Managing OVF Applications Under SLA Constraints on Contrail Virtual Execution Platform

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Outline

- Contrail project
- Contrail Virtual Execution Platform
- Service Level Agreements and derived execution environments
Contrail

Open Computing Infrastructures for Elastic Services

Contrail Objectives

- Development of an integrated approach to virtualization offering services for federating IaaS clouds and PaaS services on top of federated clouds

Research Challenges

- Seemless integration of resources from several clouds
- Trusted clouds by advanced SLA management
- Elasticity & dependability of PaaS services
- Scalability of the federation
- Interoperability
- Security
Contrail Federation

Federation = more than a simple broker or portal

Some challenges

- Heterogeneous providers
  - Public, private
- Dynamically choosing best providers
- Combine providers for a single application
- Elasticity: add resources from extra providers
- Migration?
- Security and privacy framework

QoS, QoP

- Service Level Agreements
- Via provider selection and integration
- Enforcement mechanisms at federation level
- Federation as a mediator and a 3rd party
The Contrail Software Stack

Contrail federation

SLA management and enforcement

VEP: Virtual Execution Platform

IaaS
The Contrail Software Stack

Contrail federation

SLA management and enforcement

VEP: Virtual Execution Platform

- VEP sits between the federation and SLA management components and an IaaS provider.
- VEP provides a uniform high level interface to manage Contrail applications on different providers.
- VEP integrates support for SLA enforcement.
- VEP can be exploited as an independent component.

IaaS
**VEP: Virtual Execution Platform**

**Outline**

- Manage lifecycle of distributed applications on a Cloud provider
- Support for Cloud federations (partial deployment)
- Support for heterogeneous IaaS models
- Support (partial) for cloud bursting
- SLA support through Constrained Execution Environments (CEE)
- Support for advance reservations (necessary to guarantee provisioning)
- RESTful API, DMTF CIMI proposition style
VEP applications

- OVF distributed applications
  - OVF: Open Virtualization Format, DMTF standard
  - distributed applications made of virtual machines, disks, networks, shared storage
  - integrate deployment and configuration rules

- Application lifecycle
  - Contextualization
  - Deployment
  - Elasticity
  - Checkpoints (OVF)
  - Support for partial deployment (from federations): deployment documents

- Heterogeneous IaaS models
  - VEP integrated to provider infrastructure (Contrail + OpenNebula)
    - Supports advance reservation
  - Remote exploitation of IaaS Cloud from VEP (Amazon)
OVF applications and Service Level Agreements

Not all users require the same constraints for application execution

- Security / protection
- Data protection
- Performance
- Monitoring

Contrail derives Constrained Execution Environments (CEE) from negotiated SLAs

- VEP applications are executed inside Constrained Execution Environments
- Deploying the application inside a different CEE results in different guarantees about performance, protection, etc.

Note: Contrail VEP is not in charge of reacting to SLA violations
- All monitoring data published on a publish-subscribe bus
CEE: Constrained Execution Environment

- A CEE defines a virtual elastic infrastructure
  - Resource handlers for virtual machines, storage and networks
  - Constraints on allocated resources
    - Location
    - Affinity
    - Protection
    - Performance
  - Monitoring configuration
- User applications are deployed inside CEEs
- A user can have multiple environments

- CEE templates proposed by Cloud providers
- CEE generated from Service Level Agreements (SLA)
  - Contrail: external service for SLA management
OVF application deployment on a CEE

- Physical resource allocation
  - CEE resource handlers define rules for allocating OVF virtual resources
  - Explicit mapping rules from *deployment documents*
  - Default rules

- Deployment document
  - A list of OVF virtual resources to deploy
  - Multiple deployment documents for elasticity management

- Constraint awareness
  - VEP integrates (interacts with) a resource allocator/scheduler
    - Not possible on all providers

- Resource allocation in 2 steps
  1. Pre-deployment of all virtual resources: gather all resource requirements
  2. Allocation of all resources in a single shot
    - Elasticity: allocator aware of already allocated resources
Deployment Documents

Deployment document
- A list of virtual resource to be deployed
  - OVF virtual resource
  - CEE handler
  - Constraints
  - Contextualization data (OVF properties)
- Each new deployment document posted to the CEE adds new resources to the environment

Deployment documents can be submitted
- by the user
- by the federation layer
- by the SLA enforcement system
Snapshots

CEE snapshot

- It is possible to take a snapshot of a CEE with an application running inside
- The CEE snapshot can be re-instantiated later (on the same provider)

Application snapshot

- Links between virtual resources and handlers not maintained in the snapshot
- The application snapshot can be re-instantiated in a different CEE
- All capabilities (elasticity) are maintained

OVF snapshot

- Stopped application snapshots (all data inside disk images) can be exported in OVF format
- The resulting OVF contains
  - The original OVF
  - Deployed items added as extra virtual systems or disks
- Elasticity capabilities maintained
VEP Status

- First release since spring 2012
  - Does not support all VEP capabilities (no CEE)
- Next release planned spring 2013
  - With full CEE support
  - CIMI RESTful API
- Full compliance with CIMI expected
- CEE integrated as an extension to CIMI
Conclusion

Contrail VEP

- Support for cloud federation
- Support for Service Level Agreements
- Support for application elasticity
- Standard OVF applications
- Plugins for different IaaS providers