IBM Global Services
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Cloud computing: Innovative solutions for test environments

Speed test cycles and reduce cost to gain a competitive edge

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Executive summary

With the global economy contracting, organizations around the world are seeking new ways to optimize IT capital and operating expenses, while delivering unique services and products into a highly dynamic marketplace. In increasing numbers, chief information officers (CIOs) and IT managers are turning to flexible sourcing models like cloud computing to address these challenges. Some are starting to adopt test cloud solutions to speed test cycles and reduce cost in order to help them gain a competitive edge.

This paper introduces the innovative cloud computing approach and solution for test environments, a workload that organizations can perform with cloud computing. In addition to the many benefits that a cloud computing solution can provide for test environments, this paper also presents a typical cloud usage scenario and two successful client projects.

Highlights

Market forces are driving changes for traditional testing environments.

Leading drivers of change for test environments

CIOs and test managers today are under increased pressure to reduce the total cost of ownership of their test organizations. As test configurations grow in complexity and the competitive pressures increase to deliver innovative applications to the marketplace faster, CIOs and test managers find themselves caught in the middle. How do they reduce the time to plan, install, configure and validate complex test environments while improving the quality of testing? Traditional testing approaches are not keeping pace with the demands of those who are requesting services from the test organizations. It's time for a breakthrough, innovative solution. It's time to look at cloud computing as a way to address the challenges faced by test organizations.

Here are some facts that further illustrate the CIO and test manager plight:

- Not having the right or sufficient resources is creating a testing backlog that is often long and comprises the single, largest factor in the delay of new application deployment. It's a challenge to stay competitive if innovation cannot get to the marketplace in a timely manner. Also, manually configuring complex test landscapes often results in inefficient and inconsistent use of the IT test resources.

- On average, 30 to 50 percent of all servers within typical IT environments are dedicated to test.1 Most of these test servers run at 3 to 5 percent utilization, if they are running at all.[1] Because of large, unused inventories, some businesses see their test environments as inefficient and costly based on their return on investment. Inadequate resource management of test resources comes from not knowing what is installed, where it is, who uses it and how often.

- The inability to ensure that test environments match production environments can result in quality problems and slow problem resolution when the applications are deployed. Thirty percent of all defects in production level environments have been caused by wrongly configured test environments.[1]

Highlights

In rapidly growing numbers, customers are searching for alternatives, such as cloud computing to address these challenges in the test environment.

Cloud computing offers new methods that overcome many of the challenges of traditional testing methods.

Surmounting testing challenges with cloud computing solutions

Cloud computing is an evolving acquisition and delivery methodology that helps to rapidly develop, deploy and deliver services in a simplified way to cost-effectively support innovative business solutions. As an acquisition model, cloud computing is about ease of access and use, the ability to get the resources or information quickly and have elastic scalability, and the ability to pay only for what they use and then unplug. As an emerging style of IT delivery in which applications, data and IT resources are rapidly provisioned and provided as standardized offerings, cloud computing is a way of managing large numbers of highly virtualized resources such that, from a management perspective, they resemble a single large resource. This resource can then be used to deliver services dynamically, as illustrated in the following workflow of a cloud computing model:

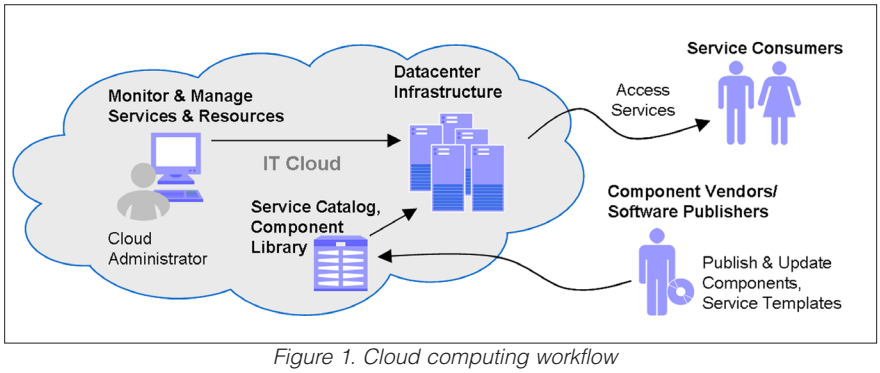

Figure 1. Cloud computing workflow

Organizations that have adopted cloud computing are benefiting from new and better ways for their users to access services. Cloud computing offers an improved means of infrastructure management and supports a new services delivery methodology. The key features of cloud computing are:

- Standardized, consumable, Web-based deliverable services
- Elastic scaling
- Flexible pricing
- Metering and billing capability
- Advanced virtualization
- Rapid provisioning of resources

The emerging three types of computing cloud methods are: public clouds, private clouds and hybrid clouds. Public clouds are generally owned and managed by a service provider and typically deliver very standardized services. Public clouds acquire computing needs across the Internet and offer the benefits of very quick access to resources, no capital outlay, and an ability to pay only for what you use with no long-term commitments. Concerns about public clouds include security, availability, resiliency and a reduced ability to tailor the resources to exactly meet the needs.

Private clouds are maintained behind the firewall and are typically part of a client's IT infrastructure using a private network, or they may be hosted for a client by a service provider. Private clouds are readily auditable and offer the benefits of security, known resiliency, a very high utilization of internal resources, and an improved ability to customize the resources to meet a specific need. Concerns about private clouds include capital expense, the need to ensure service automation, ease of consumer use and access, and availability may be limited depending on the resource investment made.

Hybrid clouds are part public cloud service and part internal private cloud. A hybrid cloud model can be set up in several ways; for example, using an outside provider's hardware onsite, such as cloud appliances, that is designed to provide cloud-based services, or purchasing public cloud resources and then combining with private cloud resources to deliver the end service to the consumer.

As shown in Figure 2, application and system testing are some of the many workloads that organizations are redesigning to leverage cloud computing and address the challenges noted in the previous section. The key building blocks of a cloud computing solution consist of a service management tier that allows access to physical resources through a virtualized layer.

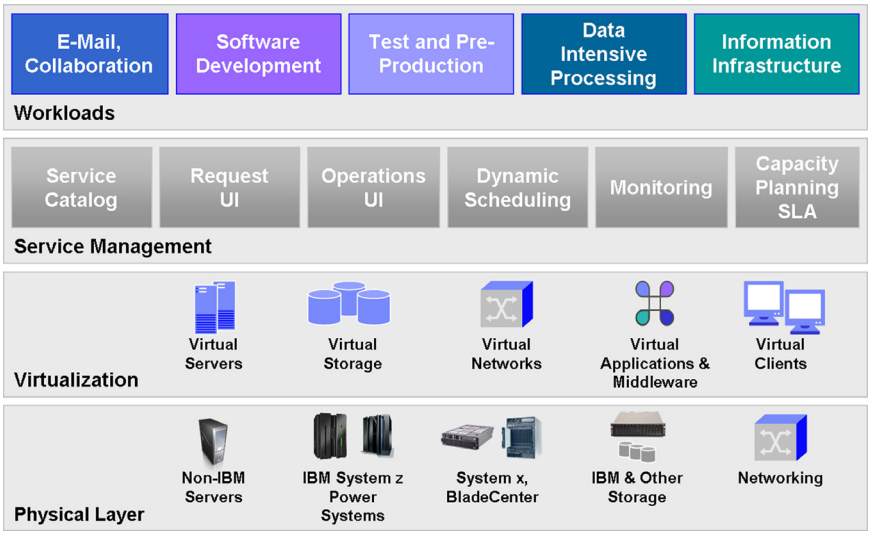

Figure 2. Typical cloud infrastructure

Customers who are enthused about adopting cloud computing for their business typically want to know "how and where do we get started?" In growing numbers, customers are choosing to begin their cloud computing journey within their testing organization to overcome the challenges presented with traditional testing methods.

Because traditional testing methods can be long, drawn-out, manual processes that tie up many resources, the test environment is a prime target for leveraging a cloud computing solution. Considering that development and test cycles are critical paths to offering new services to clients, cloud computing also presents an opportunity to increase cycles of innovation and improve solution quality.

A test cloud solution will typically have these four architectural layers:

- Hardware: servers, storage, network components and provisioning appliances and software to automate provisioning.
- Virtualization: uses techniques such as firmware-based bare-metal hypervisor, software-based bare-metal hypervisor, a hosted operating system and paravirtualization, including storage and network virtualization, and many times middleware application virtualization.
- Resources management: automated provisioning change management, de-commissioning and management of the test environment, including the monitoring, metering and billing disciplines.
- End user access: a service-oriented model that provides an easy-to-use interface that presents the available resources in the form a service catalog from which the consumer can select and combine components to build their needed testing environment.

Based on testing needs, a test cloud can be implemented on a private cloud at a customer site, a private cloud on a vendor site, a managed service delivered over the network or a hybrid cloud with private and public environments.

Highlights

Customers that leverage cloud computing for testing environments can look for greater return on investments with:

- *Reduced IT labor cost by as much as 50 percent*[2]
- *More efficient license management*
- *Reduced test provisioning cycle times, from weeks to minutes*
- *Improved quality by eliminating 30 percent or more of all defects that come from faulty configurations*
- *A substantial increase in asset utilization*

Benefits of a cloud computing solution for test environments

Cloud testing provides an end-to-end solution that transforms the way testing is done and can help an organization boost its competitiveness by reducing the expense of testing without negatively impacting mission-critical production applications. By leveraging a cloud computing solution for testing, organizations can shorten provisioning time because the cloud enables provisioning of test servers on demand. This helps ensure unused servers are re-provisioned, which maximizes asset usage. Consider that a major financial customer was able to save US$1.6 million in capital costs and drive utilization up 75 percent on Windows® and 25 percent on IBM AIX® systems with the faster provisioning provided by a test cloud infrastructure. Internally, IBM was able to the reduce annual expense of test environments with the Technology Adoption Program by 83 percent.[2]

By automating the provisioning of test resources, organizations attack a key variable cost that has an impact on their bottom line—IT operating costs. Then, organizations can redirect key resources from manual configuration activities and previously under-utilized assets to more mission-critical and value-added tasks.

Furthermore, with test cloud environments, test teams can leverage live environments for their testing services and not just modeling tools. With a predictive approach to testing, test clouds help to improve productivity and manage compliance and risk in the IT environment. This also helps the test team create a more resilient test landscape. And, with application on-boarding through the automation of middleware deployments, testers will be able to smoothly migrate new applications and infrastructures from old to new systems and from standalone systems to virtualized environments.

Once a test cloud computing solution is in place, CIOs and IT managers will realize the benefits that cloud computing can provide for testing teams, such as:

- Significantly reduced time to take new technologies and innovations through the test cycle so they are delivered quicker with higher quality to customers
- Labor cost savings related to time spent installing and configuring software test platforms
- Elimination of errors—estimates as high as 30 percent—that come from faulty configurations
- More efficient software license management
- Reduction in IT operating and capital costs by leveraging of under-utilized infrastructure components and optimizing of existing investments

Using the test cloud environment

Assume that a tester needs a highly complex test environment configured in order to conduct performance testing on a new application. As illustrated in Figure 3, in a test cloud environment, the tester (user) would first log on to an easy-to-access and easy-to-use service request portal, which accesses a services catalog and then submit the request for the test environment desired. The portal and catalog mask the underlying complex infrastructure from the user so that the focus is shifted to the services provided.

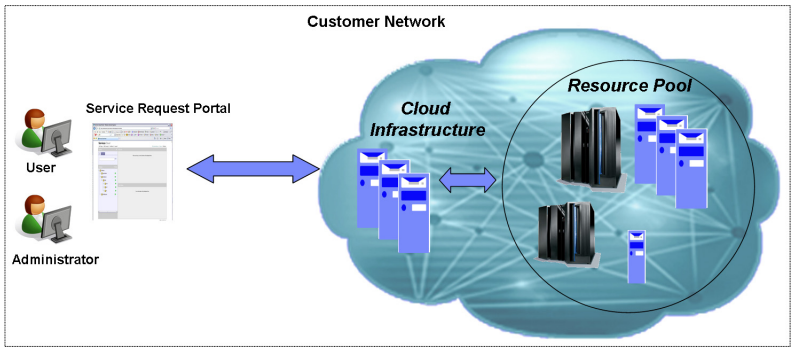

Figure 3. Service request in a cloud computing model

The request is delivered through the service request catalog and passes through the cloud infrastructure where the requested resources, including the bare metal, operating system, middleware, network, data and applications, are provisioned. The services can be defined as a simple operating image inside a virtual partition or a complex application stack.

When testing completes, the resources can be de-provisioned and returned—as illustrated in Figure 4—to the resource pool for others to use. This on-demand approach facilitates resource sharing and prevents hoarding of resources that have low utilization.

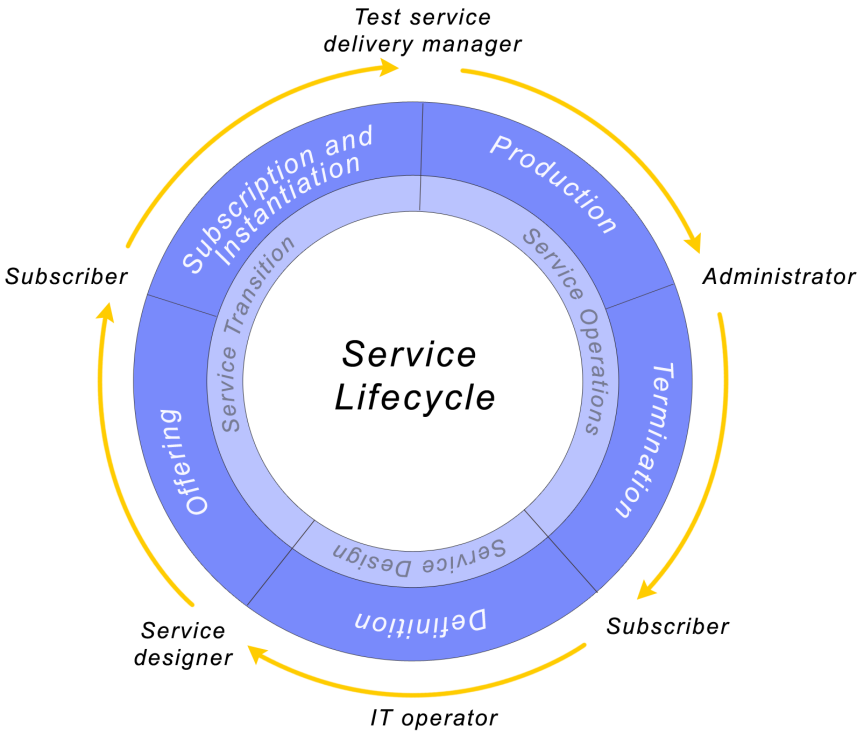

Figure 4. Test cloud service lifecycle

Highlights

To address specific challenges, such as return on investment, capacity and availability issues, organizations are adopting cloud computing models for their testing environments.

Clients adopting IBM cloud computing

To better understand cloud computing and how organizations can leverage this delivery technology, consider the following cloud solutions developed and implemented by IBM for the city of Wuxi, China and at a major US federal agency.

China Cloud Computing Center at Wuxi

Wuxi, China, an economically growing city that is located about 100 miles outside of Shanghai developed a software business park where substantial tax incentives are offered to businesses that open new offices within the park. One challenge facing startups in Wuxi was the high upfront investment in IT infrastructure needed before being able to accept business from enterprise clients. To address this challenge and attract companies to the software park, the municipal government of Wuxi worked with IBM to build a cloud computing center based on the dynamic infrastructure model.

Tenants in the software park can now use this data center to rent software development and test environments. Because multiple customers are hosted within one environment, this solution requires exceptionally effective network isolation and security. In this virtualized environment, hosts from one physical server may have virtual machines used for multiple projects; one project might also span multiple hosts. Virtual private network (VPN) technology is used to make sure each client has its own isolated network. When resources are provisioned, additional networks or bridges are configured on either the host or virtual I/O server.

In this example, IBM helped Wuxi design and implement a public cloud they offer to their users that provides assurances of security and privacy.

Highlights

Major US federal agency

A major US federal agency supports roughly 40,000 users and faced capacity and demand issues for tasks such as application testing. In addition to resolving their availability issues, they were also looking to cut costs while adopting innovative solutions for their method of testing and other services. They acted to reduce the cost and time of provisioning development and test environments by transitioning to an automated process that rapidly instantiates virtual environments.

They researched their objectives and created a testing strategy that leveraged a self service model with a streamlined process that enabled the following workflow:

1. Develop a request
2. Submit the request
3. Track the status using Web pages
4. Receive information on how to access the environment through an email

With implementation of an automated cloud computing solution, the customer reduced the time to build test and development environments from about a month, down to around three minutes and were able to cut administrative costs and better utilize existing assets. This also dramatically improved their overall consumer satisfaction and helped improve innovation within the agency.

Design and implementation services for test environments from IBM offers on-demand provisioning of dynamically scalable, virtualized test server resources in a secure, private cloud environment.

IBM Implementation Services for Cloud Computing – design and implementation for test environments

With IBM's Implementation Services for cloud computing –design and implementation for test environments, CIOs and test managers can get the assistance they need for building and operating an automated request-driven infrastructure for delivering test resources to their innovators. This solution includes an integrated and extensible platform that combines service request management and provisioning with change and configuration management.

IBM believes that this approach allows customers to better drive their time-to-market and competitiveness. By using a proven method-based approach, the design and implementation can be completed in a short period of time and help form the basis of a future cloud computing operating environment, enterprise-wide.

Design and implementation services for test environments from IBM offers on-demand provisioning of dynamically scalable, virtualized test resources in a secure, private cloud environment. The solution comprises a pre-integrated set of services from planning through management of the customer's test environment, and it is designed to enhance and accelerate their return on investment.

With on-demand provisioning, this IBM offering helps customers reduce capital investments, while the automated provisioning and configuration of test resources help save IT labor costs. The automated configuration and more effective modeling of the customer test environment also helps eliminate configuration errors, streamline and simplify the environment, and improve solution quality.

Customers can start with virtualization and automation for their test environments or implement full lifecycle management of their testing processes. With our best practices approach in test environments, we can help customers develop and strategically plan for the many advantages that testing in the cloud environment can provide for their organization. More specifically, our services and experienced professionals can help customers:

- Optimize their existing IT infrastructure to meet the needs of their business
- Achieve a successful test cloud implementation project
- Expand a limited implementation across their entire enterprise
- Ensure that their test cloud is aligned with the needs of the business and can evolve to support new business requirements

In addition, IBM Implementation Services for cloud computing – design and implementation for test environments now supports automated provisioning and management of IBM WebSphere® Application Server virtual images through the new WebSphere CloudBurst appliance.

For more information

For more information about cloud computing, please contact an IBM representative or visit: **www.ibm.com/cloud**

Additionally, IBM Global Financing can tailor financing solutions to a customer's specific IT needs. For more information on rates, flexible payment plans and loans, and asset buyback and disposal, visit:

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IBM Global Services
Route 100
Somers, NY 10589
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[1] IBM internal analysis based on IDC, Global Testing Services: Coming of Age, Doc # 214504, October 2008

[2] Based on results from IBM's Technology Adoption Program, in which an internal "Collaboration Innovation" cloud was developed using IBM technology. The solution has more than 100,000 participants. Results vary depending on the customer's existing environment. Final results can only be ascertained after a return on investment analysis.

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