

IBM Cloud Computing

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Abstract— Recently cloud computing has become a buzzword and it is having applications in many domains. IBM cloud computing is used for a set of cloud computing services for business offered by the information technology company IBM. All offerings used to be marketed under the name IBM Smart Cloud. IBM cloud includes infrastructure as service (IaaS), software as a service (SaaS) and platform as a service (PaaS) offered through public, private and hybrid cloud delivery models, in addition to the components that make up those clouds.

Keywords— IBM cloud computing, IaaS SaaS, PaaS.

I. INTRODUCTION

IBM began to develop a strategy for cloud computing in 2007, announcing that it planned to build clouds for enterprise clients and provide services to fill what it regarded as gaps in existing cloud environments. In October 2007, IBM announced a partnership with Google to promote cloud computing in universities. In addition to donating hardware and machines, the two companies also provided a curriculum to teach students about cloud computing. IBM offers three hardware platforms for cloud computing. These platforms offer built-in support for virtualization.

For virtualization IBM offers IBM WebSphere application infrastructure solutions that support programming models and open standards for virtualization. The management layer of the IBM cloud framework includes IBM Tivoli middleware. Management tools provide capabilities to regulate images with automated provisioning and de-provisioning, monitor operations and meter usage while tracking costs and allocating billing. The last layer of the framework provides integrated workload tools. Workloads for cloud computing are services or instances of code that can be executed to meet specific business needs. IBM offers tools for cloud based collaboration, development and test, application development, analytics, business-to-business integration, and security.

II. IBM SMARTCLOUD (OR IBM CLOUD)

The IBM SmartCloud brand includes infrastructure as a service, software as a service and platform as a service offered through public, private and hybrid cloud delivery models. IBM places these offerings under three umbrellas: SmartCloud Foundation, SmartCloud Services and SmartCloud Solutions.

III. CLOUD COMPUTING SERVICES

Cloud service providers that can be collected into three categories:

A. SAAS: Cloud application services or "Software as a Service (SaaS)" deliver software as a service over the Internet, eliminating the need to install and run the application on the

customer's own computers and simplifying maintenance and support.

B. PAAS: The "Platform as a service" covering a layer of software and presents it as a service that can be used to construct a higher-level services. In other words, the capability provided to the consumer is to deploy onto the cloud infrastructure consumer-related or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations.

C. IAAS: Cloud infrastructure services or "Infrastructure as a Service (IaaS)" delivers computer infrastructure, typically a platform virtualization environment as a service. Rather than purchasing servers, software, data center space or network equipment, clients instead buy those resources as a fully outsourced service. The service is typically billed on a utility computing basis and amount of resources consumed (and therefore the cost) will typically reflect the level of activity. It is an evolution of virtual private server offerings.

IV. PUBLIC, PRIVATE AND HYBRID CLOUD MODELS

IBM offers cloud delivery options including solely private cloud, solely public cloud, and variations in between. Private, public and hybrid clouds are not strictly distinct, as IBM allows the option to build a customized cloud solution out of a combination of public cloud and private cloud elements. Companies that prefer to keep all data and processes behind their own firewall can use private cloud services managed by their own IT staff. A company may also choose pay-as-you-go pricing. Hybrid cloud options allow for some processes to be hosted and managed by IBM, while others are kept on a private cloud or on a VPN or VLAN. IBM also offers planning and consultation throughout the deployment process. IBM offers five cloud provision models:

- Private cloud, owned and operated by the customer
- Private cloud, owned by the customer, but operated by IBM (or another provider)
- Private cloud, owned and operated by IBM (or another provider)
- Virtual private cloud services (based on multi-tenanted support for individual enterprises)
- Public cloud services (based on the provision of functions to individuals)

The majority of cloud users choose a hybrid cloud model, with some workloads being served by internal systems, some

from commercial cloud providers and some from public cloud service providers.

The IBM public cloud offering, SmartCloud Enterprise, was launched on April 7, 2011. SCE is hosted IaaS with service level agreements (SLA)s, and can be offered in a private, public or hybrid model. The environment is hosted on IBM servers (System p or System x), with a standard set of software images to choose from.

For customers who perceive that the security risk of cloud computing adoption is too high, IBM offers private cloud services. IDEAS International wrote in a white paper, "IBM believes that its clients are currently more comfortable with private clouds than public or hybrid clouds, and that many are ready to deploy fundamental business applications in private clouds." For building strictly private clouds, IBM offers IBM Workload Deployer and Cloudburst as ready-to-deploy, "cloud in a box" style solutions. Cloudburst provides blade servers, middleware and virtualization for an enterprise to build its own cloud-ready virtual machines. Workload Deployer connects an enterprise's existing servers to virtualization components and middleware in order to help deploy standardized virtual machines designed by IBM. For customers who prefer to perform their own integration of private clouds, IBM offers a choice of hardware and software building blocks, along with recommendations and a reference architecture, prior to deployment. Clients may choose from IBM virtualization-enabled servers, middleware and SaaS applications.

V. CLOUD STANDARDS

IBM participates in several cloud standards initiatives within various standards development organizations involved in cloud service models IaaS, PaaS and SaaS, all of which work toward improvements in cloud interoperability and security.

IBM is a member of The Open Group, a council that works for the development of open, vendor-neutral IT standards and certifications. Other members of the group include HP, Oracle, SAP and numerous others. IBM contributed the Cloud Computing Reference Architecture in February 2011 to The Open Group as the basis of an industry-wide cloud architecture. IBM's CCRA is based on real-world input from many cloud implementations across IBM. It is intended to be used as a blueprint/guide for architecting cloud implementations, driven by functional and non-functional requirements of the respective cloud implementation. HP and Microsoft have also published Cloud Computing Reference Architectures.

Within the IaaS space, IBM is a member of the Cloud Management Work Group (CMWG) within the Distributed Management Task Force (DMTF), which released a draft version of their IaaS APIs, called the Cloud Infrastructure Management Interface (CIMI), on September 14, 2011. The CIMI APIs define a logical model for the management of resources within the Infrastructure as a Service domain. With these APIs, clients can create, manage and connect machines, volumes and networks.

VI. SCOPE OF IBM CLOUD

Three months after IBM acquired SoftLayer for \$2 billion, the company is aggressively transitioning all of its cloud computing services to the SoftLayer platform.

IBM announced that it is moving the IBM Social Learning Platform and the recently acquired Xtify mobile messaging software to the Softlayer cloud platform. The company also reported that it has signed up 1,100 additional customers since acquiring SoftLayer. Dennis Quan, IBM vice president of cloud infrastructure services, says the total base of customers using the SoftLayer platform is more than 22,000, and IBM now has over 100 software as a service (SaaS) applications.

To add to its portfolio, IBM also launched an IBM Mobile Feedback application delivered via the cloud that makes it easier to gather employee feedback and an IBM Survey Analytics application that uses text and visual analytics to extract and display over one million pieces of anonymous, unstructured data garnered from employee surveys. IBM also announced that the IBM PureFlex family of integrated servers is now available as a platform option in the IBM SoftLayer cloud.

VII. TIMELINE

October 2014

- IBM Cloud Manager with OpenStack
- IBM Cloud Orchestrator

October 2011

- IBM SmartCloud Application Services
- IBM SmartCloud Foundation
- IBM SmartCloud Ecosystem
- IBM SmartCloud Enterprise+

August 2011

- Launch of hybrid cloud solution with Cast Iron Cloud Integration

July 2011

- IBM opens two cloud data centers in Japan
- IBM Smarter Commerce

June 2011

- IBM SmartCloud Archive launch
- IBM SmartCloud Virtualized Server Recovery
- IBM SmartCloud Managed Backup

April 2011

- Launch of IBM SmartCloud
- Launch of IBM SmartCloud Enterprise
- IBM Workload Deployer
- IBM joins Cloud Standards Customer Council

November 2010

- IBM Federal Community Cloud for government organizations

October 2010

- IBM Service Delivery Manage
- IBM CloudBurst v2.1 (with POWER7-based hardware)
- IBM Blueworks Live

July 2010

- Announcement of cloud computing data center in Ehningen, Germany

- IBM Smart Business Desktop Cloud
February 2010
- IBM opens cloud computing data center in Raleigh, North Carolina
November 2009
- IBM Smart Business Development and Test on the IBM Cloud
- IBM Smart Analytics Cloud
October 2009
- IBM Smart Business Storage Cloud
June 2009
- IBM Smart Business Services
- IBM Cloudburst (later renamed IBM Workload Deployer)
January 2009
- LotusLive collaboration suite

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