contrail

open computing infrastructures for elastic services

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

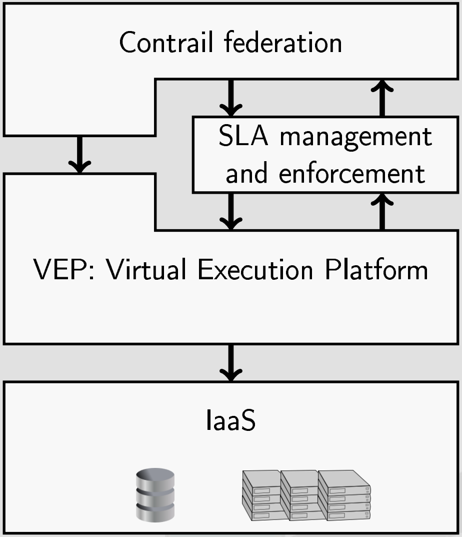
Some challenges

- 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

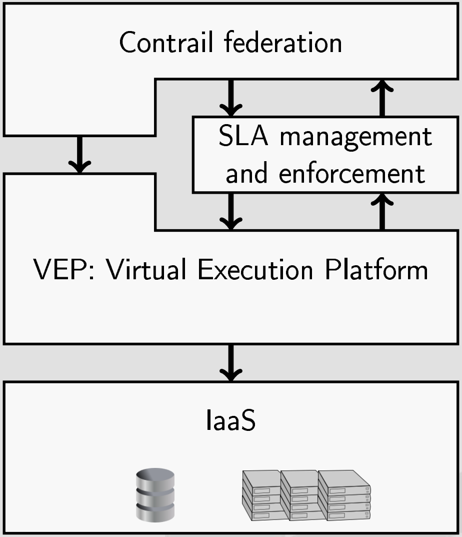
QoS, QoP

- Service Level Agreements
- Via provider selection and integration
- Enforcement mechanisms at federation level
- Federation as a mediator and a 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
IaaS

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

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 Contrained 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

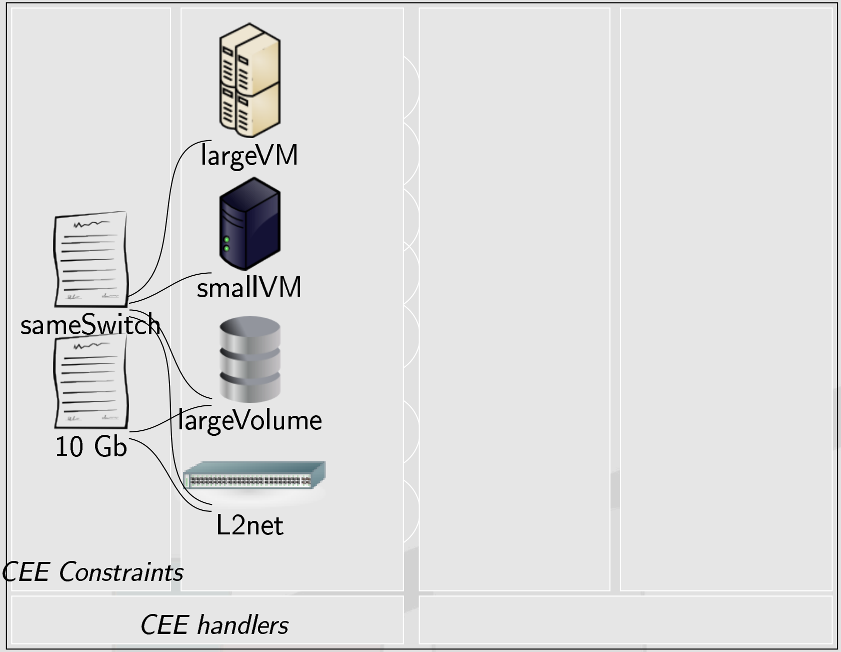
- VEP applications are executed inside Constrained Execution Environments
- Deploying the application inside a different CEE results in different guarantees about performance, protection, etc.

- 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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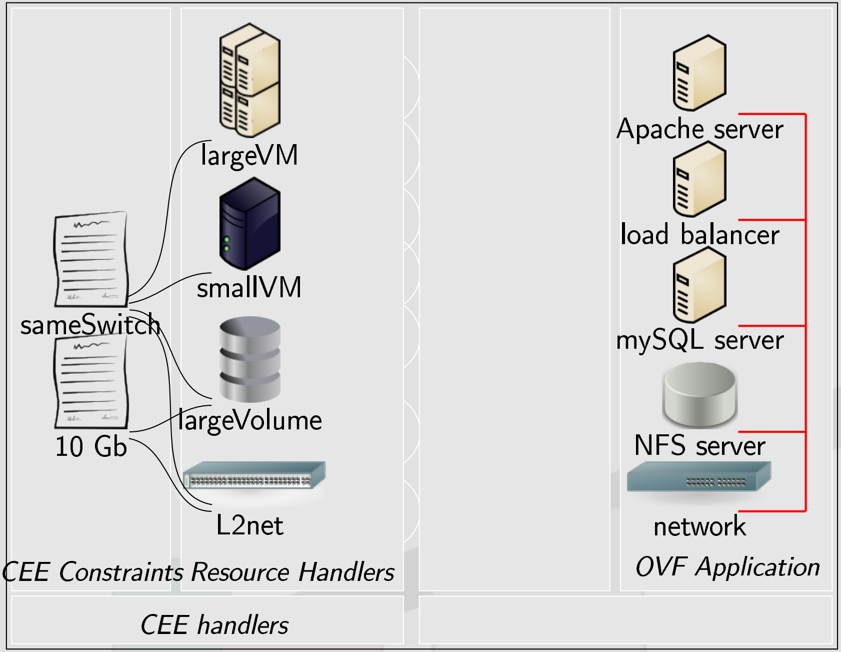
smallVM
sameSwitch
10 Gb
largeVolume
L2net
CEE Constraints
CEE handlers


largeVM
smallVM
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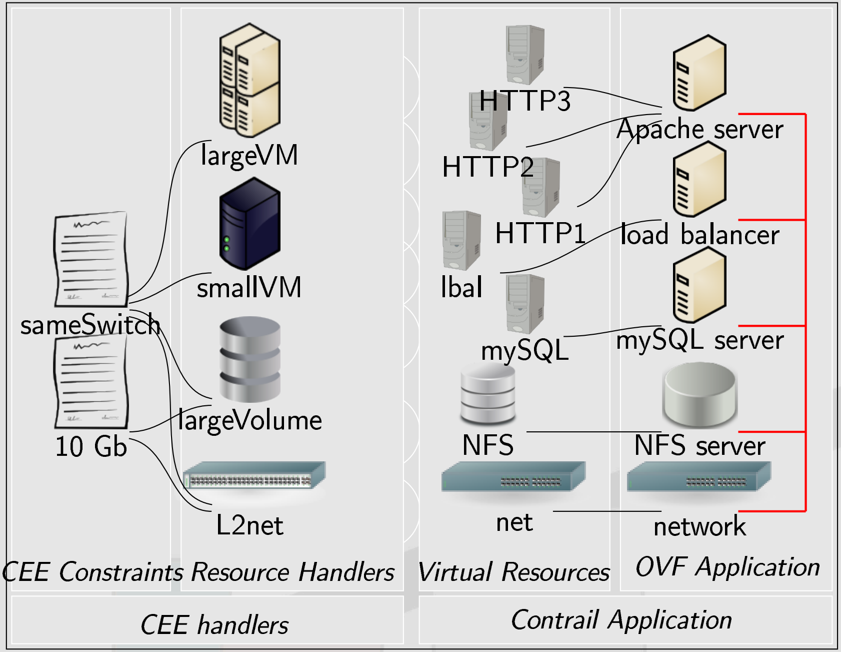
L2net
sameSwitch
10 Gb
CEE Constraints Resource Handlers
Apache server
load balancer
mySQL server
NFS server
network
OVF Application
CEE handlers



largeVM
smallVM
largeVolume
L2net
sameSwitch
10 Gb
HTTP3
HTTP2
HTTP1
lbal
mySQL
NFS
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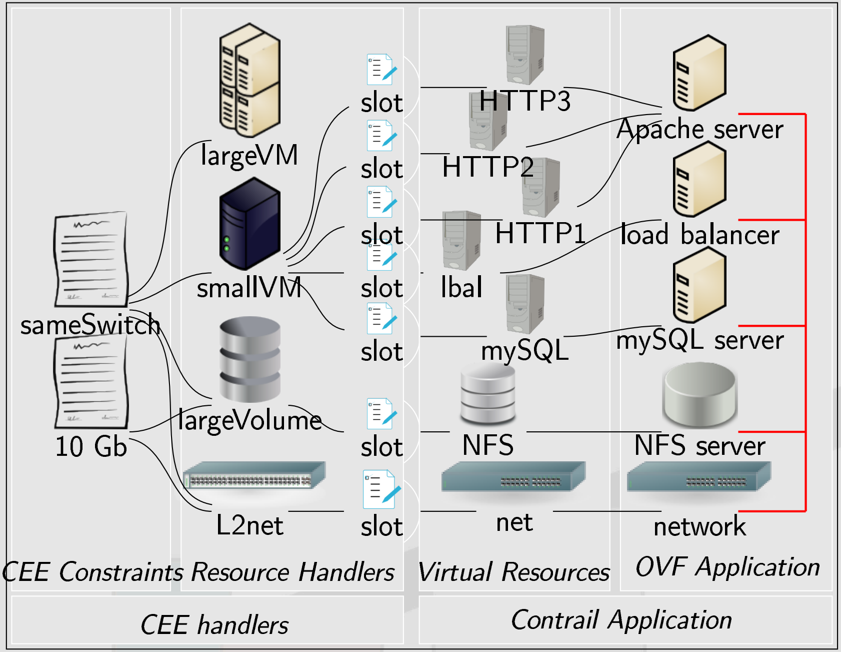
Apache server
load balancer
mySQL server
NFS server
network
CEE Constraints Resource Handlers
Virtual Resources
OVF Application
CEE handlers
Contrail Application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largeVM
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HTTP3
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HTTP1
lbal
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CEE Constraints Resource Handlers
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CEE handlers
Contrail Application

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