TG3 – Service Composition, SLA Usage and Workflow

Overview – Objectives, Research Topics, Involved Projects, Achievements

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TG3 Objectives

• Facilitate **knowledge, experience and results** sharing
  ▪ among EU funded research projects through
  ▪ surveying the current project’s **state of the art** in terms of
    ▪ Innovations and approaches (technical and methodological)
    ▪ Achieved results (and their potential reusability)
  ▪ Promotion of project **cooperations & collaborations**
    ▪ Common experience/comparison papers
    ▪ Common developments

• Help in identifying **future research challenges** in the targeted domain
Identified Research Topics

- Modelling of workflows
- Automatic service composition
- Dynamic change of workflows and processes
- Optimization of processes for resource selection and service composition
- Verification and validation of models
- Integration and Interoperability
- Monitoring and Controlling to support SLA mangt
- Self-* Services
- SLA Negotiation and Quality of Service
- Semantic Technologies implication
- Provenance

Detailed descriptions are provided in the Whitepaper!
Major Achievements

• 14 Contributing projects
  ▪ ArguGRID, AssessGrid, A-ware, BEinGrid, BREIN, BRIDGE, CATNETs, NextGrid, Plastic, SECSE, SIMDAT, SORMA, WS-Diamond, g-Eclipse

• TG3 Wiki
  ▪ Meeting Mintes and other information
  ▪ Register at
    • http://wiki.cs.cf.ac.uk/twiki/bin/view/TWiki/TWikiRegistration

• White paper
  ▪ Title: “White Paper on State of the Art and Planned Developments in the context of FP6 Grid Projects” (living document)
  ▪ available at
    • http://wiki.cs.cf.ac.uk/twiki/bin/view/Sandbox/WhitePaper
## Collaboration Matrix

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Collaboration Matrix

• Why the matrix?
  ▪ Help projects to identify which other projects are working on the same issue
  ▪ Facilitate project commitment in collaboration
  • Each project is involved in at least two topics core for them together with at least two other projects
• Identify overlaps and potential gaps!
  - In the next 30 minutes 😊
  - Start discussion with other WGs and projects (e.g. Monitoring)
  - Proposal: Use the collaboration matrix
Thank you!

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Identified Research Issues
Analysis and Assessment

Detailed Descriptions
Research Topics analysis

- Modelling of workflow
  - Research is needed to make the modelling of a workflow easier to design, configure, and deploy applications, in particular for large scale, multi organizational, distributed environments. There is the lack of a well-established workflow description language that is suitable for describing workflows on a high level and at the same time efficiently usable in different application areas, such as those related to the science and engineering domains. Indeed, application areas in science and engineering usually have their own established methodologies for solving domain specific problems and require their own specialised set of tools. This is clearly conflicting with the desirable requirement of having a workflow language conform to current (and proposed) standards for interoperability. This research issue, in turn, involves challenges related to verification, optimization, execution, and dynamic change of the models.
Research Topics analysis

- **Automatic services composition**
  - Missing description
• **Dynamic change of workflow**
  
  There is the need to be able to deal with dynamically changing workflow processes. This consists of supporting dynamic change to the process model to include one or more new execution paths, i.e., migrating cases from an old to a new workflow. The execution and reliability of a composite service can take advantage of the underlying grid technology in identifying the available and most suitable grid service instances to invoke in order to meet the new workflow. However, this form of self-adaptation and its implications, clearly, need to be further and carefully investigated.
Research Topics Analysis

- **Optimization of processes for resource selection and service composition**
  - Due to the dynamic and heterogeneous nature of the Service oriented and Grid based Infrastructure, the optimized selection of resources and services is not easy. Indeed, optimized resource selection should allow to discover on the fly: i) the most suitable resources on which Task /Job can be deployed and service instantiated, and ii) component services that can be orchestrated for delivering the composed workflow process. However, this is not always possible, because the selection should rely on advanced resource monitoring capabilities and performance analysis of workflows and should be based on QoS criteria that often are not available. Moreover, it should be taken into account that resources and services can be available/unavailable at runtime and at a particular point in time. Hence, optimization and/or failure handling strategies commonly adopted in static environments might not be optimal. Therefore, this is another important problem, closely related to robustness, availability, and reliability issues, that must be considered.
• **Verification and validation of models**
  - The combination of several services into a coherent process requires to identify correctness criteria allowing to assess when the processes is correct. These criteria have to take into account that processes are composed of building blocks and are often composed of long running activities operating in a highly dynamic environment. Failure handling strategies are directly affected by the activities of verification of the models. For example, in cross organizational workflows some changes, that are reasonable from the point of view of a single organizational unit, may be in conflict with superior process goals. Therefore, research effort is needed to ensure the correctness of a workflow process and to verify it in a (semi)-automatic way.
• **Integration and Interoperability**
  
  - When interfacing the workflow services with external applications a fully interoperable solution keeps applications completely autonomous and exchanges the minimum amount of data. This requires information integration, which handles the context, ontology, and interpretation of data. Methodologies for the integration and the interoperability of data and applications make possible the reuse of legacy systems, allowing to preserve past investments. Research is needed to investigate and analyze these methodologies and the opportunities that these can offer.
• Monitoring and Controlling to support SLA mangt

- Some processes are intrinsically continuous and, usually, cannot be stopped without problems. In these cases, but also in general the suitability is clear, there is the need of monitoring performance with customizable metrics and then using the monitored data as input in the process to automatically alter the definition of execution of the processes (e.g. work balancing). The loop from the monitoring to the definition or execution phase rarely exists in the current systems. Hence, in addition to the monitoring research issues, methods and implementations for coupling monitoring phase with definition and executing phase should be further investigated.
Research Topics Analysis

- **Self-* services**
  - The vision of self-managed applications is being proposed in autonomic computing to support self-managing computing systems, where system components are self-configuring, self-optimizing, self-healing, and self-protecting. Autonomic computing applied to business processes based on Web services is emerging as a new research area. The result is the development of flexible and adaptive business processes based on the service oriented approach. Flexibility is the capability of changing process behaviour dynamically according to variable execution contexts; adaptivity is the capability of executing a service even when the execution conditions are not exactly the ones assumed during the initial design of that service, and the executed service might offer limited functionalities.
Research Topics Analysis

- **SLA Negotiation and Quality of Service**
  - Applications require flexible and efficient negotiation mechanisms supporting various ways and different levels of QoS guarantees. The interactions between grid services are currently limited to simple request-response exchanges. However, in the longer term we believe this is unsustainable. More complex protocols for web service interactions are necessary if the participants are to tailor their needs and offers to the prevailing context and they are to coordinate multiple services in open and realistic environments. In particular, simple exchanges are unsuitable for coordinating transactions between multiple web services because of the explosion in the amount of communication. Advanced transactional systems where participants continuously tailor their needs and offers are also beyond the scope of request-response messages because of the absence of negotiations. These QoS issues include also reliability concerns. In particular, fault tolerance is an important property in Grid environments, because the availability of individual Grid resources may not be guaranteed. Usually, QoS is specified in the form of SLA, but currently the most of resource management systems of Grid middleware do not very well support QoS and SLA negotiation. It seems reasonable that QoS guarantees have to be attached to individual constituent services in order to derive the quality of the overall composite workflow. So cost models and runtime information on the resources has to be investigated. Therefore, research is needed to determine efficient and effective ways in which negotiations and QoS aspects can be faceted. Clearly, negotiation and QoS facets involve also issues related to the choice of the of more suitable contract type, policy and strategy to adopt, and support for interoperability.
Research Topics Analysis

- **Semantic Technologies implication**
  - In the context of enterprise wide and cross enterprise workflows, semantic technologies have a special relevance and importance. Adequate semantic descriptions of resources and workflows, general purpose as well as specialized for a number of different application domains, enable a lot of value-added characteristics and potentially affect all interoperability issues. Ontologies for the description in a formal and explicit way of Grid services make as automatic as possible the intelligent discovery of resources and services on the fly. The semantic representation of both functional and non-functional attributes of each service and workflow, together with inference rules, allows the (semi)-automatic composition and substitution of single services, or whole processes, within a workflow, thus enabling the exploitation of semantically equivalent, potentially more efficient composition of services and processes. There is a need for extensive work in this research area, in particular to support the design and deployment of ontologies. At the same time, tools and methodologies need to be developed so that emerging metadata and ontologies can be successfully and extensively applied.
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Meeting Minutes,

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main issues discussed

Number of Participants: <35>
23 projects represented:

Edutain@grid, SIMDAT, AssessGrid, HPC4U, RODIN, g-Eclipse, Chemomentum, BeInGrid, GridEcon, GREDIA, DEGREE, Ws-Diamond, A-Ware, CATNETs, SORMA, Grid4All, SELF, NEXGRID, Brein, ArguGrid, BRIDGE, GridTrust, SECSE

- Points debated
  - Settle the previous workshop results
  - Use of the WiKi for sharing knowledge
  - Review of the Research topics and settle the Projects’ responsibility
  - Projects collaboration and related patterns
    - Jointly papers
    - Software components reuse
  - Next Steps
    - Regularly update of the White Paper (it is a live document)
      - http://wiki.cs.cf.ac.uk/twiki/bin/view/Sandbox/WhitePaper
    - Meet in St. Augustin in March 2008
main issues discussed

• Achievements
  ▪ The research topics are confirmed
    • Provenance added as new research topic
  ▪ Identified the project collaboration topics
    • Each project will put on the WiKi their proposal

• At the next meeting will be presented the details about collaboration output
  ▪ Share knowledge through the WiKi
• Decision 1
  - All the projects update their White Paper sections on the Wiki

• Decision 2
  - Research topics description will be updated by the responsible projects according to the matrix
    - First collaboration step 😊

• Decision 3
  - At the next meeting have to be provided the details about project collaborations

• Next Meeting
  - In conjunction with the workshops is St. Augustin
• Liveliness/interest of the discussions in the working group
  ▪ Successful meeting held last 23 and 24 July – 16 project represented 3 from software area
  ▪ Involved projects are committed

• Critical mass of contributions to this topic & potentials for expansion
  ▪ 2 more projects (Chemomentum and DEGREE) joint the group and confirmed their commitment
  ▪ We are looking to extend the Software area project participation

• Future developments of this working group regarding collaboration
  ▪ For each research topic a pair of project has been identified
  ▪ All the project are committed to provide on the WiKi their collaboration proposal
  ▪ Next six month will be used for setting the collaboration context – results presented at the next meeting
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- Self-* Services
- SLA Negotiation and Quality of Service
- Semantic Technologies implication
- Provenance (new)