

Private Cloud For the Technical Decision Maker

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Introduction

Cloud computing represents the latest trend in enterprise IT that presents a radical change in how organizations develop, deploy and manage their enterprise applications. Every platform vendor has either customized their existing offering to meet the expectations of cloud computing or developed platform products specifically for the cloud to enable expected feature capability.

The goal is to define the Microsoft Corporation view of those cloud computing expectations in content that is easily consumable by a wide range of audiences throughout the organization and lead into solution guidance that solves customer business challenges as they embrace this change brought about by cloud computing.

This document is one of a series created and will be created to explore and define the private cloud. The intended audience is the key members of the organization that drive the business needs around the utilization of IT to drive business agility, responsiveness and efficiency to nourish, grown and expand their business in reliable, repeatable and secure manner enabled by cloud computing.

In this document Microsoft Corporation presents cloud computing, and more specifically private cloud computing in terms that are independent of any platform technology. That is we're presenting the capabilities that must be present to be considered a private cloud. In subsequent documents we will drive deeper into architecture and finally into implementation using Microsoft products to realize the capabilities defined in this paper to solve business challenges for our customers.

The Advent of Cloud Computing

High operational costs, low system utilization, inconsistent availability, and poor agility are the key drivers of cloud computing. Businesses are demanding transparency in costs and better responsiveness to new opportunities. CIOs and CTOs are looking for ways to right-size their IT organizations. With the growing reliance on IT to operate their businesses, organizations are realizing that high availability is no longer an optional service attribute.

Organizations are continuously looking for ways of mitigating these issues. There is a cyclical trend to outsource; sometimes only to discover that the promised cost savings never materialized or the service quality and operational responsiveness suffered. Many organizations embraced IT Service Management and IT best practices to reduce the risk; however, sometimes this overhead reduces agility as well. Organizations have poured money into hardware redundancy to improve availability. Others have embraced emerging technologies such as virtualization, only to find that they have increased their operating complexity and costs, and created new phenomena such as Virtual Machine sprawl.

With the emergence of Cloud Computing, IT has a new option that reduces costs while improving resiliency and agility. Businesses are attracted to the idea of pay-per-use and right sizing, but regulatory compliance and service criticality prevents them from moving all but the most commoditized services to Public Clouds. Businesses now understand that there are more effective operating models and they are demanding and the same level of effectiveness from their own IT organizations.

What organizations need is an IT architecture that provides highly-reliable services, right-sized infrastructure, and a low-cost but highly responsive operating model.

Business Opportunities

Cloud computing puts new tools in the hands of the CIO for addressing the changing business needs by providing them with very valuable and effective architectural, delivery, and sourcing options. For example, a CIO may decide to purchase Cloud-based shared business processes/software services, such as CRM, collaboration technologies, and e-mail or choose to operate a private infrastructure Cloud to improve operations of their legacy applications. Despite the hype that surrounds it, Cloud Computing is not a panacea for all IT woes. It is indeed a powerful extension of existing architectures and technologies, which enables delivery of hardware, software, and infrastructure as standardized, modular services. Businesses may choose to either give out commercial contracts for these services or provide them internally. Pragmatic use of Cloud capabilities as part of an overall IT strategy can enhance IT's effectiveness in addressing critical business needs and add to IT's overall value to the business.

Cloud computing has the potential to improve the following aspects of your organization:

Agility

- **Reduces Time to Market:** Rapid deployment, lowered financial barriers to entry, and self-service capabilities increase business responsiveness and decreases the time required for realizing the value of IT projects.
- **Shortens the Solution Development Life Cycle:** A service-oriented approach to solution development and a standardized architecture help reduce the lead time between vision and deployment.
- **Enhances Responsiveness to Business Changes:** Improves the ability to respond to demand spikes and changes in IT supported business processes.

Cost

- **Lowers Barriers to Entry:** Often described as a shift from Capex to Opex, Cloud services decouple fixed overhead from demand and enables a pay-as-you-go model that facilitates innovation and entry into new markets.
- **Reduces Operational Costs:** People, power, and space costs can be reduced through standardization, automation, and elastic Capacity Management.
- **Improves Cost Control:** Standardization, transparency of IT costs, and the ability to use cost or price to motivate behavior improves budget predictability, cost effectiveness, and strategic IT alignment.
- **Enables Reuse:** A modular approach to IT provides an opportunity for significant application/functionality re-use across the enterprise, thereby lowering development costs and improving the predictability and cost effectiveness of solutions deployed across business units.

Quality

- **Improves Customer Satisfaction:** Cloud Computing improves an IT organization's ability to manage their customers' expectations and perceptions of solutions' responsiveness, capacity, and availability through the life cycle.
- **Enhances Service Level Efficiency:** Cloud Computing enables IT to procure as well as deliver functionality at an improved service level per dollar spent over traditional IT.
- **Enriches Continuity of Service:** Cloud computing's inherent modularity and ability to decouple applications from the physical infrastructure creates opportunities to greatly improve the disaster recovery/business continuity aspects of an application.
- **Improves Ability to Meet Regulatory Requirements:** Cloud Computing offers sourcing options that enable CIOs and their business stakeholders to make risk managed decisions to effectively meet their businesses' regulatory, competitive, and differentiation needs.



Realizing these goals requires CIOs to evaluate the available and emerging Cloud technologies in the context of their business needs, existing application portfolio, and growth projections.

New Choices for Delivering IT

The Cloud provides options for approach, sourcing, and control. It delivers a well-defined set of services, which are perceived by the customers to have infinite capacity, continuous availability, increased agility, and improved cost efficiency. To achieve these attributes in their customers' minds, IT must shift its traditional server-centric approach to a service centric approach. This implies that IT must go from deploying applications in silos with minimal leverage across environments to delivering applications on pre-determined standardized platforms with mutually agreed service levels. A hybrid strategy that uses several Cloud options at the same time will become a norm as organizations choose a mix of various Cloud models to meet their specific needs.

Cloud options typically are categorized by the following service and sourcing models:

Service Models

Software as a Service

Software as a Service (SaaS) delivers business processes and applications, such as CRM, collaboration, and e-mail, as standardized capabilities for a usage-based cost at an agreed, business-relevant service level. SaaS provides significant efficiencies in cost and delivery in exchange for minimal customization and represents a shift of operational risks from the consumer to the provider. All infrastructure and IT operational functions are abstracted away from the consumer.



Platform as a Service

Platform as a Service (PaaS) delivers an application execution services, such as application runtime, storage, and integration, for applications written for a pre-specified architectural framework. PaaS provides an efficient and agile approach to operate scale-out applications in a predictable and cost-effective manner. Service levels and operational risks are shared because the consumer must take responsibility for the stability, architectural compliance, and overall operations of the application while the provider delivers the platform capability (including the infrastructure and operational functions) at a predictable service level and cost.

Infrastructure as a Service

Infrastructure as a Service (IaaS) abstracts hardware (server, storage, and networking infrastructure) into a pool of computing, storage, and connectivity capabilities that are delivered as services for a usage-based cost. Its goal is to provide a flexible, standard, and virtualized operating environment that becomes a foundation for PaaS and SaaS.

IaaS is usually seen to provide a standardized virtual server. The consumer takes responsibility for configuration and operations of the guest Operating System (OS), software, and Database (DB). Compute capabilities (such as performance, bandwidth, and storage access) are also standardized. Service levels cover the performance and availability of the virtualized infrastructure. The consumer takes on the operational risk that exists above the infrastructure.

Comparison of Cloud Service Models

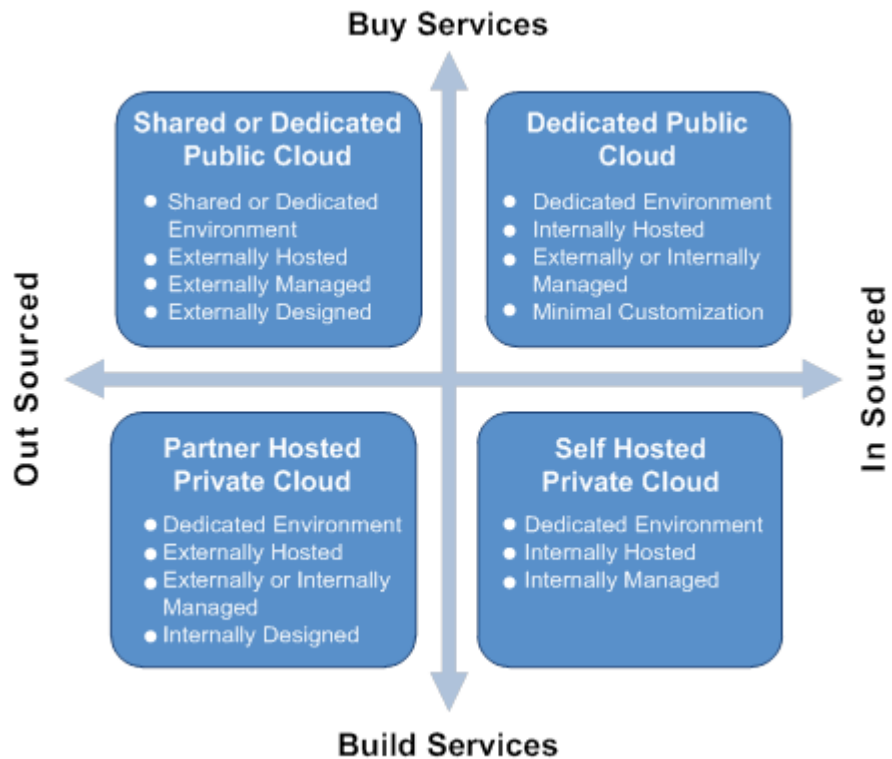
Type	Consumer	Service Provided by Cloud	Service Level Coverage	Customization
SaaS	End user	<ul style="list-style-type: none"> Finished application 	<ul style="list-style-type: none"> Application uptime Application Performance 	<ul style="list-style-type: none"> Minimal to no customization Capabilities dictated by market or provider
PaaS	Application owner	<ul style="list-style-type: none"> Runtime environment for application code Cloud storage Other Cloud services such as integration 	<ul style="list-style-type: none"> Environment availability Environment performance No application coverage 	<ul style="list-style-type: none"> High degree of application level customization available within constraints of the service offered Many applications will need to be rewritten
IaaS	Application owner or IT provides OS, middleware, and application support	<ul style="list-style-type: none"> Virtual server Cloud storage 	<ul style="list-style-type: none"> Virtual server availability Time to provision No platform or application coverage 	<ul style="list-style-type: none"> Minimal constraints on applications installed on standardized virtual OS builds

Sourcing Models

Sourcing models (shared or dedicated, and whether internally hosted or externally hosted) are defined by the ownership and control of architectural design and the degree of available customization. The different sourcing models can be evaluated against the three standards - cost, control, and scalability.

Public Cloud

The Public Cloud is a pool of computing services delivered over the Internet. It is offered by a vendor, who typically uses a “pay as you go” model. Public Cloud Computing has the following attractive attributes: you only pay for resources you consume; you gain agility through quick deployment; there is rapid capacity scaling; and all services are delivered with improved and consistent availability, resiliency, security, and manageability. Public Cloud options include:



- Shared Public Cloud:** The Shared Public Cloud provides the benefit of rapid implementation, massive scalability, and low cost of entry. It is delivered in a shared environment where the architecture, customization, and degree of security are designed and managed by the provider according to market-driven specifications.
- Dedicated Public Cloud:** The Dedicated Public Cloud provides functionality similar to a Shared Public Cloud except that it is delivered on a dedicated infrastructure. Security, performance, and sometimes customization are better in the Dedicated Public Cloud than in the Shared Public Cloud. Its architecture and service levels are defined by the provider and the cost may be higher than that of the Shared Public Cloud, depending on the volume.

Private Cloud

The Private Cloud is a pool of computing resources delivered as a standardized set of services that are specified, architected, and controlled by a particular enterprise.

The path to a Private Cloud is often driven by the need to maintain control of the delivery environment because of application maturity, performance requirements, and regulatory or business differentiation reasons. For example, banks and governments have data security issues that may preclude the use of currently available Public Cloud services. Private Cloud options include:

- **Self-hosted Private Cloud:** A Self-hosted Private Cloud provides the benefit of architectural and operational control, utilizes the existing investment in people and equipment, and provides a dedicated on-premise environment that is internally designed, hosted, and managed.
- **Partner-hosted Private Cloud:** A Partner-hosted Private Cloud is a dedicated environment that is internally designed, externally hosted, and externally managed. It blends the benefits of controlling the service and architectural design with the benefits of outsourcing.
- **Private Cloud Appliance:** A Private Cloud Appliance is a dedicated environment that procured from a vendor, is designed by that vendor with provider/market driven features and architectural control, is internally hosted, and externally or internally managed. It blends the benefits of using pre-defined functional architecture, lower deployment risk with the benefits of internal security and control.

Comparison of Cloud Sourcing Models

Cloud Sourcing Type	Hosting Location	Shared or Dedicated	Architectural Control	Scalability	Investment
Shared Public Cloud	External	Shared	Provider or market	Minimal constraints	Pay as you go
Dedicated Public Cloud	External	Partially or fully dedicated	Provider or market	Constrained by contract	Pay as you go
Self-Hosted Private Cloud	Internal	Fully dedicated	Self	Constrained by capital investment	Build the Cloud, share resources
Partner-hosted Private Cloud	External	Fully dedicated	Self	Constrained by capital investment or contract	Varies by contract, may or may not have capital impact
Private Cloud Appliance	Internal	Fully dedicated	Provider	Constrained by offering	Varies by contract, may or may not have capital impact

Hybrid Cloud

The Hybrid Cloud model combines two or more public or private cloud services that are each unique entities that are bound to enable data and application portability.

Challenges

In this section we offer insight into challenges that organizations face with adopting private cloud with a focus on what it means to face these challenges and realize business opportunity once these challenges are understood and resolved. This then leads us into the next section on adopting an approach that demonstrates the path to challenge resolution and allows the organization to focus on the business application management within the private cloud.

1. **Cost of Entry:** Implementing a private cloud in the organization will require a significant cost to enter the arena to satisfy the needs of virtualization and the management layers that compose the fabric to deploy, operate and monitor the environment. These costs must be realized in each step of the deployment process from prototyping to production. Over time these costs will turn to cost benefits as shared resource usage wins over traditional forms of resource allocation on a per application instance basis.
2. **Data Location:** When discussing cloud computing the challenge of data location within the cloud surfaces an impediment to adoption. This is likely the prime reason that drives the private cloud deployment model into the discussion since this alleviates the concern of placing enterprise data in the public cloud. In a private cloud deployment model enterprise data remains in house but due to the management characteristic of a private cloud the infrastructure required to satisfy data storage is largely commoditized.
3. **Security:** Designing for a secure environment is always a challenge as new threats continue to emerge on a regular basis. In that sense this is not a new concern for cloud computing but the attack surfaces and vectors are different in cloud computing and must be understood. Private cloud mitigates many of these attack surfaces since the entire operation is in-house however organization concerns still exist when meeting compliance requirements.
4. **Compliance:** In any IT organization the goals of IT must be met while maintaining conformance to organizational and regulatory compliance requirements. This compliance will drive cloud computing deployment models and the management layers to establish and implement management boundaries for sensitive data storage and transmission throughout the private cloud infrastructure.

5. **Application Programming Models:** When considering cloud computing adoption within the organization a challenge will likely surface around the existing application programming model and tools for development and test. This will drive an evaluation of the migration effort to move legacy application to the cloud and ongoing development of new applications for the cloud.

As we progress deeper into this content series we will present a reference architecture and implementation designed to solve these and other cross cutting challenges and concerns to adoption of a private cloud.

An Approach to Embracing the Cloud

Embracing the cloud in the organization is a significant step even for the most mature IT organizations. A key to successful adoption is to start small and walk before you run. The first step is identifying the business case for the cloud or private cloud within the organization. Is it to provision IT capability in a more predictable and responsive manner, or is it cost efficiencies on server racks, power and cooling? Maybe costs related to staff throughout the lifecycle? Perhaps organizational or regulatory compliance requirements are driving the business case or it may be a complex mixture of all these and other reasons but the business decision maker in the organization must be clear and understand what is driving this initiative and the desired outcome.

Next is to identify low hanging fruit within the organization in terms of applications and staff that are receptive to a platform shift. Perhaps it's a department or group that has adopted virtualization or partitioned an application for public and private cloud deployment. Existing groups like these are prime candidates to adopting cloud like characteristics in their



environment and taking the organization to the next step. Many organizations are starting out with Private Cloud for development and test environments. These scenarios and their often erratic usage profiles are ideally suited to private and provide a low risk way of exploring the technology and operational capabilities required to effectively deliver that service. Given confidence and learning proof of concept projects may be built out in a small well defined area of the organization that demonstrate the capability of cloud computing on actual business applications and allow for future growth and onboarding of new application into the cloud as the organization transitions to cloud vs. traditional IT deployment.

Lastly once operational run book procedures have been adopted and approved an overall plan for deployment and consolidation of new and existing services can be built and executed upon.

The content in this series is intended to guide our customers on the private cloud computing journey as they adopt these exciting capabilities and build end to end solutions that drive growth and opportunity in the business.

