A Survey Literature on Multi-cloud

Sayantan Chakraborty
Founder, NDEDGE Informatics Private Limited, MCA, Pailan College of Management and Technology

***Abstract*— This is a short research that describe a survey on multicloud that already exists and deployed by the existing big vendors and their approaches to the multiclouds. and In the simplest terms, federation is a means to enable interaction or collaboration of some sort. Federation is an overloaded term with different meanings to different stakeholders. What does it entail in this context and with regard to the cloud computing model? What is the scope of capabilities it can or must support? Of course, federation can have multiple definitions in different use cases, in different application domains, and at different levels in the system stack. In some situations, federation is used to mean identity federation. This means being able to ingest identity credentials from external identity providers. This can be used to provide single sign-on (SSO) – a very useful capability.**

1. SSO allows a single authentication method to access different systems within external identity providers based on mutual trust. Here we will refer federation as federation in cloud sense and

2. we will take a deep dive into federation cloud and multi cloud.

3. At first we will have a quick look at Federation cloud high level architecture.

4. Then we will go for IaaS multi cloud ,PaaS multi cloud and task scheduling methods in multi cloud and other related topics. Key products which are considered in collaboration :

1. Oracle single sign on

2. Zimbra collaboration etc.

The above diagram describes the generic federated cloud. We will look into this in upcoming slides. They are too similar to the generic one but they are more useful as they are already a part of some clouds.

MULTI-CLOUD OR MULTI-TENANCY IN CLOUD

The term multi-cloud has been used when cloud provider capabilities are "integrated" by defining a separate interface layer for each “back-end” provider whereby a single, common interface can be presented to the user. This approach achieves cloud interoperability by using the rich feature set of the

cloud capabilities, but integrates them very shallowly, if at all. Another approach is to use a "lowest common denominator" approach. Here, some minimal feature set across all providers is used, e.g. VMs, and the "integrated" infrastructure system is built on top using, for example, Docker, Kubernetes, OpenStack, or various DevOps solutions. This approach provides portability.

BURSTING (HYBRID) ARCHITECTURE. AS FIGURE (A) SHOWS

The cloud bursting or hybrid architecture combines the existing on-premise infrastructure (usually a private cloud) with remote resources from one or more public clouds to provide extra capacity to satisfy peak demand periods. Because the local cloud OS has no advanced control over the virtual resources deployed in external clouds beyond the basic operations the providers allow, this architecture is loosely coupled. Most existing open cloud managers support the hybrid cloud architecture, which has been explored in various research efforts and is used in infrastructures such as StratusLab (http://stratuslab.eu).

AGGREGATE ARCHITECTURE

Aggregation consists of two or more partner clouds that interoperate to aggregate their resources and provide users with a larger virtual infrastructure.

This architecture is usually partially coupled, since partners could be provided with some kind of advanced control over remote resources, depending on the terms and conditions of contracts with other partners.

MULTI TIER ARCHITECTURE

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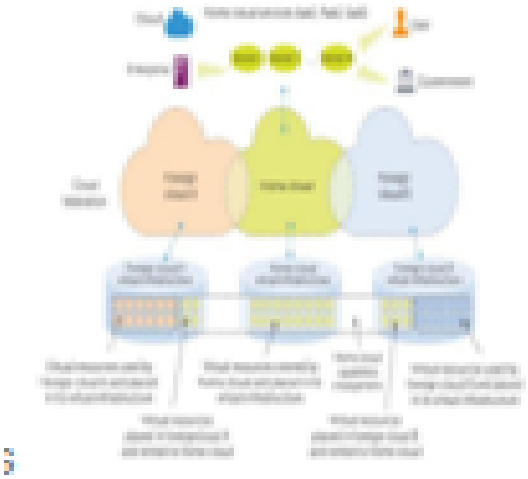
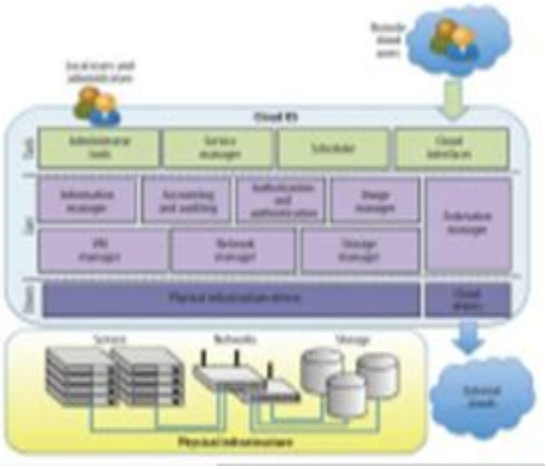
CLOUD OS



A cloud OS's role is to efficiently manage datacenter resources to deliver a flexible, secure, and isolated multitenant execution environment for user services that abstracts the underlying physical infrastructure and offers different interfaces and APIs for interacting with the cloud. While local users and administrators can interact with the cloud using local interfaces and administrative tools that offer rich functionality for managing, controlling, and monitoring the virtual and physical infrastructure, remote cloud users employ public cloud interfaces that usually provide more limited functionality. OpenNebula (http://opennebula.org) is an example of an open cloud OS platform focused on datacenter virtualization that fits with the architecture Virtual machine manager



1. Storage manager
2. IMAGE MANAGER
3. Network Manager
4. Image Manager
5. Information manager
6. Accounting and auditing
7. Authentication and authorizatioN
8. Federation manager
9. Scheduler
10. Administrative tools
11. Service manager
12. Coupling levels
13. Cloud interfaces

These are the other component of multi cloud in an IaaS environment

Microservice as the basis of federating multiple cloud datacenters as part of a cohesive federation, where datacenter providers can meet the performance requirements of client applications through optimal placement a nd migration of microservices across datacenters.

IAAS BASED MULTI CLOUD USING FAST CONNECT FOR AWS AND OCI

Create vcn

1. Create a DRG and Attach the VCN to It
2. Add a Rule to the Route Table
3. Create a FastConnect Circuit

4. Create an MCR and Connect It to Oracle Cloud
5. Add a Connection to Amazon VPC
6. Configure AWS Direct Connect
7. Oracle now a days claims that multicloud with azure interconnect is ready but not with FAST connect. Fast connect mostly satisfy all necessary and sufficient conditions of hybrid cloud.

PAAS MULTI CLOUD AND IT'S KERNEL

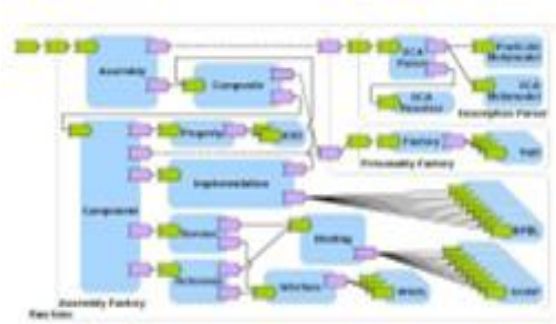


Figure 2. Architecture of the PaaS kernel

This kernel draws inspiration from our FRASCATI, platform for reconfigurable SOA and from the domain of Software Product Line (SPL) design. An SPL can be defined as "a set of software-intensive systems that share a common, managed set of features and that are developed from a common set of core assets in a prescribed way" . A Feature Model is used to compactly define all features in an SPL and their valid combinations. Another PaaS would be kubernetes based oracle kubernetes engine. However the above sections describe a conceptual kernel design for PaaS Multi cloud but PaaS multi cloud holds some basic components we will discuss them. multi-PaaS cloud (cloud4SOA):In order to implement a multi-PaaS application management solution the two main features required are the PaaS management (to manage applications at different PaaS) and the Cloud monitoring (to monitor the applications across PaaS). Based on the results of table 2.2 only Cloud4SOA satisfies these two requirements.
1. Moreover Cloud4SOA offers a matchmaking service that allows searching among the existing PaaS offerings that best match the developer's needs.

TELEPORTATION OF VMS

It's a most recent development happening in vmware lab and they put this research on live as they are able to teleport all the vms during migration. We will take a quick look at this and we will finish up with a quick recap of the priorior tech jargon which we must consider. They developed teleportation for migration purposes.

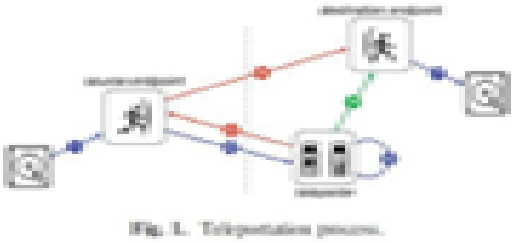
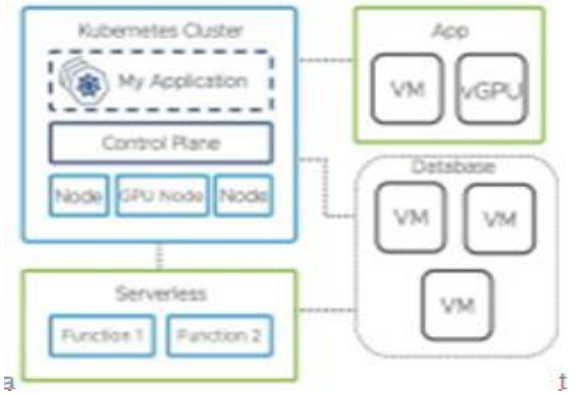


Fig. 1. Teleportation process.

1. Use of strong/weak head recognition for sequence discovery.
2. Use of hash files to preserve referential locality for hashes stored on disk and reduce memory footprint.
3. Use of block sequences to reduce both the amount of disk I/O and memory footprint.
4. Novel space-efficient cache that combines cuckoo hashing with LRU approximating cache replacement policy.
5. Probabilistic cache admission policy that affects cache item's lifetime.
6. Use of indirect addressing to reduce the size of each cache entry by 7 bits.
7. Alignment of sequences in the sequence cache on the 128-block boundaries to reduce disk I/O. 8. Novel cache coherence protocol that does not require notifying teleporter when destination blocks get modified. 9. Use of grain table compression to reduce the memory footprint of the destina tion endpoint.



GPU VIRTUALIZATION

within multi cloud GPU virtualizations comes with a different way. Modern developer and data scientist

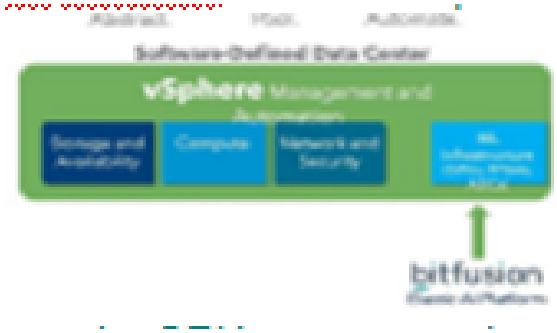
may require to use certain GPUs as virtualized.so VCF (vmware cloud foundation) offers GPU virtualization as a service (SaaS) in some specific manner. You need to use GPU and GPU Virtualized cluster as a part of SaaS within Multi cloud which you need to get through brokers to other providers. Call to Action:Audit how GPUs are used in your organization's infrastructure! Calculate the costs and utilization of the existing GPUs in the environment; What are the use cases for GPUs across
different groups?;Propose an internal virtualized GPUaaS infrastructure by combining all resources for better utilization and cost optimization.

HIGH SPEED NETWORKING WITH PVRDMA & ROCE

Remote Direct Memory Access (RDMA) provides direct memory access from the memory between hosts bypassing the Operating System and CPU. This can boost network and host performance with reduced latency & CPU load while providing higher bandwidth. RDMA compares favorably to TCP/IP, which adds latency and consumes significant CPU and memory resources. Mellanox conducted Benchmarks that demonstrated NVIDIA® vComputeServer or virtualized GPUs achieve two times better efficiency by using VMware's paravirtualized RDMA (PVRDMA) technology than when using traditional networking protocols.

VSPHERE BITFUSION:

vSphere Bitfusion extends the power of VMware vSphere's virtualization technology to GPUs.
vSphere Bitfusion helps enterprises disaggregate the GPU compute and dynamically attach GPUs anywhere in the datacenter just like attaching storage. Bitfusion enables use of any arbitrary fractions of GPUs. Support more users in test and development phase. vSphere Bitfusion supports the CUDA API and demonstrates virtualization and remote attach for all hardware. GPUs are attached based on CUDA calls at run-time, maximizing utilization of GPU servers anywhere in the network.



REVIEWS AND CONCLUSION

GPU VIrtualization in Multi cloud:vSphere Bitfusion extends the power of VMware vSphere virtualization technology to GPUs. vSphere Bitfusion helps enterprises disaggregate the GPU compute and dynamically attach GPUs anywhere in the datacenter just like attaching storage. Bitfusion enables use of any arbitraryfractions of GPUs. There are certain aspects of research still pretty much possible where instances' lifespan is quite lesser than usual or providers willing to reuse the resources for other purposes except cloud's end users after a certain time.

In a nutshell the microservice architecture is quite convincing and adopted by all other cloud providers quite decently: kubernetes, swarm, DevOps, modal cloud etc.
After researching previous works there are certain concerns which still exist; those are security in multi-tenancy and broker designing with respect to multi-tenancy or multi cloud.
From a practical point of view task management is still challenging.GPU based HPC and security within

multi-cloud is challenging as it is part of distributed cloud. Distributed cloud also can be considered as an exceptional area of interest interms of quantum computing which is part of quantum inter cloud.

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