Grid & Virtualization Working Group

OGF21 gridvirt-wg

Erol Bozak, Chair
SAP, Development Architect

Wolfgang Reichert, Co-Chair
IBM, Senior Technical Staff Member

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Agenda

- Goals, Milestones & Status
- Recap of Previous Sessions
- Refine One Selected Use Case
- Working Streams & Next Steps
Goals of the WG

1. Verification that within existing Grid standards the specifications are neutral to virtualized systems and resources
   • The request for “resources” may be satisfied either by “virtualized resources” or “physical resources”
   • Is virtualization “transparent to the current Grid standards”?

2. Explore how virtualization technologies can be exploited to better support Grid use cases
   • Define the use cases / scenarios wherein the Grid infrastructure is seen interacting with system virtualization platforms and making use of its capabilities
   • Exploit existing concepts and work, e.g.
     • System Virtualization, Partitioning and Clustering (SVPC) – (DMTF)
     • “Virtual Workspaces” (http://workspace.globus.org/papers/)
Goals of the WG

3. Define the requirements to the Grid architecture for integration with system virtualization platforms

4. Define profile(s)
   - Align with existing standards:
     - DMTF - System Virtualization, Partitioning and Clustering (SVPC)
     - etc.
Milestones and Status

- **Milestone 1 (OGF 19)**
  - Introduction of the workgroup

- **Milestone 2 (OGF 20)**
  - Terminology definition
  - Collection of use cases
  - Determine relations to other OGF WGs and SDOs

- **Milestone 3 (OGF 21)**
  - Requirements collection
  - Determine relation to other standards
  - First draft of a profile

- **Milestone 4 (OGF 22)**
  - Augmented profile for broader (external) review (e.g. DMTF)

...
Recap: Virtualization Concept

- Virtualization decouples presentation of resources to consumers (applications) from actual resources through a virtualization layer (Hypervisor).
- Several virtual machines (VMs) may run on a single physical host.
- Each VM has its own installed operating system and applications.
Recap: Virtualization Concept

- **Sharing**: Virtual Machine to Virtual Machine
- **Aggregation**: Virtual Machine to Hardware
- **Emulation**: Virtual Machine to Virtual Machine
- **Insulation**: Virtual Machine to Hardware
Recap:
Key Capabilities of Virtualization

• **Creation of virtual systems on-demand**
  • Specify the environment the application / jobs needs to run
  • The environment of the allocating can be pre-configured and persisted as images that can be activated on creation (multiple times if necessary)

• **Dynamic resizing**
  • Change the configuration of virtual system

• **Isolation**
  • Applications / jobs can run isolated from each other

• **Snapshotting**
  • Suspending the virtual system and persisting the state which can be reactivated again

• **Migration**
  • Movement of virtual system among host systems (physical systems)
Recap: Scenario Examples

- „The Grid“ (Job / Execution Managers, Resource Managers etc.) does not only react on the „static“ configuration of the landscape → it may requests to create the proper environment for the applications / jobs

- The job manager may request that the application / job should run isolated because of security policies, to isolate the job malware etc.

- The application / job may require more resources to run → the Grid can dynamically adjust resource allocation (e.g. insulate more memory, CPU capacity, network bandwidth etc.)

- etc.
Recap: Use Cases Overview

**Virtualization use cases**
- Power saving
- Planned maintenance
- Changing capacity requirements
- Changing capacity offering/availability
- Stateful cloning
- Protecting long running jobs from system failures
- Reproducing situations
- Metering of job resource consumption
- Resource consumption enforcement
- Protection against malware
- Ensuring Security
- Avoiding conflicts
- Emulating an environment for legacy jobs

**Virtualization capabilities**
- Live migration
- Dynamic resizing
- Snapshotting
- Isolation
- Provisioning
Recap: Use Cases & Capabilities

System Virtualization

Provision Virtual System(s)
- Create / Discover Image(s)
- Configure Image(s)
- Deploy Virtual System(s)

Manage Virtual System(s)
- Migration
- Dynamic Re-sizing
- Monitoring
- Snapshotting

Decommission Virtual System(s)
OGF Reference Model

Service Level Management

Enterprise

Grid Management Entity

Grid Component

Resources (other GCs)

Accounts / Provisions

Manage

Monitor

Metrics

Consumed

Generates

Reconciles

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OGF Reference Model

Lifecycle of a Grid Component

Unconfigured

Create / Discover

Inactive

Configure

Unconfigure

Active

Start

Stop

Manage

Provision

Decommission

Destroy
Refine Selected Use Cases

Use cases

- **Dynamically changing capacity requirements**
  During runtime the job may require additional capacity (e.g. CPU capacity, Memory capacity, I/O bandwidth etc.).
  If the underlying physical system is able to serve the requirements more capacity for the job / virtual system can be provided locally on the same physical system. If the requirements can be better fulfilled on another physical system the virtual system might be migrated.

- **Dynamically changing capacity offering / availability**
  Capacity availability may change in the physical system (e.g. CPU capacity, Memory capacity, I/O bandwidth etc.) because of recently freed resources by the completed jobs. In these situations available capacity can be utilized for the running jobs.
  Additional resources might become available on another physical systems which can be utilized.

Related virtualization capabilities

- **Dynamic system resizing**
- **Live migration of virtual system during runtime**
Remarks

- Two related use cases have been selected: Dynamic Resizing and Live Migration. Both are about dynamic resource availability and changing environments during the lifetime of an application.

- Any management capabilities and communication with the ComputerSystem should be handled by the GME. The GME needs to be virtualization aware and enabled. The application code should not have any “intelligence” or knowledge to manage dynamic environments. This is in accordance with the OGF Reference Model.

- It might be desired that the application is “virtualization friendly”. The application shall allocate resources only when needed and deallocate them if no longer needed. It shall not assume that any allocated resources are physical and dedicated.

- The Virtualization Platform GME is considered to be an CIM Object Manager, i.e. an implementation of CIM profiles and classes (like CIM_ComputerSystem). It is assumed that the application GME understands CIM to the extent it exploits system capabilities. It directly communicates with the respective CIM Object Manager(s).
Managing Hierarchy

Enterprise

1

Application GME

Policies

Accounting & Billing

1

APPLICATION VIEW

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Datacenter GME

1

Virtualization Platform GME

Policies

Accounting & Billing

1

VIRTUALIZATION VIEW

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Application / Grid Component

MANAGE MONITOR

According to CIM

ComputerSystem

(Virtual System)

Host System

MANAGE MONITOR

SERVER VIEW
Relation to CIM System Virtualization Profile

Application / Grid Component

Uses

Virtual System ComputerSystem

AllocatedFromPool

Virtual CPUs

AllocatedFromPool

Virtual Memory

HostedBy

Host System ComputerSystem

CPUs

CPUs

CPUs

CPU Pool

Mem

Mem

Mem

Memory Pool

CIM System Virtualization Profile
Communication Paths

According to CIM

Enterprise

Datacenter GME

Virtualization Platform GME

Application GME

Application / Grid Component

ComputerSystem (Virtual System)

Host System

No direct communication between Application and Computer System.

Query avail servers
Query avail resources

Notification when resource is changed

Query avail resources
Query capabilities
Change settings
Request resources

VirtualSystemSettingData
VirtualSystemManagementCapabilities
ResourceAllocationSettingData:PROC
ResourceAllocationSettingData:MEM

COMMUNICATION

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Policy Hierarchy

Enterprise

Application

GME

Business Policy
Service Level
- End-to-end response time / overall throughput
- Max/min resource allocation (processor, memory, …)
- Business priority
- Security level
- Availability level

Derived Policy
- Response time / throughput
- Max/min resource allocation (processor, memory, …)
- Relative priority / weight
- Security settings (isolation, encryption)
- Availability settings (HighAvailability, multipathing)
Workload Management

- Enterprise
  - Application GME
    - Business Policy
      - Business priority
    - Derived Policy
      - Relative priority
  - Virtualization Platform GME
  - Datacenter GME
    - Enterprise Workload Manager
  - Local Workload Manager
  - ComputerSystem (Virtual System)
  - Host System

COMMUNICATION

MONITOR
Workload Management
Workstreams

- **Workstream 1:** *High-level Use Cases Description* & Alignment of *Grid Reference Architecture* in the Context of System Virtualization
  - Define the requirements to the grid architecture for integration with system virtualization platforms

- **Workstream 2:** Refine the *Resizing and Migration* Use Case
  - Define Interaction among the components in the architecture to create / discover, configure and start a Virtual System
  - Describe relationship to SVPC Model

- **Workstream 3:** Refine the *Provisioning* Use Case
  - Define Interaction among the components in the architecture to create / discover, configure and start a Virtual System
  - Describe relationship to SVPC Model & OVF (Open Virtual Machine Format)