Integrated Monitoring Approach for Seamless Service Provisioning in Federated Clouds

Attila Kertész, Gabor Kecskemeti, Marc Oriol, Attila Csaba Marosi, Xavier Franch and Jordi Marco

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Introduction

- Highly dynamic service environments require a novel infrastructure to handle on demand deployment and decommission of service instances.
- **Cloud Computing** allows:
  - Outsourcing these dynamic environments
  - Constructing extensible service-based applications
  - Utilizes the latest achievements of Grid Computing, Service-oriented computing, business-processes and virtualization
- Virtual Appliances encapsulate metadata with a complete system (OS, libraries and applications)
- Infrastructure cloud systems (IaaS) allow to instantiate VA’s on their virtualized resources: Virtual Machines
- Several public and private IaaS systems co-exist
  - Only a “Federated Cloud” could offer the different capabilities as a whole
Federated Cloud Management (FCM)

- An autonomic resource management solution
- Provides an entry point to a cloud federation
- Provides transparent service execution for users
- Following challenges are considered:
  - Varying load of user requests
  - Enabling virtualized management of applications
  - Establishing interoperability and provider selection
  - Minimizing Cloud usage costs
- Builds on *meta-brokering, cloud brokering* and automated *on-demand service deployment*
- Layered architecture
  - Meta-broker
  - Cloud Brokers
  - Cloud infrastructure providers
FCM Architecture: overview

- **Top-level brokering**
- **Autonomously manage the interconnected cloud infrastructures**
- **Forms a federation with the help of Cloud Brokers**
FCM Architecture: overview

- Manages **VA distribution** among the various cloud infrastructures
- Automated federation-wide repository content management
- Offers current VA availability and estimates its future deployment
FCM Architecture: overview

- Interacts with a single IaaS system
- Manages resources
- Schedules service calls
Generic Meta-Broker Service

• BPDL – Broker Property Description Language
  • Cloud Brokers are described

• Basic and aggregated dynamic properties
  • Estimated availability time for a specific VA in the native repository
  • Average VA deployment time

• Scheduling filters and ranks Cloud Brokers
Cloud Broker

- Dynamic requirements may be specified with a service call
- Treated as a new VA type
- Some IaaS systems offer predefined classes of resources
  - Resource class selected with at least the required resources
Cloud Broker: Scheduling of service calls

- The Cloud Broker performs *scheduling* of service calls to resources (VMs)
  - Based on the monitoring information gathered

- May **decide** to start new resources based on:
  - The number of running VM’s to handle the service call
  - The number of waiting service calls in the Service call queue
  - The average execution time of service calls
  - The average deployment time of VA’s
  - SLA constraints

- VM decommission
  - Takes into account the “billing period”
Service monitoring with SALMon

- Service Level Agreement Monitor (SALMon): designed for monitoring QoS of software services
- Capable of passive monitoring and testing purposes
- Supports any type of service technology (SOAP-based WS, RESTful services, etc.)
- It is itself an SBA with two main components:
  - Monitor: retrieves values of quality metrics with the help of Measure Instruments
  - Analyzer: evaluates conditions over these metrics
- It is suitable for monitoring running services in Cloud infrastructures
The SALMon service monitoring framework

- Service user
  - uses
  - << Component >> Proxy Service
  - uses
  - << Component >> Measure Instrument
  - uses
  - << Service >> Monitor
  - Create and Manage
  - << Service >> Analyzer
  - << DSMS >> Data Base
  - Query
  - Insert
  - *
  - Manage
  - << Service >> Authentication and Authorization
  - Check
  - *
  - SOA System
  - Service 1
  - Service 2
  - Service 3
  - Service 4
Integrated Monitoring Approach for Seamless Service Provisioning (IMA4SSP)
IMA4SSP details

• We have integrated SALMon to enable performance-driven service executions in Cloud federations

• Metrics related to service methods may be defined to monitor service operations

• Metric values are regularly refreshed in the Generic Service Registry (GSR) of the architecture

• Finally information stored in the GSR are used by the GMBS for Cloud infrastructure selection based on service reliability
Enhanced monitoring with M3S

- SALMon reports service metrics to a DB regularly checked by the meta-broker.
- The Minimal Metric Monitoring Service (M3S) is used to monitor:
  - Availability;
  - Computing capability;
  - and data transfer reliability.
Mimimizing monitoring costs

• Keeping the monitoring VMs in the Cloud can be costly

• To reduce these costs, the IS Agent component of GMBS has been extended to initiate the deployment and decommission of these VMs

• The monitored metric values have timestamps

• When the retrieved metric value of a service is outdated, the IS Agent contacts the responsible Cloud Broker to initiates a M3S and SALMon VM deployment

• When metric values with new timestamps are read from the registry, the IS Agent contacts the CB again, to decommission the monitoring VMs
Conclusions

- We have designed a Federated Cloud Management solution that acts as an entry point to cloud federations
  - Meta-brokering, cloud brokering and on-demand service deployment
- We have shown how Cloud Brokers manage the number and location of VMs for the various service requests
- We have extended FCM with enhanced monitoring capabilities with the SALMon framework, and created the IMA4SSP architecture
- We have shown a simplified version that uses the M3S reference service to monitor infrastructure reliability
- Our future work targets performance measurements in Cloud federations
Thank You for your attention!

Questions?

https://www.lpds.sztaki.hu/CloudResearch