

# GlobalGridForum

Leading the pervasive adoption of grid computing  
for research and industry

## **Grid Scheduling Architecture – Research Group**

Uwe Schwiegelshohn  
Philipp Wieder

GSA-RG  
14 February, 2006 (GGF16 in Athens)



## GGF Intellectual Property Policy

---

All statements related to the activities of the GGF and addressed to the GGF are subject to all provisions of Appendix B of GFD-C.1, which grants to the GGF and its participants certain licenses and rights in such statements. Such statements include verbal statements in GGF meetings, as well as written and electronic communications made at any time or place, which are addressed to any GGF working group or portion thereof,

Where the GFSG knows of rights, or claimed rights, the GGF secretariat shall attempt to obtain from the claimant of such rights, a written assurance that upon approval by the GFSG of the relevant GGF document, any party will be able to obtain the right to implement, use and distribute the technology or works when implementing, using or distributing technology based upon the specific specification(s) under openly specified, reasonable, non-discriminatory terms. The working group or research group proposing the use of the technology with respect to which the proprietary rights are claimed may assist the GGF secretariat in this effort. The results of this procedure shall not affect advancement of document, except that the GFSG may defer approval where a delay may facilitate the obtaining of such assurances. The results will, however, be recorded by the GGF Secretariat, and made available. The GFSG may also direct that a summary of the results be included in any GFD published containing the specification.

**Sign into  
participants list !**

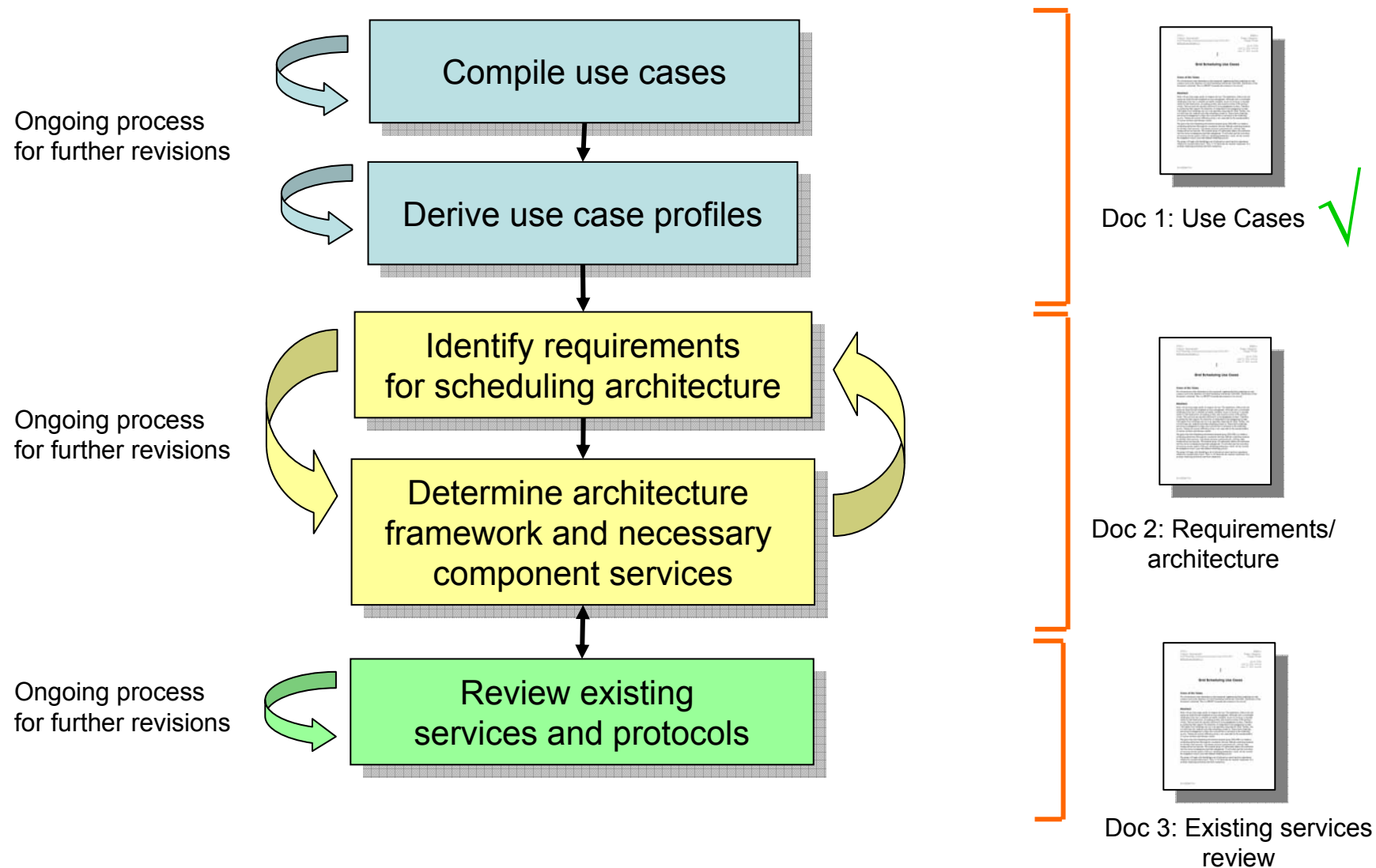


## Session Agenda

---

- Update on group status (10 min)
  - Roadmap
  - Document: Grid Scheduling Use Cases
- Presentations (15 min each)
  - ASKALON
  - VIOLA
  - GridWay
- Grid Scheduling Architecture – Requirements (30 min)
  - Template & requirements example
  - Discussion

# Roadmap





## *Grid Scheduling Use Case Document*

---

- October 2005: Public comment period
- February 2006: Final version (post public comment) sent back to editor
- Input to OGSA-RSS' *Service Description* doc
- Will become a GFD soon
- Many thanks to all the authors!
- Additional use cases are always welcome
  - This document will be updated with future revisions

## Presentations

---

- *Workflow Scheduling in the ASKALON Grid Environment*  
Marek Wieczorek, University of Innsbruck
- *The VIOLA Meta-scheduling Service*  
Wolfgang Ziegler, Fraunhofer SCAI
- *GridWay Scheduling Architecture*  
Ignacio Martín Llorente, Universidad Complutense de Madrid



## *Grid Scheduling Architecture – Requirements Document*

---

- Identifies components & interactions for a modular scheduling architecture
- Introduces terminology
  - *Scheduling instance* and relation between instances
  - What else? – Basic terminology, but no dictionary
- Derives service requirements from use cases
  - Descriptive, no WSDL, protocols, etc.
- Compares requirements with existing solutions

Done

Current  
activity

Description of services & their interaction



## Grid Scheduling Requirements: Template

- Free-form specification of requirements did not work properly -> template
  - helps authors of requirements
  - guarantees comparable level of abstraction
  - delivers also description of terms

|                 |  |          |  |
|-----------------|--|----------|--|
| ID              |  | Category |  |
| Short name      |  |          |  |
| Requirement     |  |          |  |
| Use case(s)     |  |          |  |
| Acting entities |  |          |  |
| Profile(s)      |  |          |  |
| Reason          |  |          |  |
| References      |  |          |  |
| Priority        |  |          |  |
| Constraints     |  |          |  |
| Frequency       |  |          |  |
| Performance     |  |          |  |
| Comments        |  |          |  |
| Author          |  | Version  |  |

- [https://forge.gridforum.org/projects/gsa-rg/document/GSA\\_Requirements\\_Template\\_V0.5/en/1](https://forge.gridforum.org/projects/gsa-rg/document/GSA_Requirements_Template_V0.5/en/1)





## Performance Prediction Requirements Example

|                        |   |                 |            |
|------------------------|---|-----------------|------------|
| <b>ID</b>              | R-PP-F1   | <b>Category</b> | Functional |
| <b>Short name</b>      | Job Execution Times Prediction  |                 |            |
| <b>Requirement</b>     | A performance prediction system must provide a prediction of job execution times                        |                 |            |
| <b>Use case(s)</b>     | K-Grid  |                 |            |
| <b>Acting entities</b> | Grid Scheduling Instance, Scheduling Access Client  |                 |            |
| <b>Profile(s)</b>      | Single-site execution with service guarantees, job execution with advance reservation, complex workflow |                 |            |
| <b>Reason</b>          | This knowledge is essential for accurate scheduling and service guarantees                              |                 |            |
| <b>References</b>      |   |                 |            |
| <b>Priority</b>        | Critical  |                 |            |
| <b>Constraints</b>     |   |                 |            |
| <b>Frequency</b>       | For each submitted job; may be very frequent  |                 |            |
| <b>Performance</b>     | Response must be very quick to avoid slowing down a whole scheduling process                            |                 |            |
| <b>Comments</b>        |   |                 |            |
| <b>Author</b>          | AO  | <b>Version</b>  | 1.2        |



## Grid Scheduling Requirements: Current List

---

- Information Service (IS)
- Job/Workflow/Requirement Description (JD)
- Resource Discovery (RD)
- Reservation Management/Agreement and Negotiation (RM)
- Accounting and Billing (AB)
- Job Management (JM)
- Job and Resource Monitoring (MO)
- Data Management (DM)
- Network Management (NM)
- Performance Prediction (PP)

## Requirements Discussion

---

Major questions to be answered:

- Do the present use cases cover all requirements?
  - If no please fill the gap by providing additional use cases
- Does the template satisfy our needs?
  - Are all necessary terms included?
  - Has it the appropriate scope and abstraction level?
  - ...
- Who is going to help specifying the requirements?



## Next Steps

---

- Requirements document
  - Complete document sections for required services and elaborate on interaction of services
  - 1st complete version for GGF17
  - Actually planned for GGF16, but template discussion slowed down the process
- Next step will be the review of existing services
  - Existing Grids, OGSA, ...
  - Use GGF17 for discussion
  - Compile first contributions for GGF18
- If you want to participate in the work you are invited to subscribe to the mailing list: [gsa-rg@gridforum.org](mailto:gsa-rg@gridforum.org)



## Appendix

---

## Presentation abstract I

---

### *Workflow Scheduling in the ASKALON Grid Environment*

by Marek Wieczorek, University of Innsbruck

The ASKALON Grid environment is a full Grid environment designed to compose and execute scientific workflow applications. The ASKALON scheduler is a dynamic scheduling service using different optimization techniques to maximize the user's profit in accessing the Grid. Pluggable architecture of the scheduler enables the user to apply different workflow scheduling algorithms, to apply advance reservations, and to consider different optimization criteria, among them execution time and economic cost. Acting as a part of a full Grid environment, the scheduler interacts with other components of the ASKALON, namely with the resource management, the enactment engine, the performance prediction and the monitoring services, trying to make scheduling decisions based on the most reliable and up-to-date information. Our goals are to make the service SLA-aware and to extend it in the directions recommended by the GGF community. Besides the functionality of ASKALON scheduler we will also reflect general requirements for a Grid scheduler.

## Presentation abstract II

---

### *The VIOLA Meta-scheduling Service*

Wolfgang Ziegler, Fraunhofer SCAI

Distributed applications or workflows usually require different specialised resources like compute nodes, visualisation devices, storage devices, or network connectivity with a defined QoS at the same time or within a given period of time to be executed successfully. Orchestrating such resources on a local level within one organisation is only a minor organisational problem. Orchestration of resources on a Grid level requires a service that is able to solve the same problems in an environment that probably stretches across several administrative domains. Additional conditions have to be taken into account, like site autonomy and different site policies.

In this talk we first describe the environment where co-allocation of resources is of vital importance, the requirements for the MetaScheduling service that provides the required co-allocation means, and related work. In the next step we characterise the functionality of the MetaScheduling service, followed by the description of the current implementation. As a use case we show the integration of the scheduling system into the UNICORE Grid middleware and finally we present a new project based on this work that started end of 2005.



## Presentation abstract III

---

### *GridWay Scheduling Architecture*

Ignacio Martín Llorente, Universidad Complutense de Madrid

GridWay, on top of Globus services, enables large-scale, secure and reliable sharing of computing resources (clusters, computing farms, servers, supercomputers...), managed by different resource management systems (PBS, SGE, LSF, Condor...), within a single organization (enterprise grid) or scattered across several administrative domains (partner or supply-chain grid). GridWay is an open source meta-scheduling technology that performs job execution management and resource brokering, allowing unattended, reliable, and efficient execution of jobs, array jobs, or complex jobs on heterogeneous and dynamic Grids. GridWay performs all the job scheduling and submission steps transparently to the end user and adapts job execution to changing Grid conditions by providing fault recovery mechanisms, dynamic scheduling, migration on-request and opportunistic migration. The presentation describes the scheduling requirements for partner grid computing, the functionality provided by GridWay to meet those requirements, the GridWay scheduling architecture and finally its requirements on core Grid services for the implementation of such functionality.