### Cloud Computing Infrastructure

“Infrastructure” represents all infrastructure elements needed on the cloud service provider side, which are needed to provide cloud services. This includes facilities, server, storage, and network resources, how these resources are wired up, placed within a data center, etc.

**Sheng Liang(CEO) and Peder Ulander(CMO) Cloud.com** says for the architect employed with building out a cloud infrastructure, there are seven key requirements that need to be addressed when building their cloud strategy. These requirements include:

### Heterogeneous Systems Support

### Service Management

### Dynamic Workload and Resource Management

### Reliability, Availability and Security

### Integration with Data Center Management Tools

### Visibility and Reporting

### Administrator, Developer and End User Interfaces

**Ref**: *http://www.cio.com/article/648465/7\_Requirements\_for\_Building\_Your\_Cloud\_Infrastructure?page=3&taxonomy Id=3024*

### Cloud Computing Infrastructure basically consist of:

**1.Hardware/Software**

Normally hardware for cloud consists of servers, storage and networking.

**2. Virtualization**

The next missing link in the cloud setup is virtualization. Provides a method for sharing hardware efficiently. Virtualization needs a special set of hardware and software. Virtualization can be applied very broadly to just about everything you can imagine including memory, networks, storage, hardware, operating systems, and applications. Virtualization has three characteristics that make it ideal for cloud computing:

* **Partitioning**: In virtualization, you can use partitioning to support many applications and operating systems (OSes) in a single physical system.
* **Isolation**: Because each virtual machine is isolated, each machine is protected from crashes and viruses in the other machines. What makes virtualization so important for the cloud is that it decouples the software from the hardware.
* **Encapsulation**: Encapsulation can protect each application so that it doesn’t interfere with other applications. Using encapsulation, a virtual machine can be represented (and even stored) as a single file, making it easy to identify and present to other applications.

There are many virtualization software available that can emulate an entire computer, which means 1 computer can perform as though it were actually 20 computers. Using this kind of software we might be able to move from a data center with thousands of servers to one that supports as few as a couple of hundred.

**Oracle** provides a complete virtualization stack in terms of a hypervisor on both architectures: X86 and Sparc CPUs. There is Oracle VM for X86 and Oracle VM for Sparc available at no additional  license costs if your are running this virtualization stack on top of Oracle HW (and with Oracle Premier Support for HW). This completes the virtualization portfolio together with Solaris Zones introduced already with Solaris 10 a few years ago.

Lets explain how Oracle VM for X86 works:

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| Oracle VM for X86 Overview  Oracle VM for x86 consists of two main parts:  **The Oracle VM Server**: Oracle VM Server is installed on bare metal and it is the hypervisor which is able to run virtual machines. It has a very small footprint. The ISO-Image of Oracle VM Server is only 200MB large. It is very small but efficient. we can install a OVM-Server in less than 5 mins by booting the Server with the ISO-Image assigned and providing the necessary configuration parameters (like installing an Linux distribution). After the installation, the OVM-Server is ready to use. That's all.  **The Oracle VM-Manager**: OVM-Manager is the central management tool where you can control your OVM-Servers. OVM-Manager provides the graphical user interface, which is an Application Development Framework (ADF) application, with a familiar web-browser based interface, to manage Oracle VM Servers, virtual machines, and resources. The Oracle VM Manager has the following capabilities:   * Create virtual machines * Create server pools * Power on and off virtual machines * Manage networks and storage * Import virtual machines, ISO files, and templates * Manage high availability of Oracle VM Servers, server pools, and virtual machines * Perform live migration of virtual machines.   **Ref**: *https://blogs.oracle.com/orasysat/entry/building\_up\_a\_infrastructure\_cloud* |

**According to “***Introduction and Architecture Overview IBM Cloud Computing Reference Architecture 2.0***”**



Fig :IBM –Cloud Computing Infrastructure Détails

In the infrastructure model of IBM they describe that, The decision whether the infrastructure is virtualized or not depends on the actual workload characteristics to be run on the respective infrastructures: For many workloads (e.g. compute & storage as-a-Service) it is very convenient to virtualize the underlying infrastructure, especially since virtualization enables some use cases which can basically not be realized with a physical infrastructure (e.g. all use cases related to image management or dynamic scaling of CPU capacity as needed). For other workloads (e.g. analytics/search) it is required to have maximum compute capacity and use 100’s or 1000’s of nodes to run a single specialized workload. In such cases a non-virtualized infrastructure is more appropriate. This is not a violation of the architectural principles postulating as much as possible commonality across cloud services: While maximum commonality is a core architectural principle, it is allowed to have different infrastructure architectures per workload category. For example, a collaboration, web and infrastructure workload requires a different underlying infrastructure than an HPC or highly transactional workload. However, a requirement in any case is that all of these infrastructure components get managed from a single, central CCMP and CCMP has the ability to place instances of each cloud service on the corresponding infrastructure (or IaaS service instance, in case a SaaS instance is not directly running on an infrastructure but leverages a IaaS cloud service as an alternative sourcing model).

The less variance the infrastructure has, the more it caters to the standardization needs of a cloud environment. Minimal variance on the infrastructure side is critical for enabling the high degrees of automation and economies of scale which are base characteristics of any cloud environment. However, it has to be acknowledged that in many installed cloud computing environments (specifically private clouds) there are different workloads to be provided as a cloud service and each of these workloads might have special infrastructure needs and might need to support different SLAs. So although the ideal case is total homogeneity on the infrastructure side, it is important to note that there will cloud installations with a few variants in the infrastructure elements (e.g. different HW platforms).

The infrastructure is managed by the OSS as part of the CCMP, whereas the CCMP by itself is also running on the infrastructure.

Note: The physical existence of a virtualized infrastructure on the cloud service provider side is not mandatory, since it is also possible for a cloud service provider to consume infrastructure as a service (and the required CCMP) from a different cloud service provider and put higher value cloud services on top. Clearly, the consuming service provider inherits all SLA constraints defined for the consumed cloud service. So depending on the capability to implement SLAs in software or by using other means, improving SLAs beyond what is provided by the underlying cloud service might be hard (admittedly, there are exceptions to this statement, specifically for cloud workloads which have QoS totally realized in software).

**Microsoft’s** IaaS based cloud infrastructure uses a combination of Hyper-V, failover clustering, storage, and networking technologies. The Hyper-V server role hosts the virtual machines that make up the IT workloads running in the IaaS cloud. The Failover Clustering feature allows a set of computers to act as a single computer, providing scale-out and failover to clustered services and resources, including storage and virtual machines. File and Storage Services allows a pool of storage to be made available to the cluster to assign to virtual machines and to store virtual hard disk files. The network adapter teaming feature allows you to group multiple network adapters into a team that appears as a single network adapter for bandwidth aggregation and fault tolerance. Hyper-V network virtualization Enables easy migration to the cloud by separating a tenant's logical topology from the data center’s physical topology with a virtualization layer for the network. A tenant’s networks can be virtualized and have the illusion of their own IP address space, which can be different from the IP address space that is used by the IaaS hosting provider to build the cloud infrastructure. Enterprise workloads running in a hosting provider's IaaS cloud must have a connection back to the enterprise network and be manageable. Windows Server 2012 introduces support for site-to-site virtual private network (VPN) connectivity with the addition of IKEv2 protocol to the Routing and Remote Access Service (RRAS) and a wizard. This wizard facilitates the configuration of site-to-site connections between the enterprise network and the virtualized network in the IaaS hosting provider's data center. With a VPN connection, workloads that run inside a cloud-based data center become an extension of the enterprise network. As a result, at the core networking level, workloads do not have to be configured or modified to be able to run in the cloud and can be managed using normal tools. The Hyper-V virtual switch platform allows network partners to easily hook into the Hyper-V virtual switch network flows and build monitoring, security, and forwarding extensions. IaaS clouds based on this process for building your cloud infrastructure require Windows Server 2012. The exact hardware requirements depend on the types of workloads you are planning to run on the Hyper-V servers in the IaaS cloud.

## Update Log

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| 2012-08-09 | 0.1.0 | Added:  Cloud Computing Infrastructure(Intro)  Hardware/Software  Virtualization | Sailesh Krishna |