Linux and Commercial Software: Combining to Support the Cloud Environment

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Executive Summary

Cloud computing has become one of the most important technical and business trends in decades. Increasingly, companies are turning toward cloud computing as a way of increasing the agility of their computing environment. Management understands that IT is a business asset that should be able to expand and contract based upon need. They are looking for methods of having the best possible resources at the optimal price without increasing capital expenditures.

The movement toward this increasingly optimized cloud model is part of the movement towards the industrialization of computing. Therefore, cloud computing is helping to transform the way we think about using technology as a business asset and as an agent of change.

In this paper we will present an overview of cloud computing including: the economic benefits to companies building, managing, storing, and leveraging cloud environments; and the benefit of rich Linux open source technology as the foundation of the cloud. We will also explore the depth of software requirements to create a commercially model for predictable management. Finally, we will provide an overview of the technology and services that IBM offers to service providers and customers.

Cloud Computing Defined

What is cloud computing? Cloud computing is the next stage in evolution of the Internet. The cloud in cloud computing provides the means through which everything from computing power to computing infrastructure, applications, business processes to personal collaboration can be delivered to the user as a service. This service is then delivered to that user wherever and whenever the service is needed. There are six characteristics of cloud computing that are critical:

- **Elasticity.** The cloud needs to allow the user to add and subtract resources as needed.

- **Self-service provisioning.** The cloud needs to make it easy for a customer to add and subtract these resources through an online interface rather than through human intervention.

- **Ubiquitous network access.** A cloud service must provide the customer with access to the network at the right speed and functionality without latency.

- **The ability to measure usage.** For the cloud to be practical, a customer needs to have an accurate measurement of what resources they have used and at what cost.

- **Location independent resources.** To support customers, hardware and software, resources should not be tied to a specific location.

- **Support for openness.** Customers require the ability to move workloads across clouds in order to maintain maximum flexibility. Customers also need the support of open source standards such as Linux to ensure affordability.

Clouds can be delivered through a public resource or can be made available within a company's firewall as a private resource. Cloud services are delivered in different ways depending on the problem the organization is trying to solve. There are three delivery models:

- **Infrastructure as a Service** is the delivery of computer hardware as a service combined with the operating system and virtualization technology to manage those resources. Most Infrastructure as a Service providers are built on the Linux operating system.

- **Platform as a Service** is the ability to provide a computing environment, the related development, and deployment components. Most of the Platform as a Service vendors leverage the Linux operating system as the foundation of the platform.

- **Software as a Service** is the delivery of a packaged application delivered in a cloud platform. Most of the vendors in this space use Linux as the foundational operating system.

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The Economic Considerations

While cloud flexibility is a critical factor for business leaders, economic considerations are high on the list of requirements. In fact, economic considerations are the overriding consideration for both cloud service providers and individual customers. For example, the Linux operating system is available without license fees. Therefore, it dramatically reduces the costs for cloud providers. In turn, these savings are passed along to customers. In addition, because of the wide spread use of Linux in most cloud environments the cost of finding technical resources is less than proprietary environments.

Cloud computing also allows customers to experiment with potential breakthroughs without up-front investments. Therefore, leveraging cloud services improves the ability for customers to be able to introduce new technologies and innovative approaches quickly. Cloud service providers are better able to provide new offerings more rapidly and test out potential services before investing in expensive marketing programs. Companies are also looking at the cloud to reduce labor costs since, when using a cloud, the IT organization does not have to procure and build their own software environment. There is also the potential for avoiding mistakes in software configurations and the provisioning process. When companies are able to gain greater use of existing resources through the use of cloud, the business gains increased efficiency and better overall results. Since customers can add new capacity on demand, they avoid complex capacity planning. They are therefore able to respond proactively to the needs of the business in a cost effective manner.

While there is plenty of technology required to implement a cloud strategy, the cloud has to be put into context with the economic benefit to the organization. Many organizations are trying to reduce capital investments in favor of operating expenses. These organizations would like to be able to pay for the resources they use rather than investing in physical servers and software in anticipation of future requirements. This incremental approach allows an organization to use the right services at the right price when the service is needed. For example, many companies would purchase additional servers, storage, and software in anticipation of new business opportunities or peak demands. With cloud computing, those same companies can use a cloud service to enable them to scale up or down depending on changing business needs. Service providers offer these types of elastic services to support the economic requirements of their customers.

Factors in Effective Cloud Environments

Corporate computing requirements require a hybrid environment consisting of a variety of different solutions. Most customers simply can't afford to have a pure computing environment. In the next section we will detail three key factors in the success of the cloud environment:

• The ability to support a variety of workloads effectively

• The ability to offer portability across cloud ecosystems

• The ability to manage a hybrid environment

Supporting Workloads Effectively

All workloads are not the same. The key to effective support for complex and changing workloads requires a holistic approach focused on the operating system, the service management environment, and support for hybrid environments. In fact, as cloud computing becomes more pervasive, there will be a variety of workloads that have to be supported. For example, there will be some workloads that require massively scaled approaches such as YouTube or supporting gene research projects. As an operating system, Linux is ideally suited to support a variety of workloads since it works across all of the major hardware architectures including Intel, IBM's POWER systems, and IBM's System z.

One of the principles of an effective cloud is that the environment must be optimized for the workloads that have to be supported. An open source platform such as Linux ensures that the cloud developer can customize the operating system platform for the specific customer requirements. The Linux kernel supports componentization and is well suited to scale-out computing environments. In a scale-out environment, service providers typically run a heterogeneous collection of commodity hardware, networking capabilities, and storage equipment. In addition, because so many developers have Linux skills, it is more cost effective to locate talent rather than training developers in a proprietary environment.

While the operating system is the foundational component of the cloud platform, there are many management capabilities critical to operating the cloud. This is especially important for companies that are combining some public cloud services with private clouds created for internal use. These requirements include performance management, workload management, security, and data management. As companies begin to use the cloud for mission critical workloads across public, private clouds, and internal data centers, they will need to have a consistent and predictable management environment. This will require companies to leverage sophisticated commercial software to complement the open source offerings. Companies using this hybrid approach must be able to maintain a consistent and predictable service level as well as meeting compliance requirements. Customers also need the assurance that their data is secure no matter which environment they are managing.

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Portability Across Clouds

As cloud environments mature it will become more important than ever for customers to have the ability to move their workloads across and between different cloud environments. Customers need to have the flexibility to move from one environment to another if service levels in one cloud environment meet their performance objectives more effectively. In addition, customers want to be able to take advantage of innovations as they emerge. Portability can become an issue if the cloud provider offers extensions to its environment that lock in the customer. Linux is an ideal platform to support portability in the cloud because it is the standard across a majority of the cloud offerings including Infrastructure as a Service, Platform as a Service, and Software as a Service.

Portability is clearly enhanced by emerging standards. Cloud computing environments will be able to take advantage of emerging standards already established for Service Oriented Architectures and Service Management. In addition, standards organizations are working to create standardized interfaces to promote cloud interoperability.

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Managing a Hybrid Environment

The early adopters of cloud computing tend to focus on short-term project needs both to gain experience and to solve immediate problems. However, as the use of cloud computing becomes more mainstream, companies will begin to use cloud services in combination with on-premise solutions. The Linux operating system is the common thread between different cloud computing models. To understand this better, it is important to look at the options for use of the cloud. Three approaches to cloud implementations are emerging:

- **Public Clouds.** The availability of infrastructure or platforms to perform tasks such as access to computing resources, development areas, or new applications testing. Many Software as a Service companies will offer their software in a public cloud protected by multi-tenancy. With multi-tenancy each customer has a segregated space where its customizations and its data are managed.

- **Private Clouds.** Companies that have large data centers and high levels of security requirements are choosing to implement self-service, scalable environments inside their firewall. A private cloud can be a segregated environment within a traditional data center. In some cases, companies are designing new cloud data centers to handle well-defined workloads for an increase in flexibility and cost control.

- **Hybrid Clouds.** All workloads are not the same. Most organizations will inevitably need a combination of public and private cloud services in order to meet the demands of their customers, partners, and employees. For example, a company may decide to use a public cloud service as a way to offer new services to customers; however, that same company might want to keep critical customer data within a private cloud inside the data center.

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Starting Your Cloud Journey With the Basics

Company management is beginning to understand that taking advantage of the cloud requires forethought and planning. Therefore, whether you are a service provider or a customer, jumping into the cloud requires good planning –---so start your investigation by asking the following questions:

1. Why are you evaluating cloud computing as a strategy? What problems are you trying to solve? Are you looking for speed of deploying new applications or are you trying to reduce costs? Before you can develop a strategy, you have to start with an assessment of your current IT strategy.

2. How will you deal with change over time? Have you considered what happens after your initial experimentation? You need to be able to plan for the future. If the cloud is a successful business model, how can you make sure that you can make it work as your needs evolve.

3. As you begin to expand your use of the cloud, can you create a cloud strategy that allows you to move in order to embrace important emerging technologies without being locked in to a single approach?

4. What standards in adjacent areas, such as service management, service oriented architectures, and web services, will impact your cloud strategy? What do you think is missing? What open standards are emerging in areas such as security and virtualization? Standards will make a significant difference in the level of flexibility in the cloud environment.

5. What type of workloads are you planning to manage in the cloud? While this may sound like a technical issue, it is actually based on a pragmatic business judgment. For example, a highly specialized, customized environment that supports five users may not be economically viable in the cloud. However, there may be a workload that is used to support significant functions across the company that is perfectly suited to the cloud.

6. How will you manage the service levels for the variety of cloud services that might be used over time? You need to plan for a Service Level Agreement with your providers. You also need to design a plan to manage services across the various cloud services. This plan must include the ability to manage security and compliance with governmental and industry regulations.

Why start with these types of questions? If you are going to use the cloud as a platform, you need to think both strategically and pragmatically. You need to put your cloud strategy in perspective with your overall information technology plan which inevitably will be a combination of your internal enterprise environment, the open source technology and tools that you will use to combined the cloud services that will result in a more flexible environment.

Linux: The Common Denominator

Cloud providers that exist in a highly competitive market must be able to create sophisticated service offerings at a competitive price. Therefore, it is not surprising that many of these suppliers have opted to use open source and Linux as the foundation of their offerings. Because Linux is an open source platform, it has benefited from contributions from many of the most accomplished operating system experts around the world. In addition, its foundational characteristics such as modularity, high performance, and power efficiency are required to support a cloud environment. Finding the right developers with the right skills to get the job done is another economic factor for cloud providers. Because Linux is so widely used it is relatively easy to find the technical skills needed to support these environments.

Almost all cloud providers implement their services on the Linux operating system. In fact, Linux is the common denominator for cloud environments because it is open source and provides the ability to customize the platform for a wide variety of customers and service providers. The combination of open source and the modularity, efficiency and scalability of Linux has propelled it to the forefront of the cloud market; however, cloud environments do not exist in a vacuum. The reality is that these environments have to live in harmony with traditional data centers and with a variety of third party cloud platform and application environments. Therefore, the value of Linux and open source is to act as a good citizen based on standards and portability.

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The Five Principles of Building an Effective Cloud Platform and Strategy

What does it take to build a cloud platform that is both cost effective and sophisticated? There are five characteristics that are key to a manageable and useful cloud environment:

1. **Clouds must be flexible.** A cloud must be able to provide cost effective and flexible services to customers. Customers must be able to add or subtract the services they need without complex process management. This includes the availability of dynamic provisioning, support for virtualization, and a self-service portal. Clearly because of the Linux licensing model it provides a cost effective platform to support a variety of workloads.

2. **Correct service levels.** A cloud must be able to provide the right level of service to the customer at the right price. There are a variety of workloads that are supported within a cloud environment. Technologies such as server and desktop virtualization are important tools available to control customer costs; however, to be successful, a virtualized environment must be able to be effectively managed. Therefore, cloud providers must be able to have a range of services to support the economic concerns and constraints of customers. Most cloud providers are able to leverage the sophistication in Linux to design service level management capabilities.

3. **Portability.** Portability is a key requirement. Customers may move to embrace different types of cloud services depending on changing business requirements. This might mean that a service build on a simple Infrastructure as a Service environment will need to move to a highly secure platform. In other situations, customers will want the assurance that they can move their workloads if their needs change. Emerging standards will help ensure that portability can be delivered to customers. Because of the wide support for Linux across hardware, software, and services, portability is enhanced.

4. **Security and compliance.** Companies must be able to rely on a cloud provider to secure, manage, and meet compliance reporting demands. Therefore, cloud service providers must be able to demonstrate that the environment is as safe and predictable as a tightly controlled internal data center. Even if that internal data center has underlying security issues, management often will perceive that it is safer than an environment controlled by a third party. Most security experts have determined that Linux is among the most secure operating system platforms.

5. **Create a strong partner ecosystem.** The cloud environment promises to become an important pillar for customers across the world. Therefore no one company can offer the depth and breadth of products and services that will emerge. Therefore, successful companies will work with emerging companies as well as those with deep expertise in specific markets. Linux is the foundation for a majority of the cloud ecosystem players.

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IBM Offerings to Support the Cloud Ecosystem

IBM has been investing heavily in the cloud market over the past several years. It offers a variety of services in the cloud and leverages Linux as a primary platform for implementing cloud services (see Table 1). As one might expect from a company of IBM's size and reach, the array of services are broad. Many large corporations have turned to IBM to create private and hybrid clouds to help these customers transform their data centers to become more efficient. In addition, IBM has added a variety of solutions focused on public cloud offerings for such functions as software development, testing, and monitoring. IBM has created a centralized cloud computing organization with a goal of creating offerings that encompass software, hardware, and services.

IBM anticipates a lot of demand for solutions to manage the interface between public and private clouds. For example, IBM's Smart Business for SMB platform supports both public and private cloud interfaces. In this scenario, the customer has a physical box on site in the data center. This way the customer can have a private cloud inside the firewall that also supports the ability to burst into the public cloud when they need additional computing capacity or storage.

A key element of the IBM private and hybrid cloud strategy is to offer solutions based on varying customer-driven workloads. These solutions are organized together as IBM Smart Business Cloud. IBM private and public cloud strategies offer solutions based on varying customer-centric workloads. The following table includes IBM's key Linux based cloud services.

Table 1: IBM's key Linux Based Cloud Services	
Smart Business Cloud Services	IBM Smart Analytics Cloud
	IBM LotusLive!
	IBM Smart Business Development and Test on the IBM Cloud
	IBM Smart Business Desktop Cloud
	IBM Computing on Demand
Smart Business Systems	IBM Smart Analytics System
	IBM Cloudburst
	IBM WebSphere Cloudburst Appliance
	IBM Smart Business for SMB
IBM Services in Support of Cloud Computing	IBM Infrastructure Strategy Planning for Cloud Computing
	IBM Strategy and Change Services for Cloud Adoption
	IBM Testing Services for Cloud
	IBM Networking Strategy and Optimization – Network Application Optimization for Cloud Computing
	IBM Data Center strategy
	IBM Data Center Family Solutions – Data Center Design Services
	IBM Vulnerability Management
	IBM Managed Email and Web Security
	Security Consulting Services in Support of Cloud Computing
	Resiliency Validation for Cloud Computing
IBM Technologies For Cloud Computing are Foundational Cloud Offerings	IBM System z Solution Edition for Cloud Computing
	IBM WebSphere Application Server Hypervisor
	IBM Tivoli Service Management Center for Cloud Computing
	IBM Rational Software Delivery Services for Cloud Computing
	IBM developerWorks – Linux and Open Source Zones

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Conclusion: The Importance of Choice

The value of cloud computing for customers is the ability to have many choices based on economic and workload requirements. The cloud environment hides complexity from the customer. This level of abstraction means that the cloud environment needs to be designed with consistency, predictability, and sophistication. Therefore, the operating system matters.

The fact that IBM leverages Linux, the standard across most Cloud Computing environments, is important to its ability to meet customer demand. By combining open source and commercial software, IBM intends to support a wide cross section of customer requirements for portability and accountability.

About Hurwitz & Associates

Hurwitz & Associates is a consulting, market research and analyst firm that focuses on how technology solutions solve real world business problems. The firm's research concentrates on disruptive technologies, such as Cloud Computing, Service Oriented Architecture and Web 2.0, Service Management, Information Management, and Social and Collaborative Computing. We help our customers understand how these technologies are reshaping the market and how they can apply them to meet business objectives. The team provides direct customer research, competitive analysis, actionable strategic advice, and thought leadership. Additional information on Hurwitz & Associates can be found at www. hurwitz.com.

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