Interoperability of Virtual Organizations on Complex Semantic Grid

InteliGrid project: lessons learned and future work

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InteliGrid overview
  - vision and context
  - architecture
  - results

Lessons learned and future work
  - grid technology
  - semantic technologies
  - technology adoption: push vs. pull
  - business models

Conclusions
Construction process is fragmented

Operation 70%

Design 6%

Construction 20%

Disposal 4%


Source:
Relative influence level of a decision

Source:
PM4D Final Report, CIFE Technical Report Number 143,
Martin Fischer and Calvin Kam, October 2002
Islands of automation

Buildig Information Model (BIM)

- Addresses the following core assumptions about the building process:
  - Design evolves from the “fuzzy” to the specific.
  - Design is an iterative process.
  - Multiple design variations are created in the early phases of a project.
  - Architects do not want limitations either in the form or the size of the design.
  - Architects would like to spend more time designing and less time documenting.
  - Communication is an essential component of the design process.

- Is supported by many software vendors
  - Interoperability issues
SMART integration...

2D Plan Transformation into IFC via Converter

3D model-based CAD + Facility Management

Electrical engineering

Ventilation design

Collision checking

Heating design

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... enables SMART actions ...
... and different use cases.
InteliGrid context

- European large scale engineering industries
- huge number of experts
- a wide range of software and hardware resources
- dynamic virtual organization
- secure information sharing

Engineering domains

- construction
- automotive
- shipbuilding
- ...

InteliGrid is providing information infrastructure
InteliGrid technologies

Virtual organization
- Dynamic collaboration
- Worldwide marketplace
- The source network
- Fast changing requirements

Semantic interoperability
- Common conceptualization
- Computers understanding
- Meaningful objects
- IT and AEC ontologies

Grid technology
- Resource sharing
- High performance comp.
- Pervasive computing
- Distributed computing
Generic end-user scenario

- users have prescribed roles
- role based authentication
- simple but maintain high level of security

- end-users leave VO
- unshared resources are removed from VO

- new actions or processes can be triggered based on new information

- new information needs to be shared with other actors in VO
- local data annotated and shared with VO

- fine grained role-based access policy for all VO resources
- use semantic query to find objects

- tools usually known in advance
- VO defined explicit and implicit rules what tools can be used

- offline end user applications are often used
- data needs to be available locally
Semantic grid architecture
InteliGrid results

- Semantic grid architecture
- Ontology framework

Diagram:

- Semantic grid architecture
- Ontology framework

```
Product/Process Model
  \- Business Process Ontology
    \- Organisational Ontology
      \- Service Ontology
        \- Resource Ontology
          \- Semantic Specs
            \- Organisational Ontology
              \- User/Role Authorisations
                \- Service Ontology
                  \- Services
                    \- System Resources
                      \- WSRF Services
                        \- Distributed run-time environment
                          \- Ontology-Based Virtual User Desktop
                            \- run on
                              \- grid
```

semantic grid architecture
ontology framework
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**Service**
- OGSA-DAI extensions: WebDAV, PMD, security
- Open DRMAA Service Provider
- Ontology services: gridspace, VO, services, resources, business process objects
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  - Ontology management
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more at www.InteliGrid.com
Lessons learned

- Technology
  - Combining multiple cutting edge technologies
  - Stability / standardisation
  - Service-oriented architecture
  - Ontologies
  - Interoperability on data level
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- **Generation of knowledge**
  -Multiple technology domains
  -End-users involved in technology/system development
  -End-user understanding and acceptance
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Realization lessons, exploitation, end-user acceptance
- Collaboration infrastructures
- Plug-and-play environment
- Registration of resources
- Pushing technology
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Requirements: “5S Grid”

- **security**
  - industry eager to move to a ground-up secure environment

- **simplicity**
  - must work seamlessly with current client applications and operating systems

- **stability & standards**
  - a need for stable long-term specifications

- **scalable service orientation**
  - well accepted and known

- **semantics**
  - must support rich, domain specific semantics
Problems: “5S Grid”

- **security**
  - dynamic security polices, legal issues

- **simplicity**
  - SME companies, many without IT departments, push vs. pull

- **stability & standards**
  - WS vs. Grid services, interoperability

- **scalable service orientation**
  - see above

- **semantics**
  - standardisation of domain specific ontologies, taxonomies, classifications, ...
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