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WHITE PAPER

Leveraging a Dynamic Application Infrastructure for Effective Private Cloud Computing

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IDC OPINION

As IT executives look for ways to systematically reduce costs, provide faster time to value, and improve reliability, they are turning to cloud computing and the development of private cloud capabilities from within their datacenters.

A private cloud is user centric and offers access to software as services, which is fully configured, production-ready software available to authorized users in a self-service deployment model.

Private clouds leverage investments in virtualization. A fourth-quarter 2009 IDC survey indicates that 39% of the respondents consider production servers to be the most important environment to virtualize, including the shift of business-critical workloads to virtualized environments. Meanwhile, another IDC survey during the same time period indicates that more than 80% of both custom and packaged mission-critical applications run on application middleware.

That means there is an urgent need to focus on enabling the application platform to operate within a private cloud as a first step to offering the desired applications as services to business users.

IBM has a broad commitment to cloud computing across hardware, software, and services portfolios, with a focus on providing delivery options for both public and private cloud deployments.

IBM WebSphere CloudBurst Appliance is a private cloud appliance designed to improve the speed and efficiency of the collaborative application life-cycle management process. The appliance provides self-service provisioning of WebSphere middleware images into private cloud development, testing, and production environments. Beyond the cost-efficiency benefits, the goal of using WebSphere CloudBurst is to speed up development and testing cycles, improve the quality of the application, and aid the migration of WebSphere Application Server–based applications to private clouds.

While the opportunity to deliver greater value at a lower cost is clear in a private cloud setting, there are also challenges. Developing standardized, highly repeatable self-provisioning software services requires discipline and skills. It also requires the ability to sort through what existing assets can be leveraged and what new investments are needed to build a private cloud.

Focusing on the application platform layer of a private cloud will help developers and IT operations staff gain the needed skills to extend the benefits of private cloud to business users. As such, it is a logical early area of focus.

SITUATION OVERVIEW

Common to all cloud computing models is the expectation that they will reduce costs, provide faster time to value, and improve reliability. These potential benefits have riveted the attention of IT executives as a way to control IT costs while improving service levels.

Despite the attention garnered by the public cloud, persistent concerns over security, availability, and licensing expense cause many organizations to seek cloud benefits by turning to private clouds. This is a consequence of their desire to better leverage their ongoing datacenter investments and simultaneously reduce risk.

The opportunity to improve efficiency and time to value through a private cloud is clearly illustrated when looking at the applications, deployment middleware, and subsystems that automate the operations of a business.

Until recently, customers had been deploying at least one physical server for each installed application, and often more than one when taking into account test and development environments. With the widespread use of middleware and databases to run applications, costly physical server and software license and maintenance sprawl is associated with each application.

Consolidation via server virtualization, as well as advances in the direction of system convergence, promises some relief to help address scalability, performance, and manageability requirements. But the applications and their infrastructure are ripe for efficiency improvements beyond simply focusing on server virtualization.

Beyond the cost issues associated with consolidation and improved utilization of IT assets is an equally urgent need to improve IT's ability to align itself with business cycles. Private clouds present an opportunity to accelerate the shift to a more fully automated, self-service–centric form of computing to reduce costs and to better align with the speed of business. These compelling benefits help explain the intense interest that IDC sees in private clouds.

A key area of focus for private clouds is the creation of an application services platform to provide the application infrastructure needed for application-as-a-service offerings.

Private Cloud Standardizes, Automates, and Manages Software Services

As Table 1 shows, a private cloud is user centric and offers access to software as services, which is fully configured, production-ready software available to authorized users in a self-service deployment model. Regardless of the user role or private cloud focus — infrastructure, platform, or applications — the goal of a private cloud is to

offer scalable and available services that are self-provisioned without the need for staff support beyond creating the images and packaging of services available for use.

TABLE 1

Software Services via Private Cloud

Private Cloud Feature	Feature Description	Use Case
Self-service catalog	The catalog organizes available private cloud offerings as well as their descriptions, documentation, and pricing. It supports authorization roles and access rights, and users can request only authorized services.	Line-of-business project leader accesses self-service catalog on company portal to identify authorized service that can be used to manage project team members, milestones, and tasks.
Shared, standard service	A middleware-based virtual appliance image is made available to authorized users via the service catalog, accessible by authorized roles and systems on a predictable basis.	IT packages standard images of deployment-ready software as virtual appliances for self-service provisioning by authorized users, including relevant patterns of business process management (BPM)-oriented virtual appliances.
Published service interface/API	Access to service or software is well-defined using enterprise standards.	Each virtual appliance image is assigned an entry into the self-service catalog and made accessible to authorized users.
Self-service	Service can be consumed automatically, and when needed, production-ready software can be automatically deployed for use in the private cloud.	Project leader selects project-oriented business service from self-service catalog.
Use-based pricing	Pricing can be configured based on relevant variable inputs (e.g., length of time available, number of users, processing throughput, or other units of measure).	Project leader fills out configuration questionnaire; pricing utility calculates an estimated cost and asks for permission to proceed.
Solution packaged	All of the elements required to move into production are packaged together. Differences are configurable and parameterized.	The requested business service is automatically provisioned to the private cloud and is able to communicate with the required cloud resource services, including security, storage, data grid, and systems monitoring and management, as well as production applications, such as email.
Elastic scaling	Monitoring software and provisioning software work in tandem to dynamically scale the business service.	The business service virtual appliance, deployed on a hypervisor, is monitored; if the monitoring detects a need for more resources — storage, database, CPUs — provisioning of extra capacity is automatically performed and the project leader is notified of the extra cost of the service.
Accessible via the Internet	Service or software can be accessed by communicating over TCP/IP.	The software or utility service is accessed using standard network protocols, such as TCP/IP.
Standard UI technologies	Private cloud supports standards and well-supported user interface technologies.	Users are able to access their software from computers and mobile devices using common and widely available standards and de facto standards.

Source: IDC, December 2009

The ability to offer software services on a private cloud, as described above, will yield significant savings in IT staff through the following:

- Substantially increased role of automated management capabilities, which will reduce the time spent troubleshooting and fixing problems manually
- Standardization of services offerings, which will reduce the portfolio of technology that needs to be supported
- Self-service provisioning, which means that staff will no longer be used to deploy standardized software services
- Reduced cycle times for the application life cycle, which will lead to faster development and testing and standardized delivery of applications into production

There are many other benefits, however, given the high cost of staffing a datacenter; redeployment of staff — while offering better service — promises to be a significant benefit of private cloud computing.

Application Infrastructure on a Private Cloud

A critical area of focus in private clouds is the ability to offer internal applications as a service. To do this in a standardized, predictable, and highly repeatable fashion, enterprises are turning their attention to the application platform, which also must be virtualized and private cloud enabled.

The platform layer of a private cloud forms this application infrastructure. It combines an integrated development environment and testing with services-enabled application middleware capable of accessing integration and data services, storage, security, and all of the resources necessary to run application services in an enterprise-class, virtualized production environment.

An October 2009 server virtualization survey conducted by IDC shows that 39% of the respondents consider production servers to be the most important environment to virtualize, with an increasing number of business-critical workloads migrating to virtualized environments. This is up 11% from the previous year and represents the fastest-growing shift in server virtualization environments.

Meanwhile, IDC middleware survey data from the same time period indicates that more than 80% of both custom and packaged mission-critical enterprise applications run on application middleware. Therefore, the ability to virtualize application infrastructure is critical to moving important enterprise applications to a private cloud.

Private cloud application middleware used in the platform layer — application servers, business process management suites, portals — is increasingly being offered as a virtual software appliance. New and updated management software interoperates to handle self-service provisioning and management.

Enterprises will increasingly look to middleware and private cloud development and management tools that support new types of usage-based licensing, along with more automated forms of provisioning and management, as well as accessibility of the resulting services from the self-service catalog described in Table 1.

IBM WebSphere Forms Platform Layer for Private Cloud

As a leading provider of hardware and software infrastructure, middleware, and development and testing software — in addition to its role as a leading provider of IT and business process outsourcing — IBM will play a major role in the evolution of private cloud computing.

A group of offerings within the WebSphere brand illustrates how application middleware is able to leverage existing investments in virtualization to deliver the necessary application infrastructure for a private cloud. As Table 2 indicates, IBM introduced several products over the past two years that will help enterprises build platform-as-a-service (PaaS) capabilities into their private cloud and has additional products on its near-term road map that add greater capabilities.

TABLE 2

IBM Private Cloud Platform Layer Product and Service Map

Product	IBM Brand	Description
Platform Layer Products		
WebSphere Application Server Hypervisor Edition	WebSphere	Edition of WebSphere Application Server that runs on top of a hypervisor and supports the Open Virtualization Format
WebSphere CloudBurst Appliance	WebSphere	Provides management of patterns and virtual images in a private cloud, including creation, deployment, and modification
WebSphere eXtreme Scale	WebSphere	Provides an in-memory data grid that dynamically processes, partitions, replicates, and manages data and business logic across hundreds of servers to support business applications
WebSphere Virtual Enterprise	WebSphere	Provides qualities of service (policy-based workload management, application health management, application edition management) and runtime management, including integration with server virtualization
Rational Automation Framework for WebSphere	Rational	Automates the creation of script packages for WebSphere CloudBurst Appliance by capturing the customizations done manually and allowing them to be executed automatically when the pattern is dispensed
Software Delivery Services for Cloud Computing	Rational	Consists of agile development services to enable collaborative development and test; an integrated set of services for test management, test planning, test lab management; and tools to help develop for the cloud and includes best practices and processes for successful adoption of private clouds
Telelogic System Architect – Rational Transformation Workbench	Rational	IBM Telelogic System Architect enhancements help develop a road map for developing cloud services, integrated with SOA life-cycle views
CloudBurst 1.2	STG and Tivoli	Middleware- and application-neutral services management system based on IBM System x BladeCenter platform for developing, testing, and deploying cloud computing models into production; optional integration with Tivoli Service Automation Manager and Rational Automation Framework
Platform Layer Services		
SOA Sandbox	Software Group (SWG)	Various SOA deployment software components available to purchase on a per-use basis or a try and buy from the IBM Cloud

TABLE 2

IBM Private Cloud Platform Layer Product and Service Map

Product	IBM Brand	Description
Smart Business Test Cloud	Global Technology Services	Secure, self-service test platform incorporating IBM and non-IBM hardware, middleware, storage, and network resources with service request management, automated provisioning, and configuration management for private cloud development
Smart Business Development and Test on the IBM Cloud	Global Technology Services	Runtime environment for developing and testing application code using IBM tools to configure and manage the execution environment, including an IDE for direct use of the execution environment

Source: IBM, 2010

WebSphere CloudBurst Appliance Offers "Cloud in a Box" for Application Life Cycle

WebSphere CloudBurst Appliance is a private cloud appliance for developers, testers, and the application development life cycle. The appliance proves the viability of a plug-and-play approach to a private cloud by offering a tightly bound product designed to support a specific process area and set of users.

The appliance ships with IBM WebSphere Application Server Hypervisor Edition (WebSphere Hypervisor Edition), which is a virtual application server appliance supporting the Open Virtualization Format (OVF) standard. The virtual appliance includes the operating system, WebSphere Application Server profiles and binaries, and IBM HTTP Server, all preinstalled and ready to be deployed to a hypervisor.

WebSphere CloudBurst comes with a library of patterns, consisting of images and scripts to support different deployment scenarios. The image contains all of the configuration settings required to deploy WebSphere Hypervisor Edition into a cloud. Customization is handled through script packages, which contain executable files and required artifacts that are invoked by WebSphere CloudBurst after a pattern is deployed. This approach allows customization without the need to adjust the image.

Upon implementation of WebSphere CloudBurst, developers skilled in configuring WebSphere Application Server can create additional custom images and combine them with scripts to form new patterns. When developers begin working on a new application, they access the desired pattern from the appliance's self-service catalog and a WebSphere Application Server Hypervisor Edition instance is deployed.

When the application is ready to be tested, a script package and an install script are created and the new pattern is deployed into a test cloud environment. When the testing is completed, the migration from test to production is performed by cloning the pattern and setting a parameter for the number of nodes and deploying into a production cloud.

Supports Collaborative Application Life-Cycle Management

WebSphere CloudBurst supports a collaborative application life-cycle management (C/ALM) approach to software development, which is championed by IBM Rational.

C/ALM development emphasizes rapid iteration managed by tightly integrated software development tools end to end. The tight integration between the various tools used during the application life cycle facilitates collaboration between people in different roles across the life cycle.

Key to C/ALM is rapid redeployment of frequent application builds produced as the output of continuous integration of the modifications to application code. The WebSphere CloudBurst Appliance accelerates this part of C/ALM.

WebSphere CloudBurst Benefits

There are many opportunities to improve return on investment using WebSphere CloudBurst, including:

- Improving development and testing server utilization (decrease operating costs)
- Leveraging expertise and configuration best practices embedded into the pattern library supplied by IBM as part of the offering (improve application quality, decrease costs, and increase speed to value)
- Improving the speed and efficiency of the development effort by removing common configuration-related problems (deliver business value faster)
- Increasing the amount of testing that can be accomplished over a development cycle to improve the quality of the application's initial version (decrease costs and improve speed to value)

As development teams speed up development cycles and lower the cost of developing applications using WebSphere CloudBurst, enterprises have the opportunity to increase the number of applications they are able to develop or make changes to over the course of a year. WebSphere CloudBurst offers IT the opportunity to improve its service responsiveness across the application life cycle.

Finally, the knowledge that can be gained by using WebSphere CloudBurst is transferable to the use of private cloud in the broader business environment. That alone may justify the investment for organizations that can see the benefit of this type of computing model but are concerned about gaining the necessary skills.

While the initial version focused on WebSphere Hypervisor Edition images, a DB2 test pattern is now included. IBM also plans to expand the WebSphere software images library over time with additional products.

WebSphere Virtual Enterprise

While WebSphere Hypervisor Edition brings all of the capabilities of the WebSphere Application Server into a virtualized environment, it does not fully fit into the private cloud definition until there is support of elastic scaling, described in Table 1.

WebSphere Virtual Enterprise is used to manage WebSphere Hypervisor Edition clusters to handle elastic scaling. The software's policy-based workload management prioritizes and intelligently routes requests according to service-level policies. In

addition, the software detects and corrects application server problems, and it makes sure that multiple applications within a cluster peacefully coexist.

In addition, multiple application versions are able to run in production at the same time. This is a key benefit in offering continuous availability in a virtualized environment.

WebSphere eXtreme Scale

Additional scalability is offered through the use of WebSphere eXtreme Scale, an in-memory grid that dynamically processes, partitions, replicates, and manages data and business logic across virtualized WebSphere Hypervisor Edition images. Using WebSphere eXtreme Scale, enterprises are able to cache data as well as spread processing across the grid.

Calling a data service from inside an application — rather than reading from and writing to a database — offers greater flexibility about how and where data is accessed and stored. As enterprises cloud-enable their applications, incorporating a data grid is important for improving application performance.

The combination of WebSphere CloudBurst Appliance and WebSphere Application Server Hypervisor Edition offers enterprises the ability to virtualize their applications and run them with the performance they are accustomed to in a standalone server environment. With the addition of WebSphere Virtual Enterprise and WebSphere eXtreme Scale, IBM customers will have a private cloud–enabled, data services–enabled application infrastructure that offers the elastic scaling needed to achieve the benefits of private cloud computing.

IBM CloudBurst

IBM CloudBurst enables a private cloud by integrating service management software system with servers, storage, middleware, and applications along with QuickStart services. While WebSphere CloudBurst provides self-service provisioning of WebSphere Application Server–based applications into a private cloud, IBM CloudBurst is used by enterprises for self-service provisioning of any type of workload built on custom or packaged software into a private cloud environment.

CHALLENGES/OPPORTUNITIES

The overarching opportunity of private clouds is to use their integrated packaging and operational efficiencies to accelerate the movement of IT service delivery closer to the efficiency and agility goals CIOs have been pursuing for decades. Challenges include the possibility of operational and cultural shifts that have been tough for IT shops to get through, including:

- Driving more acceptance of standardized services
- Putting more IT services delivery in the hands of users (self-service)
- Getting to a more direct cost/chargeback funding model (through better usage transparency)

- Driving a better end-to-end understanding of IT service delivery and value to the IT staff

Because the packaging of private clouds, such as WebSphere CloudBurst Appliance, mitigates quite a few of the historical implementation challenges, organizations are able to get right to these necessary cultural, operational, and organizational transformations.

Beyond the cultural issues, there are also skills challenges, including the skills required to deliver the level of repeatability needed for users to successfully select an application and have it automatically provisioned into a private cloud.

WebSphere CloudBurst is an example of an approach that narrowly defines a set of roles and capabilities but offers a fully featured cloud offering. A similar discipline of demonstrating private cloud principles on an end-to-end basis within a narrowly defined focus will help in achieving success in the shift to private cloud.

CONCLUSION AND RECOMMENDATIONS

Because the benefits that will be gained through a private cloud have been pursued for so long, IT organizations are familiar with many of the approaches that will come together for a fully functioning private cloud. Most organizations have been focusing on standardization, consolidation, and a services-oriented approach to computing, and many have already implemented various utility services.

Making the shift to cloud computing is much closer to the logical evolution of the datacenter than a discontinuous change. Putting together all of the elements of a private cloud will involve leveraging existing investments, as well as adding new capabilities.

Focusing on the platform layer of a private cloud is a logical and foundational step to take to help IT staff gain the necessary skills and create the necessary capabilities to extend the private cloud to business users and the broader host of self-provisioning business services that will entail.