Keane
an NTT DATA Company

Keane White Paper

Cloud Computing

Clear thinking about its risks, benefits, and success factors

Cloud computing is not just a trend. It is changing the way IT organizations drive business value.

EXECUTIVE SUMMARY

Driven by potential for significant cost savings, organizations of all sizes are becoming early adopters of cloud technology. Cloud computing gives organizations convenient, on-demand network access to a shared pool of computer resources. The benefits of cloud are many, including cost savings, resource scalability, environmental friendliness, and accelerating time to market.

There are three major service models associated with cloud computing: Cloud Infrastructure as a Service (IaaS), Cloud Software as a Service (SaaS), and Cloud Platform as a Service (PaaS). These services are offered as either public, private, or hybrid clouds. Each approach has its own set of benefits and drawbacks. Evaluating these options will enable enterprises to find the right balance of cost savings and security risk.

A trusted cloud partner can help an enterprise successfully adopt cloud. Find one that offers a proven risk-mitigation approach; comprehensive consulting, applications, and infrastructure services; as well as cloud point solutions that offer a low-risk way to test the waters.

About Keane

Keane, an NTT DATA Company, is an IT services firm headquartered in the US with more than 12,500 professionals worldwide. For 45 years, Keane has been an Application Services specialist with distinguished project management credentials. Today, Keane offers a flagship suite of Application Services, as well as Infrastructure and Business Process Outsourcing solutions delivered through onsite, nearshore, and offshore resources.

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Introduction

The market for cloud technology and integrated services is currently transforming from the hype cycle to testing, piloting, and implementation by larger enterprises. Given the potential for significant cost savings, smaller and medium sized organizations are also becoming early adopters of this technology. The emerging market for cloud services is being driven by the economic downturn in North America, continuing globalization, government edicts, consumer acceptance of technology, and the growth of the extended enterprise. Cloud technology enables organizations to limit the large capital expenditures previously associated with costly data centers and applications and transform these costs into operating expenses paying for technology resources only as needed. In addition, using the cloud enables end users to accelerate time to market since it uses pre-existing virtual technology and infrastructure that can be delivered and accessed globally.

The trend toward cloud computing is also being encouraged by the need for organizations to support collaboration and group decision-making and focus on core competencies, while transferring commodity services to external vendors. As a result, the cloud is changing the way that IT services are being sourced and delivered. Analysts have referred to this environment as ubiquitous computing, the third technology wave after distributed computing and network Web/ Internet. This third wave of technology in turn requires a dramatic change of focus for internal IT management and the need to transform its role from standards enforcer to strategic partner with the business.

Characteristics of Cloud Computing

According to the National Institute of Standards and Technology Information Technology Laboratory, cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computer resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. The characteristics often associated with cloud computing are as follows:

- **On-demand self-service by consumers:** The technology is available to end users as it is needed without intervention by internal IT.
- **Broad access via the network:** The technology can be accessed via an enterprise or public network and can be easily accessed from any location.
- **Resource pooling of physical and virtual resources:** Since the data center and virtual resources are situated in one place, the technology can be shared and maintained more efficiently.
- **Rapid scaling of capacity:** The cloud permits the rapid provisioning of end users and shared resources allows for elasticity of demand and capacity.

» **Enhanced transparency of usage via metrics:** Centralized resources, vendor management, and contractual Service Level Agreements (SLAs) facilitate increased transparency and meaningful information that can be used by management.

Cloud Computing Service Models

There are three major service models currently associated with cloud computing: **Cloud Infrastructure as a Service (IaaS)**, **Cloud Software as a Service (SaaS)**, and **Cloud Platform as a Service (PaaS)**. The following summarizes the key concepts of each of these three service models.

Cloud Infrastructure as a Service (IaaS)

A model in which an organization outsources the equipment used to support operations including storage, hardware, virtual servers, databases, and networking components. The service provider owns the equipment and is responsible for housing, running, and maintaining it. The client typically pays on a per-use basis. It is a well known fact that except for a few peak times per year, most servers are running with a 7 – 10% load. IaaS enables enterprises to leverage the cloud during peak need times. Doing this is often referred to as cloudbursting. To accomplish this internally, organizations must use complex resource allocation software.

Advantages/Disadvantages: IaaS allows organizations to avoid the large capital expenses associated with infrastructure and data centers. It also has a low barrier to entry and enables automated scaling. One negative aspect of IaaS is that it brings with it new security risks that require different measures. For example, due to stringent information requirements associated with regulations such as the Health Insurance Portability and Accountability Act (HIPAA), and Sarbanes-Oxley (SOX), enterprises must carefully assess where such information resides and mitigate any privacy risks. In addition, how well IaaS works is vendor dependent.

Cloud Software as a Service (SaaS)

The capability offered to the consumer is to use the provider's commercially available applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a Web browser. So applications remain available to end users when needed via the Web. One of the most common uses for SaaS is for Web-based email services. In addition, small to mid-size enterprises typical use SaaS for hosting commercial software suites such as customer relationship management (CRM), enterpriser planning (ERP), and supply chain management (SCM). SaaS enables enterprises to obtain the use of such commercially available software on demand without the need to invest in IT resources knowledgeable in its support.

Advantages/ Disadvantages: The potential for cost savings using SaaS is obvious. Rather than purchase expensive licenses for each computer, many of which remain idle at any given time, organizations can pay for the use of software by the drink. SaaS also eliminates the capital expense of purchasing software. In addition, since applications are centralized, version control and updates are relatively headache free and deploying software becomes instantaneous. On the other hand, applications that are centralized present enhanced security risks.

Cloud Platform as a Service (PaaS)

The two components of PaaS are the place on which software can be launched (platform), and the services being provided (solution stack). Resources being delivered via PaaS typically include infrastructure and applications. In many cases the data being used is also stored in the cloud and the end user's terminal may contain only an operating system and Web browser. In addition, end users can write their own code and the PaaS provider then uploads that code and presents it on the Web. SalesForce.com's Force.com is an example. The PaaS model enables resources to be increased easily with demand since end users share the same cloud. This is often called multi-tenant cloud computing.

Advantages/Disadvantages: PaaS enables enterprises to pool resources, scale when needed, and makes version control simple. However, once again, the largest downside is that centralized data increases security risks.

In short, whichever cloud services model your enterprise selects, it should enable cost savings and ease the burden and personnel resources required from the IT organization. The major drawback that must be mitigated is the security risk associated with centralization.

Major Benefits of Cloud Solutions

In addition to lower expenses, enterprises can benefit from many other primary benefits associated with cloud computing. These can be summarized as follows:

- **Cost:** Companies can save the considerable costs associated with building, maintaining, and operating a data center, especially power and cooling related expenditures. Additionally, the model allows firms to lower expenditures on support staff, particularly those providing infrastructure support, systems management, and help desk services. Lastly, cloud computing enables companies to change what has historically been capital investments (CapEx) to operating expenditures (OpEx).
- **Capability/Scalability:** Many organizations have simply run out of existing capacity due to limitations on power consumption. With the cloud, companies can scale quickly and efficiently added investment. Many cloud providers even offer "burstable" infrastructure that automatically expands and contracts to meet peak performance periods.
- **More Green:** Businesses are being pressured to reduce their impact on the environment in the form of greenhouse gases. As a result, they are now required to report their carbon footprint. Outsourcing via a cloud solution enables companies to become more environmentally friendly.
- **Organizational Agility:** By eliminating the purchasing of costly hardware and software and the need to depreciate these assets, organizations are no longer hindered by infrastructure in terms of global expansion and the ability to adopt the latest technology. Time to market is also greatly enhanced by empowering departments to deliver speedy proofs of concept and product demos via the cloud.

- **Collaboration:** The cloud provides an environment that supports global collaboration and knowledge-sharing as well as group decision-making. Shared sites can be easily set up, replicated, and torn down as needed to meet the collaboration requirements of a given project.
- **Focus:** Delegating commodity infrastructure and services allows organizations to focus on their core competencies and further develop capabilities that can differentiate their organizations in their respective business markets.

Impediments to Cloud Adoption

Enterprises should carefully consider five major impediments to the successful adoption of cloud computing. These challenges are as follows:

- **Security:** Commercial cloud providers offer broad access to end users and accordingly roles and access permissions are less controllable. Legacy security measures must be duplicated within the cloud such as firewalls and intrusion detection. Virtualization greatly adds to the complexity of this process and provides new threats in areas such as virtual switches and hypervisors.
- **Privacy/Compliance:** Issues related to privacy include jurisdiction of information (where and under what set of laws), access and controls, the availability of audit trails, and compliance with industry and legal standards and regulations, such the Statement on Auditing Standards No. 70.
- **Immaturity of Vendors/Offerings:** Public cloud IaaS providers have yet to develop a strong track record in supporting large production or enterprise systems on a turnkey basis.
- **Risk Mitigation:** It is difficult to determine how well a provider is mitigating data location, loss, or security oriented risks. In fact, some providers have simply gone out of business. Consequently, requirements for data protection should be strictly governed through the use of contractual service level agreements.
- **Legacy Applications:** Core business applications are often highly customized, convoluted, and entangled. As a result, prior to moving them to the cloud a re-engineering effort is often required to modernize and rationalize an applications portfolio before it is deemed "cloud-worthy."

Key Questions When Considering the Cloud

- Which parts of my business are suitable for moving to a cloud-based delivery model and which are not?
- How much of each process should I consider placing on the cloud?
- Should I retain control in-house but use cloud-based infrastructure, buy the entire process as a service, or something in between?
- Which services are enterprise-ready and offer the right levels of security and governance for my business?
- How does transitioning to a cloud impact my procurement and what else should I consider before signing on the dotted line?

Cloud Infrastructure Options

For most businesses, organizations, or governmental agencies, there are three relevant types of clouds: Private (internal or vendor-hosted), Public (external), and Hybrid (mixed). Each cloud infrastructure has unique characteristics and offers different advantages and disadvantages.

The following summarizes these three types of cloud options:

Enterprise Private Cloud

A private cloud enables enterprises to implement cloud technologies at their site and behind the firewall. Enterprises are implementing a private cloud within areas of their infrastructure in which a cloud model makes the most sense. A private cloud provides many of the benefits of cloud computing without the loss of control and security risks associated with other cloud infrastructure models. A private cloud includes virtualization technology to enhance scalability, resource management, and hardware utilization. In addition, it incorporates data center automation of provisioning and chargeback metering for consumption and services-based billing capabilities. Identity-based security protocols ensure that only authorized personnel have access to appropriate applications and infrastructure.

An increasingly popular version of a private cloud is a vendor hosted private cloud, sometimes referred to as a partner cloud. With this alternative, the cloud is hosted within a vendor secure data center. Virtualized applications are moved to vendor data center servers, and the vendor uses its cloud enterprise support tools, testing technologies, and procedures.

Advantages/Disadvantages of Enterprise Private Cloud Infrastructure

A private cloud enables customers to leverage many of the benefits of cloud computing within its own data center facilities. This cloud infrastructure model is ideal for clients subject to stringent privacy restrictions (banks, government, etc.). However, a private cloud will provide little to no immediate cost savings due to the investments required in technologies.

A vendor hosted private cloud allows organizations to take advantage of cloud computing and vendor tools, techniques, and experience, while limiting security risks. In addition, a vendor hosted private cloud frees in-house resources and provides an immediate reduction in IT support costs by enabling consumption-based billing. It also eliminates future infrastructure CapEx, while freeing up internal capacity. In short, this cloud model permits users to leverage vendor cloud methodologies, tools, and lower prices. However, it does not provide the optimum promise of cloud computing such as the lowest price and unlimited elasticity to ramp resources.

See Case Study A on Page 14 for an example of the use and benefits of a private cloud infrastructure.

Public Cloud

In a model similar to electric utilities, a public cloud enables organizations to use infrastructure and applications via the Internet that reside in the cloud. This shared pool of networks, servers, storage, applications, and services are available to multiple people or enterprises. End users without actually possessing these resources can gain access to them

easily on demand via a Web browser from a simple laptop or terminal, wherever they are needed and with minimal management or service provider effort. A well-known consumer version of a public cloud application is the iTunes Store.

Advantages/Disadvantages of Public Cloud Infrastructure

Since it is a shared capability, a public cloud is the lowest-cost cloud computing option. It provides an ideal platform for rapid proofs of concept, on-demand performance testing, and document and information collaboration through technologies such as Microsoft SharePoint. The major downside of this cloud computing model is the location and security of proprietary information. One issue is that vendor cloud administrators have access to data creating theft or abuse risks. The location of data is also of great consequence since it determines under which laws the information resides. Another major concern is data recovery. Most public cloud servers are not built for high availability or automatic failover. As a result, enterprises may be forced to spend additional monies for a backup or failover environments. In addition, because of the utility nature of the public cloud model, vendors cannot provide meaningful Service Level Agreements.

Key Questions When Considering the Cloud

- How do I establish a winning strategy to fulfill short-term needs and provide long-term advantage leveraging cloud computing?
- What roadmap should I construct?
- What is the best way to "cloudify" my existing IT environment?
- What areas should I focus on first in order to optimize business benefit while mitigating risk?

Hybrid Cloud Infrastructure

A hybrid or mixed cloud environment provides the best of both worlds – combining elements of private and public cloud infrastructures. Within this model, a public cloud is leveraged to extend or supplement an internal cloud. For example, a company may employ an internal cloud to share physical and virtual resources over a network, but extend these capabilities when needed such as at peak processing times. Implementing a mixed cloud infrastructure enables enterprises to pick and choose which applications within the portfolio reside on a public versus private cloud. For example, this model permits financial applications with the most proprietary information to remain behind a firewall, while other software such as collaboration, customer service, or supply chain can reside on a public cloud.

Advantages/Disadvantages of Hybrid Cloud Infrastructure

A mixed cloud infrastructure model supports high capacity time periods and mitigates security risks on mission critical applications. It enables you to leverage the advantages of public cloud for more portable and appropriate applications, while maintaining control over legacy and vital systems with greater compliance, performance, and security requirements. The hybrid model also provides an optimal approach for architecture since organizations can combine local infrastructure with infrastructure that is scalable and provisioned on demand. Accordingly, a mixed model offers substantial cost savings at the same time as enabling almost unlimited flexibility. It is important to note, however, by using this model enterprises are trading additional cost savings for added security.

Because of these considerable advantages, a hybrid cloud model is likely to be the most widely adopted infrastructure for global enterprises. The biggest

drawback to this model is the complexity of monitoring and managing all portions of the hybrid cloud from a common portal or service desk. This requires considerable engineering on the part of the IT organization or the acquisition of third-party vendor services to provide the necessary "glue" to oversee the enterprise environment wealth of information on how to enhance their business value while reducing costs and freeing resources for more strategic initiatives. Implementing Keane's prioritized Applications Rationalization recommendations will provide immediate, quantifiable results, maximizing the return on your improvement investments.

The Need for Integrated Cloud Application and Infrastructure Services

Obtaining and implementing a hybrid cloud infrastructure is not enough to optimize an enterprise's benefits and mitigate risks from cloud computing. To do this requires a vendor who can provide more than just a hybrid cloud infrastructure. It necessitates a vendor/partner that can assist with a cloud adoption strategy as well as offer proven cloud application and infrastructure services, a cloud methodology or framework, and an integrated set of tools.

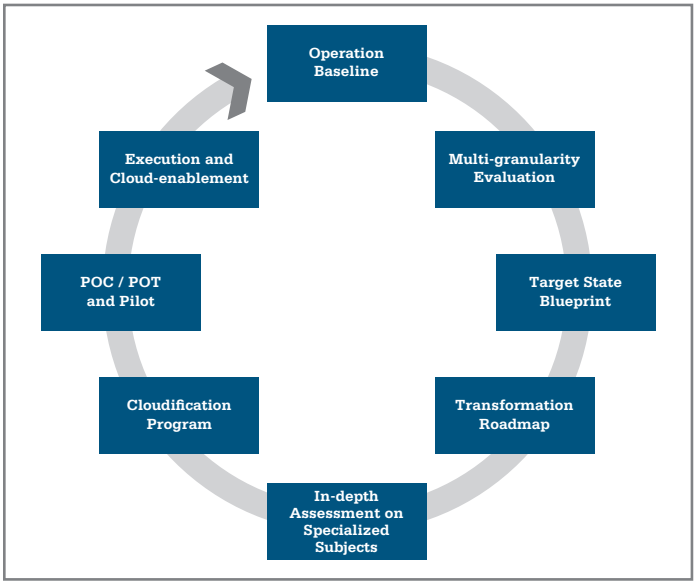
Consulting services might be the first step in helping enterprises to develop a cloud adoption strategy and roadmap. Applications services are also required to assess and prepare the targeted applications for cloud use, or to integrate pre-existing applications resident on a cloud within an existing infrastructure and applications portfolio. Services such as applications rationalization and modernization are also critical success factors prior to any porting. Most importantly, enterprise application services and applications management services under a detailed service level agreement are a necessity. Finally, multi-shore delivery enables a more cost-effective solution and assists in the realization of material, short-term cost savings with ongoing long-term returns.

In addition to application services, integrated infrastructure services are desirable for any successful foray into cloud computing since the availability, speed, seamlessness, and end user satisfaction with any cloud-based solution are vendor dependent. Success entails a vendor that can evolve, operate, and maintain the systems that support your mission-critical applications in an optimum manner. Offered services and vendor competencies must include: remote infrastructure management, ITIL-based service desk operations, and state-of-the-art data center uptimes and services.

Yet another important ingredient for leveraging cloud computing technology is a cloud methodology/framework and a suite of integrated tools. Such a framework helps to establish a set of common vocabulary and definitions between an enterprise and the vendor. It also aids in the alignment of internal IT and business users by enabling meaningful discussions regarding potential cloud technology and vendors. Finally, a cloud framework incorporates the impact to all stakeholders and defines the most applicable toolset. Such a toolset can facilitate the most efficient management of storage, transactions, databases, applications and middleware, servers, networks, and other client devices.

Figure 1: Cloud Framework

A cloud framework identifies the first steps in planning your adoption strategy.



One final important criterion for the successful adoption of cloud technology for your enterprise is the available of point solutions such as Quality Assurance & Testing services. Testing represents the easiest point of entry with the lowest risk for experimenting with various types of clouds. Cloud technology can dramatically reduce application development timeframes and testing cycle times and greatly accelerate time to market or production.

See Case Study B on Page 15 to find out how a large software company used the cloud to significantly speed testing and time to market.

Selecting a Cloud Partner

One of the most important decisions your enterprise might make as part of your cloud adoption strategy is the selection of a vendor. An appropriate selection process necessitates comprehensive due diligence and the investigation of potential risk factors. For example, the following risks must be identified and mitigated:

- Data location risk (policies and government regulations)
- Data loss risk (backup and restore capability)
- Data security risk (intrusion detection, virus protection, etc.)
- Vendor viability risk

The breadth of cloud services and service models as well as infrastructure options must also be appraised and weighted based on your organization's requirements. As already determined, experience managing applications and infrastructure on an outsourcing basis, end-to-end continuous support and transition services, and the availability of secure and redundant data centers and public cloud options are also critical selection factors. Additionally, organizations should determine if the vendor can assist in the development of a cloud strategy and roadmap.

Determine if the vendor offers readiness services such as application rationalization, virtualization, modernization, infrastructure consolidation, and data center rationalization. Most significantly, establish if the vendor uses a cloud adoption framework and best practices, has a track record of successful transitions, incorporates a suite of tools, and offers

complete transparency, detailed reporting, and frequent communications. Of course, any vendor should enable real cost savings and high-level business case modeling to demonstrate the cost/benefit trade-offs. Finally, look for the availability of a "toe in the water" cloud point solution such as Quality Assurance and Testing.

Conclusion

Leading analysts such as Gartner, Inc. believe that within five years the cloud will be leveraged by almost all corporations, organizations, and governmental agencies. This is the result of the significant cost savings which can be realized as well as the ability of cloud computing and services to transform capital investments into operating expenses and allow organizations to focus on strategic business solutions. As we have seen, the adoption of cloud technology is being driven by the trends toward globalization, consumer acceptance of technology, use of an extended enterprise, requirements for collaboration, and the organizational need to focus on core competencies. Most significantly, these developments foretell the changing role of IT within the enterprise toward becoming a true partner to the business.

The three different service models for the delivery of cloud computing, IaaS, Saas, and PaaS, provide enterprises with the ability to mix and match the best service model to the business needs of their organization based upon requirements and payment options. The availability of cloud infrastructure options, including private, public, and hybrid models, enable enterprises to pick and choose the best cloud technology depending upon the vertical industry, regulatory requirements, risk tolerance, and the specific applications portfolio. It should be noted once again that because of its best-of-both worlds solution and ability to customize placement of individual applications within the portfolio, the hybrid or mixed cloud infrastructure model is likely to become the infrastructure of choice for most global enterprises seeking to establish competitive advantage. As in all decisions, organizations should be driven by the need to balance value and risk.

One of the most important considerations is the selection of a trusted cloud partner that can provide a wide range of services. Selection criteria must include the determination and mitigation of risks, and a careful evaluation of the offered cloud services, service models, and infrastructure alternatives. Importantly, ascertain if the vendor offers comprehensive consulting, applications, and infrastructure services, as well as point solutions such as QA & Testing. In short, when determining the right cloud vendor for your enterprise, follow the maxim used by the US government when it negotiated and signed agreements with the former Soviet Union, "trust, but verify."

Keane's Cloud-based Solutions

Keane offers a comprehensive suite of integrated cloud-based solutions. Our cloud computing and data center hosting solutions allow customers to select the ideal platform for each application depending upon its requirements. Services can be delivered via IaaS, SaaS, or PaaS. Most importantly, we enable real cost savings and our clients typically save 25 – 40% using our Remote Infrastructure Management Services.

Keane believes its management and outsourcing know-how and its long track record of success in application and infrastructure management using service level agreements are critical success factors in providing successful cloud solutions.

All of Keane's platforms are integrated to allow for seamless application, code, and data transfers. Security and services remain under close control of our Service Operations Centers, which provide the full range of monitoring and management services whether the technology is located in the cloud, a Keane data center, or within a customer's own facilities. Keane's flexible, adaptable, multi-shore delivery model with our proven transition approach provides access to a 24x7 service desk to support our client base. In addition, we offer end-to-end continuous support which minimizes the impact of change to your end users.

Case Study A

Creating Subscription-based Healthcare Applications on a Private Cloud

Business Challenge

The client had multiple healthcare management applications marketed to small to medium-sized hospitals, clinics, and nursing homes. These applications were traditionally licensed for installation at the customer site and hardware platform. However, competition in this market segment was increasing, and small hospitals and nursing homes are traditionally challenged for IT resources. Even in an ASP service model (whereby a third party would host their applications), smaller healthcare providers find it difficult affording server hardware dedicated to their use. Ideally, these applications needed to be readily available from a hosting provider who could support each customer's specific needs. In addition, this provider would be required to operate on technology that is highly available and leveraged to support multiple customers without risk of security and HIPAA infractions.

Solution

The applications were ported to virtual hardware platforms: AIX partitioned servers and a Windows VMware platform. The virtual machine infrastructure which resulted provided global access, high availability, and full security features. Accessibility was delivered by hosting the technology on highly fault-tolerant technology installed in vendor managed Tier III+ data centers. Health records were partitioned separately for each customer to ensure privacy and compliance with HIPAA requirements. Most importantly, disaster recovery and failover were engineered through regular replication of data to systems located at another remote site. Remote 24x7 help desk as well as monitoring and management services support were also provided to customers including: problem, incident, change, configuration, capacity, and release management.

Results

As a result of this project, the client could now offer its healthcare applications on a cloud-hosted infrastructure with various pricing options, depending upon the needs and desired service level delivery model of the customer. Because our client was able to support multiple customers without risk to each other, hospitals, clinics, and nursing homes were able to eliminate capital investments in technology and infrastructure support. In addition, high availability and disaster recovery capabilities of the cloud infrastructure far exceeded previous onsite hosted models while operating at a reduced total cost of ownership. In short, the client became far more competitive by leveraging cloud computing technology.

Case Study B

Product Development Lab on a Private Cloud

Business Challenge

A large software products company wanted to build a multi-technology software product, which had a build-test-release cycle of six weeks elapsed time. The team consisted of 100 to 150 members composed of architects, developers, testers, and managers distributed among multiple organizations spread in three geographies. Time to market was critical to the project as there were around 1,200 test cases to be executed on 12 different hardware/OS platforms. In addition, the product development lab had 127 physical servers which had to be shared by all teams with most machines having too little RAM for the anticipated product development testing. The current environment required the product to be installed and configured on various machines from scratch, which took approximately 6 days and consumed 40% of the testing schedule.

Solution

The solution was to build a private cloud environment for the lab that would host a library of test environments. vFamilies of machines representing multiple test scenarios could be brought to live within three minutes. Additionally, commodity hardware was virtualized using VMware Esx (Virtualization on bare metal), and VMware vCenter was used to consolidate resources from multiple machines into one resource pool. VMware vCenter Lab Manager was used to create machine templates, and all the machines employed for a given scenario were made into templates that were organized into libraries based on test scenarios. A template represented a machine with all the OS/hardware/software built into it, and taxonomies were developed to name each template.

Results

The total testing time cycle for the product was brought down from six days to three minutes, allowing testers to add new test cases to the test bed, improving the quality of the product, enhancing developer productivity, and reducing the overall product time-to-market. More frequent releases resulted in customers getting their bug fixes and enhancements earlier and on time. The virtual machines hosted all Windows OSs, all Linux OSs and Solaris X86. VMware vCenter Lab Manager enabled the creation of a machine library containing pre-configured machines with SAN storage to host around 200 machines of 40GB each. The ability to create machines on the fly minimized the duration of lengthy QA and testing, and the capability to throttle computer power allowed quick and controlled builds. The clone feature of Lab Manager allowed testing teams to recreate environments and expedite the debugging and fix processes.