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Motivation & Goal

Service Consumer
- dynamic demand for complex business solutions at low costs

Service Provider
- service economy requires dependable services

Infrastructure Provider
- virtualization technologies allow for adaptive SOIs

Software Provider
- SOAs provide unprecedented flexibility

Flexible usage Business Services

Automated SLA negotiation and management

SLA enforcement via adaptive infrastructures

Engineering of predictable services

Vision of SLA@SOI
A business-ready service-oriented infrastructure empowering the service economy in a flexible and dependable way
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SLA-Aware Resource Management

A business-ready service-oriented infrastructure empowering the service economy in a flexible and dependable way
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Core Innovation

Adaptive SLA-aware infrastructures

• Standardized interfaces for adaptive infrastructures with harmonized access to different virtualization technologies.

• Advanced technologies for SLA enforcement on infrastructure level.

• Efficient resource usage with reliable SLA enforcement at infrastructure level.
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An Overview of Architecture
An Overview of Architecture

Infrastructure Mgmt Service

• Customer facing interface for registration, provisioning, redeployment and management functionalities.

![Diagram of Infrastructure Management Service System Boundary and Internal (Event) Messaging Bus]
An Overview of Architecture

Abstract Infrastructure Framework Model

- Describing required infrastructure resources.
- Accommodating infrastructure constrains defined in higher-level business SLAs.
An Overview of Architecture

Infrastructure SLA Translation

- Converts a provisioning request into an Abstract Infrastructure Framework representation.
- Potentially supports requests in multiple formats.
An Overview of Architecture

Infrastructure Deployment Planner

- Analyses requests and converts them into individual virtual resources requirements and corresponding software images.
- Checks if resources can be provisioned.
- Reserves resources for short duration.
An Overview of Architecture

Infrastructure Negotiation Workflow

- Uses the Infrastructure SLA Translation and Infrastructure Deployment Planner to see if resources can be provisioned.
- The customer may or may not decide to proceed with the provisioning request.
An Overview of Architecture

Provider Mgmt

- A plug-in management system for communicating and controlling resource providers using a consistent abstracted interface.
- Performs provisioning and re-provisioning as required.
Autonomic Mgmt (Optimisation)

- Sends a request to Deployment Planner to perform redeployment pre-emptively based on potential SLA violations identified by the Monitoring component.
An Overview of Architecture

Monitoring

- Receives events from internal or external providers.
- Standardises events and stores in a historical repository.
- Reviews the historical repository, correlates raw events, identifies escalations including potential and actual SLA violations
An Overview of Architecture

Prediction Services

- Predicts actual resources required based on historical and any other information available.
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Infrastructure Landscape

- A representation of all currently running physical and virtual infrastructure resources which are under the control of the Infrastructure Provider.
- Physical and virtual infrastructure resources must be registered here upon activation.
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SLA Negotiation

- Based on WS-Agreement specification
- Infrastructure SLA (iSLA) {Terms, SLOs, Rules}
  - Terms
    - Resource specification, e.g. Virtual Machine
    - Includes functional and non-functional attributes
  - SLOs
    - Metrics to be monitored by Monitoring component.
  - Rules
    - Conditional actions to be taken upon stage change of one or more SLOs.
- iSLAs can be combined to form a request with multiple resource provisioning per agreement.
- Multi-round negotiation
  - Counter-offers.
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Resource Provisioning & Re-Provisioning

Provisioning

- Interact with arbitrary sources of infrastructure resources
  - Internal Provider, e.g. internal physical resources.
  - Remote (External) Provider, e.g. EC2, Flexiscale, etc.

- Harmonized and Abstract interface
  - Technology neutral interface to virtualization technologies.
  - Enables high level services to remain separate from details of underlying technologies that are used in physical infrastructure.

- Provider Management interface
  - To **find** suitable physical resource that satisfy the virtual resource SLA requirements.
  - To **reserve** a virtual resource on a physical resource.
  - To **instantiate** and start the virtual resource.
  - To **stop** the virtual resources.
  - To **re-adjust** or **re-provision** the virtual resources according to the SLA constraints.
Live Migration

• A form of re-provisioning
  ◊ Consolidation of services without affecting customer SLAs.
  ◊ Relocation of virtual machines.

• Research experiments
  ◊ Live migration takes as long as it takes for the memory of the running virtual machine to be transferred from one system to the other.
    • e.g. A virtual Machine with 512MB memory was migrated in approx. 49 seconds over a 100 Mbps network with almost no noticeable impact on the running services inside the virtual machine.
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Monitoring

Multi-layer monitoring architecture

• Layer 0 (Data Collection Layer)
  ◊ Collection of raw input data.
  ◊ Basic filtering and preprocessing of collected information.

• Layer 1 (Event Evaluation Layer)
  ◊ Integration of monitors into a cascade of increasingly more complex monitors, ranging from simple metric checks to composed monitors.

• Layer 2 (Service Layer)
  ◊ Collection of conceptually similar functions of L1 that provides the services used by any service dealing with the infrastructure.
  ◊ Receives inputs from layers below it.
  ◊ Configures and defines the meaning of monitoring events generated in lower layers.
  ◊ Prevents top-level monitors from connecting to L0 and bypassing the L1.
Current Status & Future Work

Current Status

• Preliminary proof of concept prototype was developed.
• It was realised that the core functionality concerning the SLAs of the infrastructure layer could be addressed independently of the core infrastructure of the provisioning layer.
• Decoupling allows high-level SLA modelling, management and negotiation concerns to be processed independently of the low-level infrastructure management components.
Current Status & Future Work

Future Plans

- Separation of SLA management from resource provisioning system. → SLA management system can be used with any sort of provisioning system. e.g. Reservoir/OpenNebula, EC2, etc.
- Supporting storage and networking resources.
- Arbitrary customer groupings.
- Introducing software and service concepts in the infrastructure models.
- Identifying and submitting enhancements to OVF.
- Implementing OCCI interface into prototype provisioning layer.
- Providing SLA management for OCCI providers.
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- [http://www.sla-at-soi.eu](http://www.sla-at-soi.eu)
Thank you!