National Technical University Of Athens Distributed, Knowledge & Media Systems Laboratory

Framework Services for Real-time SOIs

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1. Introduction

We present here a set of framework services, which are the basis of a service oriented infrastructure (SOI), capable for interactive real-time applications with increased QoS requirements. Our challenge is to redesign the Grid middleware services by integrating real-time features in every layer of the architecture. EGEE would benefit from this contribution since new applications will be ported to Grid environment or the existing ones will be enhanced by introducing interactivity and interoperability.

These services will be developed as part of the platform within the IRMOS Project (Interactive Real-time Multimedia Applications on Service Oriented Infrastructures). Although IRMOS results will be independent from applications, they will be validated through the following highly demanding, interactive, real-time applications:

- Digital film postproduction
- Virtual and Augmented reality
- Interactive real-time E-learning.

2. Grid Added Value

In order to guarantee the high QoS requirements of the interactive real-time applications, we designed a set of real-time aware framework services for the Grid middleware that are able to support end to end lifecycle management of the Grid resources. Based on the application requirements analysis, our goals are

- automated SLA negotiation, monitoring and enforcement so as to enable delivery of QoS assurances;
- a sophisticated mapping service which will transform high level parameters to low level QoS parameters;
- specification languages that unify the various parameters and characteristics used to describe real-time applications on SOIs, and allow value chain participants to collaborate in the design, deployment and execution of networks of services;
- specific services within SOIs that support applications with real-time attributes: From event and message driven coordination of networks of services to synchronized interaction between stateful resources.

The aforementioned framework services can be integrated to any SOI that requires real-time functionally since they follow mainly the WS-* specifications.

3. Architecture of Framework Services

The IRMOS platform consists of three main subsystems: the framework services, the execution environment and the network. The role of framework services subsystem is:

- The 'design time' specification, planning and optimisation of a network of services to support the execution of applications that operate as part of extended value chains, and;
- to support the 'run time' lifecycle management of these networks of services, including real-time evaluation and adjustment of how this network of services is configured, utilised and performing.

The components of this subsystem will be exposed as services through well defined interfaces to interact with each other and also with the intelligent networking and the execution environment services. Almost all of the aforementioned platform capabilities are related with this layer.

The framework services are considered as a composition of the services listed below:

- Index Service, which collects and publishes aggregated information about Intelligent Service Oriented Network Infrastructure (ISONI) resources.
- Information Service, which acts as a gateway service in front of the Index service, supporting operations such as creation, update, deletion of registered advertisements.
- Advertisement Service, which is used by the ISONI providers to advertise their ISONIs in the index service.
- Simulation and Planning Services, which provide information needed to dynamically adjust service networks in response to execution-time monitoring and reporting as well as assist the application user in creating an abstract workflow and specifying the QoS related parameters.
- SLA Negotiation Service, which is responsible for interpreting requests for the negotiation of the terms of the application's user SLA contracts and orchestrating the interactions among the services that are involved in the negotiation and reservation process.
- SLA Manager Service, which creates, queries, publishes, and updates SLA and SLA templates.
- Reservation Service, which is in charge of performing advance reservation.
- Workflow Enactor Service, which is in charge of the coordination of the execution of the reserved application resources.
- Discovery Service, which is responsible for finding candidate locations/services.
- Mapping Service, which is responsible for mapping application level requirements to resource level specifications and vice versa.
- Selection Service, which is responsible for sorting the list of candidate resources/services.
- Monitoring Service, mechanism for monitoring the consumption of resources during the execution of the services.

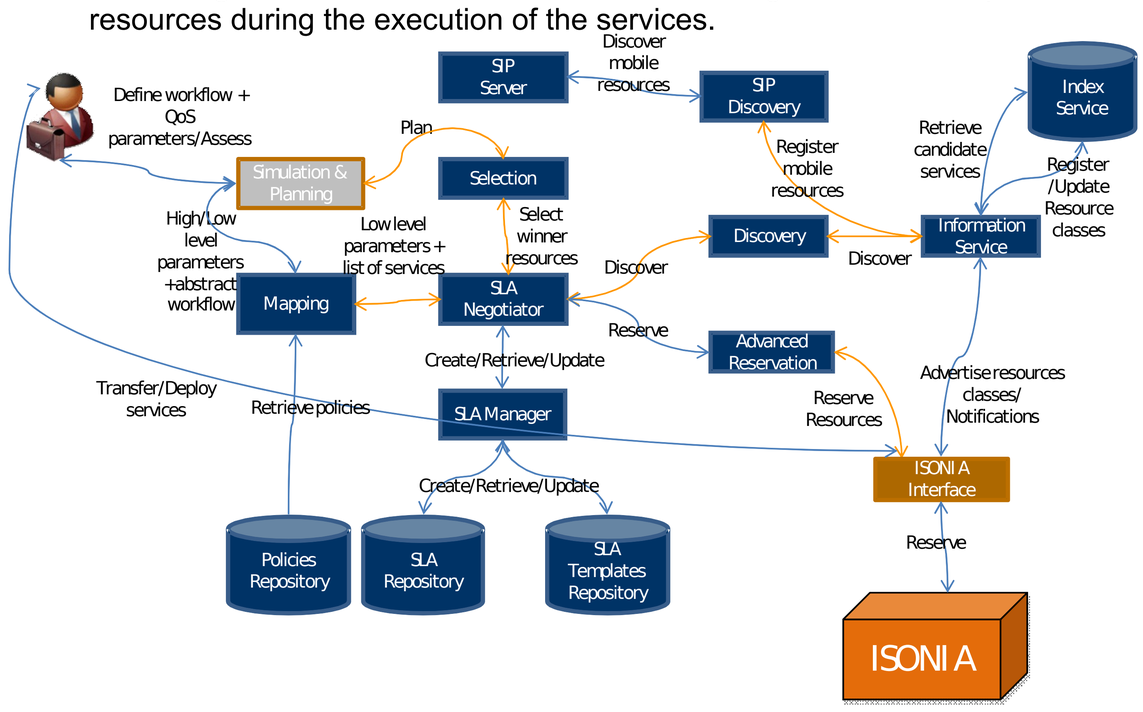

fig. 1: Component Model of Negotiation and Reservation Phase

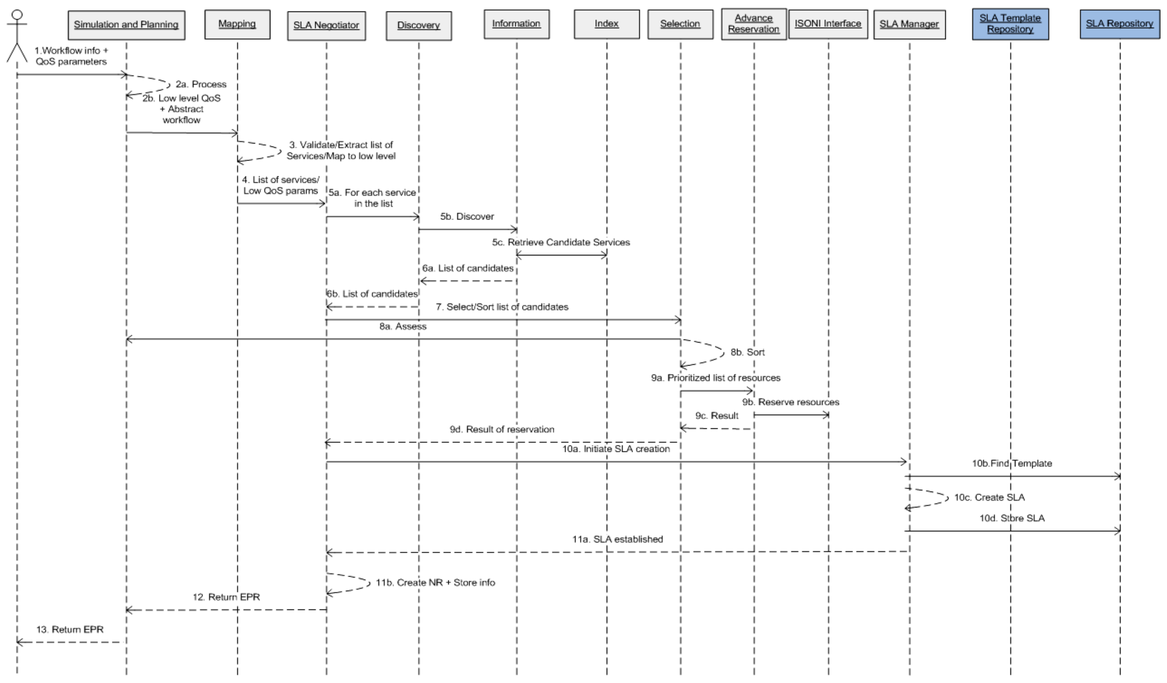

fig. 2: Sequence diagram for the Negotiation and Discovery phase

4. Ongoing and Future Work

The IRMOS project started in February 2008 and the preliminary version of the architecture design has just been completed. Our next steps are to develop the above services by using and extending the state of the art in Grid and SOA technologies while producing innovative solutions.

The research leading to these results has been performed in the context of the project "Interactive Real-time Multimedia Applications on Service Oriented Infrastructures" (IRMOS). The project has received funding from the EC Seventh Framework Programme FP7/2007-2011 under grant agreement n° 214777.