Citrix CloudPlatform for the enterprise
Private clouds have rapidly become an IT priority as enterprises seek to achieve ever-higher levels of business agility and IT efficiency and cost control.

While the majority of private cloud designs have been modeled after Amazon- and Google-style commodity public clouds, these clouds can overlook a critical architectural factor that enterprises must consider: the diversity of their computing workloads.

Although many enterprises have been aggressive in their adoption of new technologies and trends, including mobile and social applications, REST-based web services and NoSQL databases, the vast majority of enterprise applications do not yet embrace cloud era architectural principles. Thus, in order to see significant benefits from a private cloud strategy, enterprise private clouds must do more than accommodate the few cloud-era applications that exist today. Rather, to truly impact agility and costs, these clouds must also accommodate the many traditional n-tier applications such as enterprise resource planning (ERP) and customer relationship management (CRM) solutions that are running and being built throughout the enterprise.

The types of workloads and applications you plan to deliver in a private cloud can have a significant impact on the selection of a cloud orchestration platform. This is because most cloud orchestration solutions closely follow the commodity cloud architectural model and do little to accommodate traditional enterprise workloads. Likewise, solutions that do purport to create a private cloud for traditional applications, which are typically offered by legacy virtualization or systems management vendors, support cloud era workloads only by force-fitting them into traditional enterprise architectures, resulting in substantial waste.

Citrix® CloudPlatform™ is, in fact, the only cloud orchestration solution built from the ground up to address both traditional and cloud era workloads. With CloudPlatform, an enterprise private cloud can support any business application right out of the gate. Or, the private cloud may be designed for one style of workload and later expanded to include support for additional application styles.

Enter the private cloud
The typical enterprise has invested significantly in virtualization and server consolidation over the past several years. If your enterprise participated in this trend, chances are it has been able to significantly reduce CAPEX and direct OPEX—such as power, cooling and datacenter floor space—by reducing the need for servers and storage.
Yet, from an operational perspective, the challenges of managing the virtualized
datacenter remain daunting, due to an ever-increasing demand for its resources
coupled with a manual delivery model inherited from the days of physical server
provisioning. In many a “virtualized” IT shop, users open service tickets just as
before, the same approval workflows are followed and administrators provision
virtual machines (VMs) as they always have, though without the inconvenience of
physically racking servers.

In these enterprises, it is no surprise that service delivery is suffering in spite
of the virtualized datacenter. Delivery times remain long, rework levels remain
high, customer satisfaction remains low, and as a result, users are flocking to
unmanaged relationships with third-party public cloud providers. This so-called
“shadow IT” scenario exposes enterprises to significant risk of data loss or leaks
and a compromised regulatory compliance posture.

To address these critical IT challenges, private clouds have emerged as a top
priority for enterprise CIOs, CFOs and chief security officers. Like public clouds,
private clouds offer a variety of benefits to users, including highly elastic, on-
demand, self-service provisioning of resources, a high degree of automation and
programmatic (API-based) access, while providing the visibility, manageability and
control that enterprises require.

Introducing Citrix CloudPlatform
CloudPlatform orchestrates the datacenter resources that make up a cloud
infrastructure and is used to deploy, manage and configure public, private and
hybrid cloud environments. With CloudPlatform, you can easily establish a highly
automated on-premises private cloud for use by employees, customers or partners.
Rather than provisioning datacenter resources using the same laborious approach
previously taken with physical machines, your IT organization can use CloudPlatform
to offer self-service VMs to users. Automating the orchestration of VMs, storage
and network resources reduces the burden on the IT department and enhances
service delivery, while enforcing compliance with enterprise policies and industry
and government regulations.

CloudPlatform is:

Proven. With hundreds of successful enterprise and service provider deployments
at companies ranging from Autodesk to Zynga, CloudPlatform has been battle
hardened in real-world production environments.

Platform agnostic. CloudPlatform works with a variety of hypervisors, even within
a single cloud deployment. You have complete freedom to choose the right
hypervisor for your workload. CloudPlatform works with the community-supported
Xen® and KVM hypervisors, as well as commercially supported hypervisors such
as Citrix® XenServer®, VMware® vSphere® and Oracle® VM (OVM). For workloads
whose needs are not met by today’s hypervisors, CloudPlatform can also
orchestrate bare-metal servers as part of the private cloud.
Massively scalable. CloudPlatform can orchestrate tens of thousands of physical or virtual servers in multiple, geographically distributed datacenters, allowing the resultant cloud(s) to be easily managed via a user-friendly single pane of glass interface delivered by a single management server. No individual component is a single point of failure, and periodic maintenance of the management server can be performed without affecting the VMs running in the cloud.

Amazon AWS compatible. CloudPlatform implements industry-standard APIs on top of a low-level CloudStack™ API with its own unique and innovative features. In addition to supporting the CloudStack API, CloudPlatform supports the Amazon Web Services (AWS) API. Future cloud API standards from bodies such as the Distributed Management Task Force (DMTF) will be implemented as they become available.

Supported by a strong ecosystem. CloudPlatform is the center of a vibrant ecosystem spanning over 1,000 certified Citrix cloud applications, hundreds of CloudPlatform Certified Partners and tens of thousands of members of the CloudStack.org open source community. Jointly developed and supported integrations allow customers to take advantage of complementary solutions from vendors such as:

- **Cisco**: Integration with Cisco Unified Computing System™, Cisco Nexus® Series switching and Cisco Open Network Environment helps enterprise and service provider customers deliver highly efficient public, private and hybrid clouds.
- **NetApp**: Integration with NetApp’s leading storage solutions provides a fully integrated cloud orchestration and storage solution that addresses storage automation, resource allocation and VM backup and recovery.
- **CA**: Integration with CA Technologies’ management solutions provides in-depth insight and control of public and private clouds.

Part of a complete solution. Customers benefit from the fact that CloudPlatform is part of an end-to-end solution from a single vendor, which includes XenServer, Citrix® XenCenter®, Citrix® NetScaler®, Citrix NetScaler Branch Repeater®, Citrix® CloudGateway™ and Citrix® CloudBridge™. Customers choosing the Citrix platform experience streamlined purchasing, a single support contract and features that complement one another across the stack, each in an open, hypervisor-agnostic way.

Exploring cloud workloads

Whereas public clouds proved their mettle by providing an on-demand hosting environment primarily targeted at cloud era applications, it is common for private clouds to require support for a wide variety of enterprise workloads.

In fact, defining your target workloads right from the outset is key to a successful private cloud deployment, as illustrated in Figure 1. This is because the workloads that must be supported by your private cloud have distinct infrastructure requirements that will impact the selection and configuration of servers, storage and network, and the capabilities that must be offered by your cloud orchestration software.
Private clouds have been successfully deployed to support a wide variety of workloads, including:

- CRM and ERP applications
- Collaboration and communications services
- Software development, testing and maintenance
- Big data and high-performance computing (HPC)
- Social media applications
- Disaster recovery systems

While these workloads differ in many ways, in practice they can be categorized into two distinct architectural patterns, as summarized in Table 1.

Table 1. Traditional vs. cloud era workload requirements

<table>
<thead>
<tr>
<th></th>
<th>Traditional workload</th>
<th>Cloud era workload</th>
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<tbody>
<tr>
<td>Scale</td>
<td>Tens of thousands of users</td>
<td>Millions of users</td>
</tr>
<tr>
<td>Reliability</td>
<td>Provides 99.999 uptime</td>
<td>Assumes failure</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Proprietary</td>
<td>Commodity</td>
</tr>
<tr>
<td>Applications</td>
<td>SAP, Microsoft, Oracle</td>
<td>Web content, web apps, social media</td>
</tr>
</tbody>
</table>

The traditional workload

The first of these patterns is the traditional enterprise workload. The majority of existing enterprise applications fall into this category. They include, for example, applications developed by vendors such as Microsoft, Oracle and SAP. These are typically client-server or n-tier applications built to run on a single server or on a cluster of front-end and application server nodes, backed by a database. See Table 2 for examples of traditional enterprise workloads.
The cloud era workload

The second type of workload is referred to as a cloud era workload. Internet companies such as Amazon, Google, Zynga and Facebook have long recognized that traditional enterprise architectures are insufficient to deliver web scale and support the load generated by millions of users. These Internet companies rely on a new style of application architecture that does not depend upon enterprise-grade server clusters, but instead upon a large number of loosely coupled, commodity-grade computing and storage nodes. Workloads of this type include not only web and social media applications but also big data, HPC and batch processing applications, as seen in Table 3.

Table 3. Common cloud era workloads

<table>
<thead>
<tr>
<th>Cloud era workload candidates</th>
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<tbody>
<tr>
<td><strong>Web services</strong></td>
</tr>
<tr>
<td>Static and dynamic web content, streaming media, RSS, mash-ups and SMS</td>
</tr>
<tr>
<td><strong>Web applications</strong></td>
</tr>
<tr>
<td>Web service-enabled applications, ecommerce, ebusiness, Java application servers</td>
</tr>
<tr>
<td><strong>Rich Internet applications</strong></td>
</tr>
<tr>
<td>Videos, online gaming and mobile apps (Adobe® Flex®, Flash®, and AIR®; Microsoft® Silverlight®; Apple® iPhone®)</td>
</tr>
<tr>
<td><strong>Disaster recovery systems</strong></td>
</tr>
<tr>
<td>On-site/off-site backup and recovery, live failover, cloud bursting for scale</td>
</tr>
<tr>
<td><strong>HPC</strong></td>
</tr>
<tr>
<td>Engineering design and analysis, scientific applications, high-performance computing</td>
</tr>
<tr>
<td><strong>Collaboration / social media</strong></td>
</tr>
<tr>
<td>Web 2.0 applications for online sharing and collaboration (blog, CMS, file share, wiki, IM)</td>
</tr>
<tr>
<td><strong>Batch processing</strong></td>
</tr>
<tr>
<td>Predictive usage for processing large workloads: data mining, warehousing, analytics, business intelligence</td>
</tr>
<tr>
<td><strong>Development and test</strong></td>
</tr>
<tr>
<td>Software development and test processes and image management</td>
</tr>
</tbody>
</table>
Requirements for traditional and cloud era workloads

There are two fundamental differences between traditional enterprise workloads and cloud era workloads:

**Scalability.** The first difference is how these workloads scale. Traditional enterprise applications typically achieve scale by scaling up, that is, by increasing the size of the application server or database server. More modern applications built in this style can often accommodate clustering of a small number of front-end application servers, as well. The traditional enterprise application architecture is, as a result, somewhat limited in its ability to scale; these applications typically serve tens of thousands of users and hundreds of concurrent sessions.

By contrast, driven by Internet and mobile user growth, cloud era applications have a scale-out architecture that allows them to serve tens of millions of users or more. These applications are built to be deployed on tens or hundreds of application servers, and often distribute their database across multiple machines. As a result of their demand for potentially large numbers of servers, the need to reduce cost and improve efficiency becomes paramount.

**Reliability.** These workload types also differ in how they approach reliability. Enterprise applications are traditionally designed to run on reliable, enterprise-grade hardware. Application developers do not expect the underlying server or storage cluster to fail during the normal course of operations. Sophisticated backup and disaster recovery procedures are put in place to handle the unlikely scenario of hardware failure. This approach was reasonable in the traditional model, where the number of servers, and thus the cost of the infrastructure, was small. Internet scale changed the paradigm, making it impractical to deliver the same level of reliability via the infrastructure.

Cloud era workloads, by their nature, assume that the underlying infrastructure can and will fail. Rather than implementing disaster recovery as an afterthought, failover is designed into the application. Applications thus no longer need to rely on complex enterprise technologies such as network link aggregation, storage multipathing, VM high availability or fault tolerance or VM live migration to ensure reliability. Instead, the application is expected to treat servers and storage as ephemeral, meaning they may become unexpectedly unavailable at any time.

Real-world enterprise workloads

With traditional workloads strongly rooted in the past and cloud era workloads as the clear road ahead, the reality for IT executives and cloud architects is that mixed workloads will dominate the enterprise—and enterprise private clouds—for many years to come. It follows that any serious production private cloud initiative must support both traditional and cloud era workloads:

- **Supporting cloud era workloads alone,** without supporting the vast majority of today’s enterprise applications, means the private cloud fails to deliver a solution to the service delivery challenges experienced by today’s virtualized datacenters. Such a private cloud is relegated to the role of a learning experiment, which while valuable in its own right, fails to significantly impact the enterprise’s agility, efficiency or bottom line for the foreseeable future.

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• Supporting traditional workloads alone, without enabling support for cloud era applications, is not the answer either, as it fails to provide a path to the future. Even worse, private clouds locked in a traditional workload paradigm overlook the fact that today’s traditional workload will in many cases morph gradually over time to become increasingly distributed and less dependent upon traditionally architected infrastructure, eventually to emerge as a cloud era workload.

• Finally, supporting separate private clouds for each workload style also fails, this time in its gross operational inefficiency, which requires unnecessary duplication of software, infrastructure, labor and operational processes and procedures. Furthermore, such an arrangement also imposes limitations on the ability to gradually modernize traditional workloads.

In spite of the need to support both traditional and cloud era workloads, most cloud orchestration solutions do not even attempt to accommodate the former. CloudPlatform is the exception to this rule; it incorporates an open and flexible architecture that supports both traditional enterprise workloads and cloud era workloads in a single unified cloud environment, easily managed via a single pane of glass console.

Building enterprise private clouds with CloudPlatform

The ability of CloudPlatform to support both traditional and cloud era workloads lies in the openness and flexibility of its architecture. With CloudPlatform, enterprises can organize their private cloud into multiple availability zones, each comprising resources in one or more physical datacenters.

Within each of these availability zones, a combination of hypervisor, storage and networking configurations is supported to enable different types of workloads and meet their varying needs. Each availability zone can offer multiple, distinct levels of service, differing in reliability, scalability, security, compliance, performance, cost and other dimensions.

Architecting for traditional enterprise workloads

CloudPlatform availability zones that will host traditional enterprise workloads (traditional availability zones) are typically designed to deliver high availability and fault tolerance dictated by the recovery point objective (RPO) and recovery time objective (RTO) of these workloads. Traditional availability zones use enterprise-grade infrastructure components common to a modern datacenter to meet those needs.

Figure 2 illustrates how a CloudPlatform availability zone can be constructed to support traditional enterprise workloads.
Designing a zone for a traditional workload

Traditional availability zones typically begin with a commercially supported hypervisor, such as vSphere or XenServer, which supports live migration of VMs and has built-in high-availability features. VM images are typically stored on high-performance SAN devices. Traditional physical network infrastructure components such as firewalls and Layer 2 switching are used, and VLANs are incorporated to isolate traffic between servers and tenants. VPN tunneling provides secure remote and site-to-site access through existing network edge devices. Applications are packaged using industry-standard OVF files.

To ensure desired reliability levels, CloudPlatform employs infrastructure hardening techniques including link aggregation via bonded NICs for networking, multipathing for storage and VM HA, fault tolerance and live migration at the VM layer. Deep control of physical network properties allows cloud orchestrations to include activities such as adding/removing/updating physical networks in a zone, configuring VLANs on the physical network, specifying properties such as network speed, configuring a name so the network can be recognized by hypervisors, configuring the IP addresses trunked to a physical network and specifying what type of traffic is carried on the physical network.

Because they provide reliability and other capabilities that enterprise applications depend upon, traditional availability zones allow you to readily migrate existing applications into your private cloud and thus take advantage of its cost and operational efficiencies. Likewise, existing datacenter infrastructure can be repurposed as part of the traditional availability zone, further reducing transition costs.

Architecting for cloud era workloads

Due to the nature of cloud era workloads, cloud era availability zones are typically designed to minimize cost at the expense of traditional enterprise reliability. As a result, they are typically constructed using commodity servers running an affordable hypervisor such as Xen®, XenServer or KVM.
Figure 3 illustrates how a CloudPlatform availability zone can be constructed to support cloud era workloads.

**Designing a zone for an Amazon-style workload**

In cloud era availability zones, VM images are stored on relatively inexpensive local disk or NFS volumes and an object store can be offered to store data that must persist through availability zone failures.

Software-defined networking (SDN) is common in cloud era availability zones. CloudPlatform supports any OpenFlow-compatible virtual switch, including those provided by Nicira, Midokura and BigSwitch.

To overcome VLAN scalability limitations when required, CloudPlatform, like AWS, uses Layer 3 security groups to provide multi-tenant isolation. Shared networks, which are accessible by VMs that belong to different accounts, are supported as well. In architectures with multiple availability zones, elastic load balancing (ELB) or global server load balancing (GSLB) is used to redirect user traffic to servers.

Cloud era availability zones provide your organization and its developers with a high-performance yet low-cost environment for new applications being built according to modern, cloud era architectural patterns. Because of the architectural similarity and API compatibility between these availability zones and the AWS public cloud, third-party tools developed for AWS with proven integrations with CloudPlatform are readily available.

Putting it all together

Figure 4 illustrates how the cloud era and traditional availability zones described above can be combined to support both workload types managed by a single CloudPlatform instance.
One Cloud can Support Both Styles
(deployed locally or globally)

In this example, the enterprise private cloud includes both cloud era and traditional availability zones distributed across several geographic regions. With CloudPlatform, this single private cloud would support both workload types via a single pane of glass console, allowing streamlined and unified operational processes and procedures and a single point of compliance reporting and enforcement. Duplication of infrastructure would also be minimized, and investments in staff training would yield maximal leverage.

Conclusion

Private clouds have emerged as a top priority for enterprise IT organizations, offering CIOs, CFOs and CSOs a concrete solution to achieve greater levels of business agility, IT efficiency and regulatory compliance. By automating datacenter operational processes and eliminating manual bottlenecks from the delivery of key IT services, private clouds promise to dramatically reduce operational costs while increasing user satisfaction.

Many enterprises have begun designing and building private clouds to support emerging cloud era workloads. Yet to have any hope of truly impacting the bottom line, private cloud deployments must also support traditional enterprise workloads that will dominate the corporate IT landscape for many years to come.

CloudPlatform is the only cloud orchestration solution to incorporate an open and flexible architecture, allowing it to support both emerging and legacy workload types. In doing so, CloudPlatform allows enterprises to quickly deploy private clouds that can orchestrate and automate existing workloads and infrastructure, while providing a path to the future via its best-of-breed support for next-generation commodity cloud architectures.

For technical details on how CloudPlatform fits in your datacenter strategy, read the CloudPlatform deployment reference architecture document, and to get started using CloudPlatform today, download the 90-day trial at http://www.citrix.com/products/cloudplatform/try
About Citrix

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