separated from the corporate network; a Governance, Risk, and Compliance framework (GRC) built using EMC's proven Archer technology to drive policy adherence and govern the network infrastructure; and the Critical Incident

Response Center, a converged security operations platform that protects and monitors EMC's critical IT infrastructure.

Based on the success of these initiatives, EMC IT is now working on providing Information Security as a Service to its business units utilizing leading RSA technologies such as Data Loss Prevention (DLP), RSA Envision[®], and SecurID. Additionally, EMC IT is building comprehensive platforms that allow for common identity management and audit transactions that occur in a private cloud-based environment.

EMC IT will also integrate these platforms with governance, risk, and compliance engines that proactively develop and manage information security policies and ensure compliance with legal and regulatory requirements. In the near future, EMC IT plans to provide these integrated security and governance platforms as services to EMC business units, which will be able to implement custom security policies.

Integration as a Service—EMC IT is working on methods of integrating multiple data sources across business units to leverage this data seamlessly for business purposes. This includes end-to-end solutions that can transform data between several sources to meet the specific needs of business units. To provide these integration services, EMC IT included service-oriented architecture/web services, enterprise messaging, and extract, transform, and load (ETL). EMC IT is also developing methodologies to construct information from dispersed sets of data and formats, which are critical in the private cloud. EMC will leverage this expertise in orchestrating end-to-end business processes across cloud service providers and EMC IT's internal infrastructure.

Benefits of providing Application Platforms as a Service

By offering Application Platforms as a Service, EMC IT has realized many benefits:

- **Improved efficiency**—EMC IT delivers high-quality application infrastructure on demand with minimum time and effort.
- **Agility**—Applications are built on common platforms and databases are consolidated, so EMC IT can quickly and efficiently adapt to new technologies and best practices.
- **Simplicity**—This helps reduce the complexity and redundancy of systems.
- **Availability**—The robust Application Platforms as a Service solution is architected to enable high performance and zero application downtime.
- **Scalability**—The service provides a high degree of scalability and effective dynamic application capacity management.

Software as a Service

EMC IT is also providing commonly used Software as a Service to business units, including services such as BI, ERP, CRM, and master data management. This will enable EMC IT to:

- Unify business definitions and provide a consistent online experience to geographically dispersed users
- Implement consistent application security policies by connecting business applications through a single virtual directory service
- Consolidate process and integration logic outside of individual applications and interfaces

Software as a Service enables EMC IT to streamline their services to various internal departments and provide more efficient services. Its standardized and consolidated infrastructure also enables EMC IT to deliver enterprise applications to business units with a high degree of agility, while reducing provisioning time and costs. EMC IT began its journey toward Software as a Service by offering BI, ERP, and CRM application services to business units.

Business Intelligence as a Service—To reduce the TCO of business intelligence, EMC IT brought together the several existing business intelligence solutions under a unified architecture for a Business Intelligence as a Service offering. This consolidation has reduced the number of source feeds and has removed data and hardware redundancies, thus eliminating the risk of data discrepancies from multiple code bases.

Additionally, this unified architecture has also delivered significant performance gains including a 180 percent improvement in batch job performance, and a three times reduction in the storage footprint. EMC IT will continue to unify and expand the architecture to enable self-service BI sandbox offerings to the business units. EMC's Greenplum massively scalable analytical database is a key design point in offering BI as a service.

ERP and CRM as a Service—EMC IT is also exploring ERP as a Service to reduce the overall investment and time required to provision new ERP modules, and increase the return on ERP investments for customers. To accomplish this, EMC deployed global instances of its ERP and CRM environments in a scalable, shared model leveraging the work done in Platforms as a Service and Infrastructure as a Service.

The consolidated ERP infrastructure is an asset for new mergers and acquisitions because it creates a smooth and problem-free integration of organizations that join EMC. It will also help in working more effectively with suppliers, vendors, and partners.

Conclusion

By leveraging the strengths of cloud computing such as multi-tenancy for business units and elasticity, EMC IT will offer its internal customers on-demand, scalable service applications as a service, and achieve higher efficiency and availability, better service, and self-service provisioning, chargeback, and metered usage.

Although significant progress has been achieved to date, EMC IT is still on the journey and focused on addressing automation, policy, and governance. Additionally, EMC IT continues to make progress in self-provisioning and metered usage to implement a chargeback policy, along with efforts toward providing platforms-accelerated development of applications that can run seamlessly anywhere in the private or public cloud. EMC IT is also working on an architecture that will reduce TCO through consolidation.

A cloud-based solution offers the best balance of all these end objectives: lower TCO, higher ROI, enhanced efficiency, and better service—all while increasing the agility and ability of the enterprise. As EMC IT continues its transition to the private cloud, it is working to equip its IT employees with a number of skills across domains to support the successful delivery of ITaaS.

References

The following resources provide additional, relevant information. You can access these documents and sites at www.EMC.com or by contacting an EMC representative:

- [EMC IT's Journey to the Private Cloud: A Practitioner's Guide](#)
- EMC IT web page at www.EMC.com/EMCIT
- [Storage Best Practices for SharePoint and SQL Server recorded webcast](#)