

GridARS: Resource Management Framework for Multi-domain Cloud

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Cloud computing and IaaS

- IaaS provides IT infrastructure (hardware) on demand.
- IaaS provider owns a large amount of physical resources (computers, storages), and provide a fragment of them to each user through virtualization.





laaS

- IaaS provides "Virtual Infrastructures(VI)" to users on demand.
- What is VI?
 - ► A VI is an isolated infrastructure
 - Isolated from other VIs or physical infrastructure
 - A user can use a VI as if it is a dedicated infrastructure of the user.
 - Providers construct VIs using their physical resources (computers, storages), and provides them to users
- Shift from "owning" to "using"
 - Users do not have to own their own resources
 - Infrastructure is provided when needed





Data centers are the key components

- Data center: a large number of computers and storages located at a place
 - A large number of homogeneous resources reduces the operation cost
- A data center is dynamically shared by a large number of users through virtualization
 - Utilization ratio of physical resources will be high

Role of network

- Network has been considered as an "as is" resource
 - It is not easy to provide data intensive services
 - User experience may be worse than dedicated HW
- Network should be a manageable resource



Networks to be considered

For data intensive services, chunks of data are moved (copied) between IaaS and user, and inside IaaS.





Multi-domain cloud



Required technologies for Multi-domain Cloud with manageable network

- A unified interface and provisioning system to request network and other resources (computers storages)
- A mechanism to set up network related application execution environment
 - Dynamic assignment of IP addresses, VLAN ids etc.
- A mechanism to provide users with monitoring capability of virtual infrastructures while keeping isolation
 - Monitoring of not physical but virtual infrastructure

Unified interface and provisioning system

G-lambda project has been defining an interface

- Joint project of KDDI R&D labs., NTT, NICT and AIST, started in 2005. http://www.g-lambda.net/
- The goal of this project is to define a web services interface (GNS-WSI) to request heterogeneous resources (network, computers, storages etc.)
- AIST has been developing a reference implementation of GNS-WSI called GridARS

GridARS provisioning system



Application execution management

- A user job is executed on a VI
 - Environment management
 - Oetermine IP addresses of the hosts
 - Share the IP address list among the hosts
 - Configure network interface of the hosts
 - VLAN, IP address, routing
 - Set up ssh keys, authorized_hosts, known_hosts
 - Set up file system of each hosts
 - Execution management
 - Q Launch jobs, terminate jobs etc.
 - Confirm network connectivity before launching a job



AEM overview (1)



AIST **AEM behavior** Request from user/requester (2) Schedule resources, AEM Including VLAN id, IP GRC root addresses (1) Advertise available IP range, etc. (1) Advertise availability **AEM leaf** including VLAN CRM NRM NRM AEM daemon LS

LS: Local Scheduler (cf. Sun Grid Engine)

NRM

NW









AEM behavior

Start time of provisioning

















Monitoring

Monitoring information of not physical infrastructure But provisioned VI should be provided to user



(3) User requests monitoring with (4) Mapping between rsv. Monitoring the Reservation ID and the ID and physical credential. The request is infrastructure is provided overview hierarchically propagated using by GRC and RM reservation information from GRC (5) DMS filter monitoring (1) User makes a reservation User ↓ information based on policy, id with a credential and return to the user GRC DMS During provisioning, Leaf DMS periodically gather (2) Reservation ID monitoring info. is returned at each level of tree GRC GRC DMS DMS **CRM** CRM NRM NRM Provisioning GRS DMS CRM **SRM** SRM CRM Allocated Virtua astructure



Demonstration at GLIF2010



Summary: GridARS key features

- Unified provisioning system of network and compute resources
- Dynamic scheduling and automatic set up of IP addresses, VLAN (host and network), ssh and file system
- Monitoring of virtual infrastructure
 - Provide requester with monitoring information of the provisioned infrastructure (network and CPU) only
 - The monitoring system interoperates with the provisioning system
 - Policy based filtering
 - Provider can define information to be provided to a particular requester



Come and see our demonstration this evening!