OPTIMIS: Improving Cloud Management With Dynamic SLAs
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OPTIMIS Project

- IP 5th call
- June 2010 - May 2013
- 13 Partner
  - Atos Origin SAE
  - Umeå University
  - The 451 Group
  - Universität Stuttgart
  - National Technical University of Athens
  - Barcelona Supercomputing Center
  - SAP
  - Fraunhofer Institute for Algorithms and Scientific Computing
  - University of Leeds
  - Leibniz University of Hanover
  - Flexiant
  - British Telecom
  - Arsys

- Total cost: 10.533K€
OPTIMIS Scenarios

Federated Cloud Architecture

Multi-Cloud Architecture (All OPTIMIS)

Multi-Cloud Architecture (some OPTIMIS)

Hybrid cloud – “The third way”

- This scenario is initiated during the operation cycle of the private cloud. When the cloud optimizer triggers that more capacity is needed, some VMs are deployed to public clouds (public infrastructure providers).
SLA use in OPTIMIS

- Provide SLA-aware infrastructure services with extended QoS capabilities
  - SLAs between infrastructure providers and service providers
- Support for self-* and elasticity
- Definition and standardisation of new term languages
  - Trust
  - Risk
  - Eco-efficiency
  - Cost
  - Data security & legal constraints
- SLAs based on Service Manifest of the Service Provider
OPTIMIS SLA Management
Cloud QoS

- **OPTIMIS SLA Management**
  - Standard compliant SLA Management component
  - Full support of the OGF WS-Agreement specification
  - SLA Negotiation supported through WS-Agreement Negotiation
  - Based of the WSAG4J SLA Management Framework developed at Fraunhofer SCAI

- **Functionality of the SLA Management Layer**
  - Mediates between SDO and IP components
  - Negotiates IP services and triggers deployment
  - Basic integration with IP components for service deployment implemented
  - Integration of SLA monitoring planned for year 2

- **Innovations**
  - Support of TREC parameters as part of the SLA
    - Enables self-management and self-optimization operations based on TREC parameters
  - Dynamic SLA creation, monitoring and accounting
    - Rule-based definition of SLA guarantees
  - Dynamic detection of SLA compliance and violations
    - Trigger self-management and self-optimization actions in order to prevent SLA violations
    - Triggers accounting in case of SLA violation
SLA Management
SLA Creation

SLA Validation
- Template based creation of SLAs
- Templates contain restrictions on valid agreement offers
  - Structural restrictions, i.e. which element must be contained in the offer and how often
  - Value restrictions, i.e. what are valid values for specific elements
- Enforcement of offer integrity
  - Constraint validation before service instantiation
  - Protection of IP components

Service Instantiation
- Admission of services done by IP admission control component
- Deployment agreed services initiated by IP cloud optimizer
SLA Management

Monitoring

SLA Monitoring
- Periodical monitoring of deployed services and guarantees
- Guarantee states are computed based on definition in SLA
- Guarantees can specify either an importance or monetary values
- Penalties and rewards with monetary values result in notifications to an accounting system
- Penalties and rewards with an importance result in notifications to the self-management and self-optimization components
SLA Management
Monitoring of SLAs

Static Properties
- Service Description
  - Specify the user requirements on the service provisioning process
  - Can be changed by the user with respect to the agreement creation constraints
- Service Properties
  - Define variables in order to resolve static and dynamic property values
  - Are used to define the service level objectives in SLA guarantees
- Guarantees
  - Specify service level objectives
  - Define self management events and accounting models in form of penalties and rewards

Dynamic Properties
- Service Term States
  - Dynamically generated during SLA monitoring
  - Contain detailed information on the current service delivery
- Guarantee Term States
  - Are automatically evaluated by the SLA management
  - Accounting and Self-management capabilities are triggered based on evaluation results
SLA Negotiation
OPTIMIS Service Manifest

```xml
<opt:ElasticitySection>
  <ws:ServiceDescriptionTerm ws:Name="TREC" ws:ServiceName="MultipleImages">
    <opt:TRECSection>
      <opt:TrustSection>
        <opt:TrustLevel>5</opt:TrustLevel>
      </opt:TrustSection>
      <opt:RiskSection>
        <opt:AvailabilityArray>
          <!-- defines a minimum availability of the VM of 98% at a day -->
          <opt:Availability opt:AssessmentInterval="P1D">98</opt:Availability>
          <!-- defines a minimum availability of the VM of 99% at a month -->
          <opt:Availability opt:AssessmentInterval="P1M">99</opt:Availability>
        </opt:AvailabilityArray>
      </opt:RiskSection>
      <opt:EcoEfficiencySection>
        <opt:LEEDCertification>NotRequired</opt:LEEDCertification>
        <opt:BREEAMCertification>NotRequired</opt:BREEAMCertification>
        <opt:EuCoCCompliant>false</opt:EuCoCCompliant>
        <opt:EnergyStarRating>No</opt:EnergyStarRating>
      </opt:EcoEfficiencySection>
      <opt:CostSection>
        <opt:Price opt:currency="EUR">100.00</opt:Price>
      </opt:CostSection>
    </opt:TRECSection>
  </ws:ServiceDescriptionTerm>
</opt:ElasticitySection>

<opt:EncryptionAlgorithm>AES</opt:EncryptionAlgorithm>

<opt:DataEncryptionLevel/>
</opt:DataProtectionSection>
```
OPTIMIS SLA Negotiation
Service Details Examples (TREC, Elasticity, Data Protection)

- Trust
  - TrustLevel 5

- Risk
  - minimum availability of the VM of 99% at a month

- Eco Efficiency
  - No certification required

- Cost
  - 100.00 Euro (maximum cost)

- Elasticity (jboss instances)
  - 100 users per thread, with a tolerance of 5% (so trigger at more than 105 users, and down again at below 95 users)

- Data Protection
  - Data Protection Level DPA
  - Encryption Algorithm AES