Adaptation of Grid Execution Management Systems for Mobile and Ubiquitous Grid Services

Kleopatra Konstanteli, Antonios Litke, Magdalini Kardara, Konstantinos Lalos and Theodora Varvarigou   E-mail: {kkonst, ali, mkardara, lalosc, dora}@telecom.ntua.gr

Mobile Grid is the inheritor of the current Grid technology and forms the basis for the pervasive computing of the future. Mobile Grids should be able to support mobility and adjust to changes in an effective manner. Therefore to provide efficacious execution management in a mobile Grid environment, the system in charge must be able to support mobility in an efficient and seamless manner and guarantee that the differences in the way mobile and ubiquitous Grid services are handled are transparent to the users. Developed within the Akogrimo Project, EMS can guarantee end-to-end Quality of Service (QoS) while at the same time achieves "mobile awareness" by establishing communication with the mobile network middleware layer of the Akogrimo Infrastructure that builds heavily on the Session Initiation Protocol (SIP). A prototype implementation of EMS has been already developed and the resulting tests quantify its efficacy.
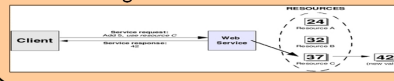
Background Technologies

EMS builds heavily on the Open Grid Services Architecture (OGSA) and Web Service Resource Framework (WSRF) specifications and was developed on the Globus Toolkti 4 (GT4) platform.

OGSA

- Developed by Open Grid Forum (OGF)
- Aims to define a common standard and open architecture for Grid-based systems
- OGSA has defined the most important services:
  - Execution Management Services
  - Data Services
  - Security Services
  - Information Services

WSRF

- Introduces the resource approach to statefulness
- State kept in an entity called *Resource*
- WS + Resource = WS-Resource
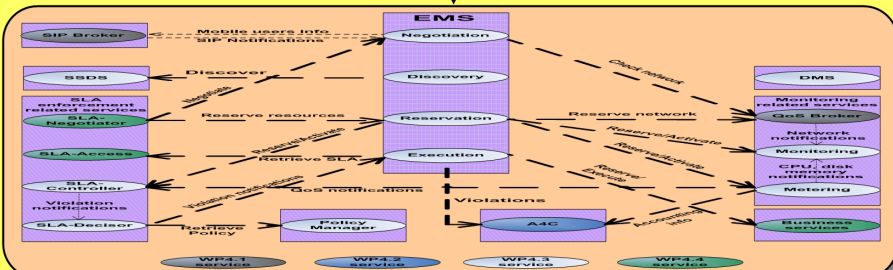- WS-Addressing provides a way of addressing a WS-Resource

GT4

- It is an open source set of software libraries and services for developing Grid applications
- It addresses the issues of resource and data management, information discovery and security

The Akogrimo Grid Layer

EMS exploits the functionalities offered by the Akogrimo Grid Layer services to provide QoS.

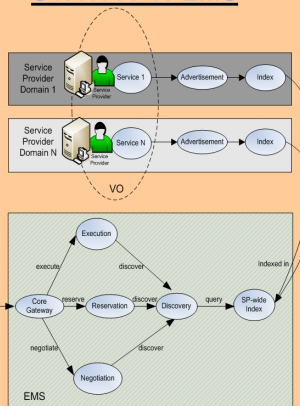### Akogrimo Grid Layer Services

- Execution Management Service
- Data Management Service
- Policy Management Service

- Metering Service
- SLA Enforcement Services
- Monitoring Service

The Execution Management Service (EMS)

EMS is a set of sub-services, with each of them addressing a specific task. From the client's perspective appears to be a single Grid service. EMS interacts with the Akogrimo SIP Infrastructure in order to gather information about mobile Grid services. This information is used vertically through out all EMS actions.
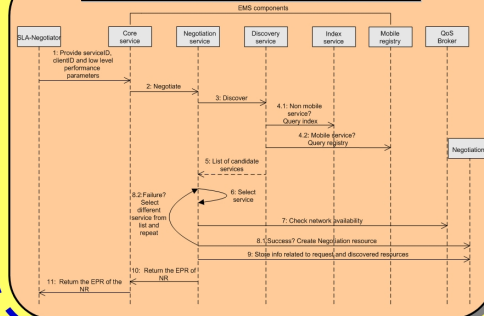
Services of EMS

EMS functionality

Interconnected

Advertisement of Grid services
- **Ubiquitous services**

- **Mobile services**

Negotiation and Discovery Phase

Reservation / Execution phase
- **Reservation phase**
- Service resource reservation: Achieved by creating instance resources of all services involved
- Network resource reservation: EMS contacts the QoS Broker service requesting bandwidth
- **Execution phase**
- EMS starts/manages the execution
- Resources are reallocated in case of change in the location of the mobile services

Conclusions

- ✓ *EMS* is a novel approach for managing execution in a Mobile Grid system

- ✓ *EMS* manages the execution of mobile and ubiquitous Grid services and takes corrective actions in case of failures

- ✓ *EMS* monitors the execution until its completion and guarantees QoS