

Build a highly affordable and scalable private cloud

*A secure cloud for data enables enterprises to improve service to
their customers*



Contents

- 2 Introduction
- 2 Begin with what you have—but know that a cloud demands more
- 3 Take advantage of the IBM SmartCloud Foundation
- 4 Step one: Consolidating and virtualizing with zEnterprise
- 5 Step two: Automating and managing with confidence
- 6 Step three: Integrating and optimizing for ongoing success
- 7 Conclusion
- 8 For more information

Introduction

By its very name, cloud computing can seem like a shapeless thing. Organizations see a goal on the horizon: better, faster service delivery at lower cost. But the question remains: How do you grab hold and make this vision real?

The winds that are blowing cloud's adoption are, in fact, very real, but they can be hard to address because they're not blowing from any one direction. Organizations are looking to meet a range of challenges—from the need for end-user self-service and rapid resource provisioning to elastic system capacity and lower business and IT costs. They're looking to increase their infrastructure efficiency, meet service level agreements (SLAs), ensure regulatory compliance and boost business agility—all while maintaining the availability and security of their business assets.

Meanwhile, organizations have to respond using real, available technologies. They need to determine which system platform is best for each of their various workloads, then consolidate and virtualize their infrastructure to reduce cost, simplify and automate to enhance management, and integrate and optimize to achieve their business and IT goals.

This white paper describes the journey that an organization can take in setting up a private cloud. It provides insight into the use of the IBM® SmartCloud™ Foundation options for deploying a cloud infrastructure in a highly scalable environment to deliver a manageable, high-performance, highly available, highly scalable cloud that builds tangible value and delivers real business and IT results.

Begin with what you have—but know that a cloud demands more

In the quest for effective cloud computing with its IT infrastructure of pooled and virtualized compute, network and storage resources and its business benefits of cost savings, agility and rapid delivery of business and computing services, many organizations start with simple, low-cost deployments.

In many cases, that means a cloud based on existing distributed x86 systems, often running Linux. Recently, more organizations have also begun to build or expand a cloud onto an existing IBM zEnterprise® mainframe, leveraging available capacity and reusing existing resources and skills.

Criteria for success of cloud systems



Cloud environments must deliver a number of capabilities to help ensure that the organization meets criteria for cloud success.

All organizations, however, need to carefully assess their business requirements and workload placement before jumping into a cloud deployment. Ensuring a thorough understanding of each service or application along with their dependencies before matching them to a computing platform—whether x86, IBM POWER® or mainframe, each selected for its own levels of scalability, security, availability and other capabilities—goes a long way toward ensuring successful operation and business results from implementing a cloud.

In order to optimize the cloud environment for scalability, availability and compliance, a workload placement strategy must also be devised so the organization understands how those services are connected—the ways, for example, in which the application server relates to the database server, how both define and support service levels, and how different workloads might have different sensitivities to issues such as processing power, memory use or latency.

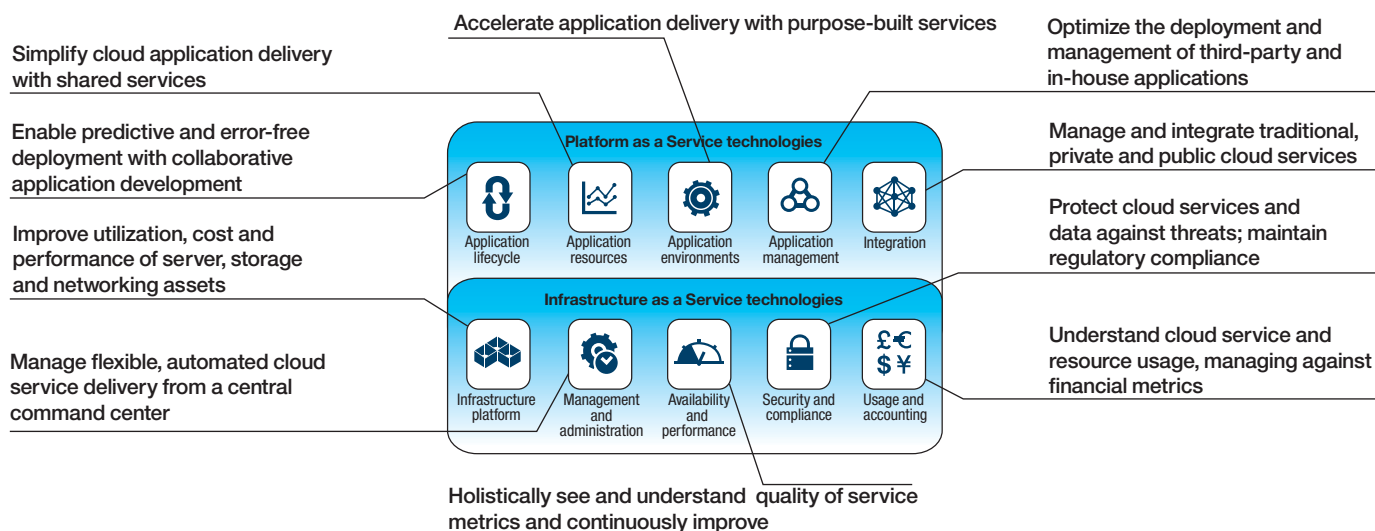
Using smaller, less expensive x86 systems already in place in large numbers can be a tempting approach in beginning a cloud deployment. But while the small size and large numbers of these systems may at first be an advantage, these characteristics can also limit the effectiveness of the cloud model for delivering business and IT services. As an organization's use of and reliance on its cloud grows, a distributed x86-based infrastructure can sprawl (with huge numbers of virtual and physical machines that can be unwieldy to manage) and drive up software license costs. It can also stall (hanging up and slowing performance in times of heavy use). Both cases require large numbers of support staff, increasing costs and time to diagnose and repair problems.

As sprawl, stall and other challenges begin to surface with x86-based clouds, organizations should look at an existing zEnterprise deployment as another viable option. In many cases, this can be a complementary approach to deploying cloud workloads that provide the highest availability and disaster recovery, and the most stringent SLAs or security compliance requirements. This approach eliminates the growth challenges that typically accompany the x86 platform, and it helps an organization scale the infrastructure and its management capabilities seamlessly as needs grow. From a hardware perspective, increasing capacity for cloud workloads on a zEnterprise mainframe simply requires adding additional processors called IFLs (Integrated Facility for Linux). The Capacity Upgrade on Demand feature of the zEnterprise system makes it easy and fast to add capacity for cloud workloads.

Take advantage of the IBM SmartCloud Foundation

The IBM SmartCloud vision for cloud computing provides a framework for accelerating business transformation with the capabilities of IBM cloud product offerings. From application development and deployment to resource provisioning, management and security, the IBM SmartCloud Foundation delivers a cloud architecture with a consistent management interface designed to make clouds easier, faster and less costly to deploy and manage.

IBM SmartCloud Foundation capabilities



IBM SmartCloud Foundation and its subset of Cloud Ready solutions provide the full range of capabilities to set up a successful cloud environment and reap ongoing benefits from its operation.

Step one: Consolidating and virtualizing with zEnterprise

Deployed in a cloud environment, the zEnterprise system delivers all the capabilities and benefits that have made it a leader in enterprise mainframe computing worldwide. With its centrally managed environment built on an underpinning of high availability and security, the zEnterprise system enables the organization to run workloads with superior levels of system reliability, data protection and integrity, auditing, chargeback, automation and isolation.

The scalability of the zEnterprise platform, which enables IT to keep up with growing demands by dynamically adding hardware and by sharing system resources using multiple hypervisors in a single machine, also extends to fundamental cloud capabilities. The mainframe can provide the flexibility, capacity and rapid response necessary for today's and tomorrow's heavy computing demands—enabling a higher quality of service via workload management for the mission-critical applications that drive business success.

This flexibility is demonstrated in a recent analyst study of the benefits of higher density virtual machines made possible per processor core by the zEnterprise platform. Among the benefits a number of organizations have achieved is a significant impact on software costs. Particularly where software is licensed per processor core, the savings in license fees can be as high as 90 percent in the context of an Oracle consolidation.¹

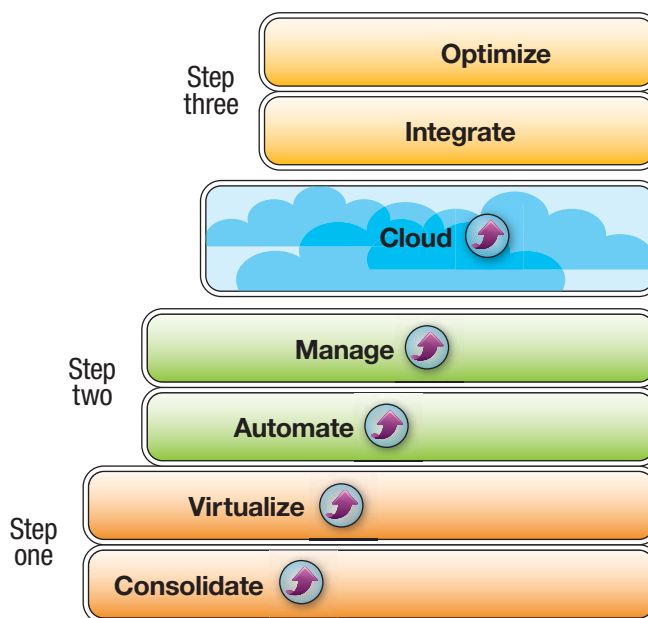
The study also notes the lack of flexibility in x86 environments, where best practices currently limit the number of virtual machines per core to approximately three. It recommends as a result that server utilization should never exceed 50 percent.¹

Such factors place strict limitations on the effectiveness of x86-based virtualization in comparison with zEnterprise servers, where the target utilization is typically well over 90 percent and the number of virtual machines regularly exceeds 30 per processor core. A single zEnterprise system can support more than 300 virtual Linux servers. In environments with between 50 and 75 servers—and especially in environments with more than 100 servers—the price-performance economics of the zEnterprise system makes a compelling case for its deployment.

Step two: Automating and managing with confidence

Security is a key consideration in cloud computing—and the zEnterprise server has the highest security rating or classification of any commercially available server. With the Common Criteria Evaluation Assurance Level 5 (EAL5) awarded by International Standards Organization, the IBM solution can provide organizations with the assurance and confidence to run many different applications containing confidential data on one zEnterprise system divided into partitions that keep each application's data secure and distinct from the others.

Deploying and evolving the cloud



Consolidation, virtualization, automation and improved management can create a cloud. Integration and optimization deliver ongoing improvements to ensure the cloud remains a key contributor to business and IT efficiency and agility.

Additionally, the zEnterprise system brings to cloud environments benefits that are not possible in traditional infrastructures. The zEnterprise platform is ideal for a cloud-based development, test and analytics environment, where large databases must be rapidly provisioned and deprovisioned. A production environment that requires three days to replicate a 300 GB master image 16 times to distributed servers can do the job in an hour using a virtualized zEnterprise environment.²

For the organization initiating cloud deployments, the IBM SmartCloud Foundation also provides a subset of Cloud Ready for Linux on System z® solutions designed to provide the infrastructure from which to create and deploy standards in virtualized and mixed environments, establish a common service delivery model, reduce the cost of delivering services and provide a plug-and-play service management infrastructure. These capabilities are made possible by industry-leading IBM solutions including:

- **IBM Tivoli® Provisioning Manager:** Automating best practices for server provisioning and software deployments, enabling the creation of thousands of virtual machines simultaneously, and helping optimize efficiency, accuracy and service delivery
- **IBM Tivoli Monitoring:** Providing a common, flexible and easy-to-use browser interface to facilitate system monitoring of cloud applications and resources and to help meet SLAs by automatically detecting and enabling recovery from problems in operating systems, databases and servers
- **IBM SmartCloud Control Desk:** Providing a service catalog for making services visible to users and administrators for deployment; providing a service desk for managing service requests, incidents and problems; supporting setting up services for users based on entitlement; scheduling and automating changes; and tracking and managing hardware and software throughout the lifecycle
- **IBM Tivoli Storage Manager:** Helping simplify the protection and management of rapidly growing data volumes with greater visibility from a single point of control; employing data deduplication and tiering to help increase efficiencies, conserve resources and meet regulatory requirements
- **IBM Tivoli System Automation for Multiplatforms:** Supporting continuous high availability with policy-based automation for starting, stopping, restarting and failing over applications or their infrastructure components to reduce the frequency and duration of service disruptions

By establishing a cloud environment with Cloud Ready for Linux on System z and the framework of the IBM SmartCloud Foundation, organizations can run private cloud workloads with greater efficiency and consistent administration. They can reduce the inefficiencies of managing sprawling x86 machines, including the challenges of managing images and workloads across multiple platforms. By moving Linux images to a zEnterprise mainframe, they gain greater reliability and help reduce high IT administration and capital costs.

Step three: Integrating and optimizing for ongoing success

Consolidating, virtualizing, automating and managing can create an effective cloud. But to get the most from its cloud deployment, the enterprise needs continuous improvements, including increasing agility by managing multi-tenant environments and speeding innovation through seamless orchestration. Ongoing workload optimization, greater integration with enterprise standards and the extension of cross-architecture services—to zEnterprise, IBM POWER and x86 platforms—enable the organization to deploy, redeploy and consume resources to meet service delivery and business needs.

IBM Tivoli Service Automation Manager enables users to request, deploy, monitor and manage cloud-computing services, speeding the availability of IT services and lowering the

cost of their delivery through automation and reduced skill requirements. This solution provides automated service lifecycle management, including dynamic instantiation and ongoing management of cloud services. Automation and management is based on templates and management plans for manual and automated deployment of management components. The ability to reclaim unused resources or optimize underutilized resources can be a key advantage of this solution.

IBM SmartCloud Application Performance Management and IBM SmartCloud Monitoring can ensure the cloud optimization that the organization needs, using monitoring to enable insights and awareness of issues such as how resources are used or where performance bottlenecks occur. Holistic visibility into the infrastructure—using easy-to-understand dashboards that track availability, performance and capacity—supports dynamic workload placement and component right-sizing to ensure cloud performance meets the organization's IT and business demands. The ability to intelligently manage applications in cloud environments supports:

- **Discovery:** Providing visibility into application resources and their relationships to infrastructure resources
- **End-user experience:** Enabling workload performance monitoring to ensure service levels
- **Workload tracking:** Providing rapid problem resolution through transaction path analysis
- **Diagnostics:** Using domain-specific tools for diagnosis, repair and capacity planning
- **Predictive analytics:** Reducing outages and improving business performance

The IBM solution's modular design enables organizations to start quickly and add capabilities as needed—growing from simple user monitoring that helps ensure service compliance; to

increased visibility with topology discovery, problem isolation and advanced diagnostics; to end-to-end monitoring that locates difficult-to-resolve problems and delivers early warning of performance problems. IBM SmartCloud Application Performance Management can meet the rapidly changing needs of enterprise users and IT infrastructures with support for advanced capabilities such as analytics as well as critical functions such as capacity planning.

Conclusion

Successful cloud deployments depend on a synergy between core components, such as the zEnterprise mainframe, combined with the IBM SmartCloud Foundation building blocks of foundational and advanced capabilities. A step-by-step approach that begins with assessing and assigning workload placement to best meet IT performance and business access needs, and then extends over time to deploying, managing and optimizing the cloud can be key to providing the successful operation and outcomes that cloud computing promises.

Consolidating and virtualizing the environment with zEnterprise mainframes can lower total cost of ownership by reducing the hard-to-manage sprawl of virtual and physical machines and their operating system images. Automating and improving management with solutions from the Cloud Ready portfolio and the IBM SmartCloud Foundation support a common service catalog and enhanced workflows to achieve the efficiencies inherent in the cloud-based service delivery model and meet regulatory compliance requirements. And integrating and optimizing the established cloud environment delivers ongoing improvements across architectures and workloads to ensure that the cloud implementation remains a key contributor to building business and IT efficiency and competitive advantage for the organization. By applying the steps outlined in this paper, enterprises and service providers can be positioned to achieve successful cloud deployments and minimize the number of storms that cast shadows today on many current cloud deployments.

For more information

To learn more about IBM SmartCloud solutions and Cloud Ready for Linux on System z please contact your IBM representative or IBM Business Partner, or visit ibm.com/systems/z/solutions/cloud/index.html

Additional details on Cloud Ready are also available [here](#).

For more information on mainframe security in cloud environments, download the IBM white paper “[Consolidated security management for mainframe clouds](#).”

Additionally, IBM Global Financing can help you acquire the software capabilities that your business needs in the most cost-effective and strategic way possible. We’ll partner with credit-qualified clients to customize a financing solution to suit your business and development goals, enable effective cash management, and improve your total cost of ownership. Fund your critical IT investment and propel your business forward with IBM Global Financing. For more information, visit: ibm.com/financing



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¹ Gary Barnett, “Building a foundation for a high-performance, low cost private cloud,” *Bathwick Group*, November 2011. [ftp://public.dhe.ibm.com/software/systemz/analystreports/2011_12_09_0301_The_Bathwick_Group_Building_a.pdf](http://public.dhe.ibm.com/software/systemz/analystreports/2011_12_09_0301_The_Bathwick_Group_Building_a.pdf)

² Based on test results achieved in IBM labs



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