Interoperability of Virtual Organizations on Complex Semantic Grid

www.InteliGrid.com

InteliGrid Project:
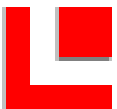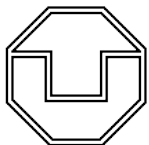# A Vision of Engineering on the Grid

M. Dolenc, Ž. Turk, V. Stankovski

mdolenc@itc.fgg.uni-lj.si

University of Ljubljana
Faculty of Civil and Geodetic Engineering
Institute of Civil Engineering, Earthquake Engineering and Construction IT
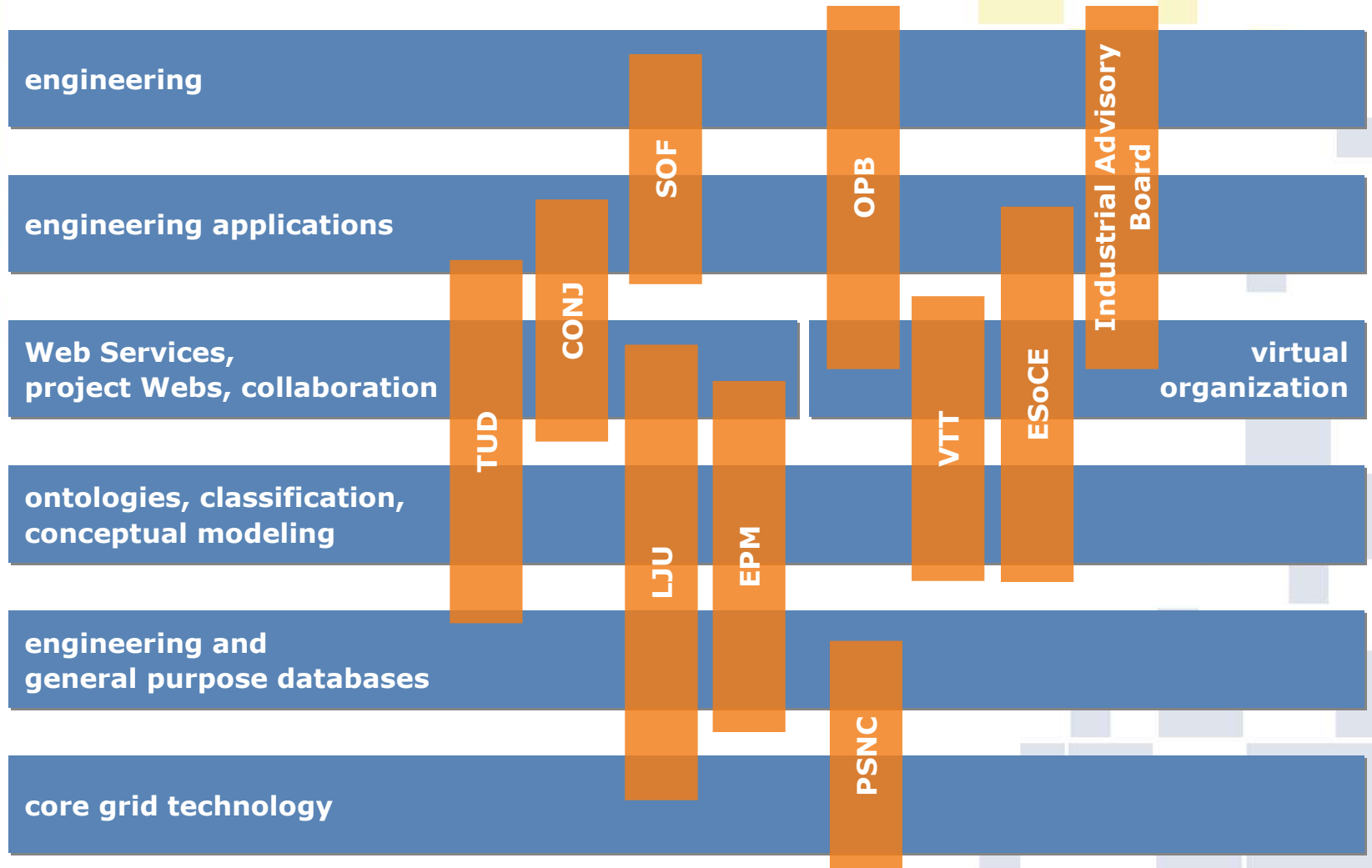*Chair of Construction Informatics*

www.InteliGrid.com

> Sept 2004 – Feb 2007 (30 months)

> Effort 360 person months

> EU funding 2.100.000 € (STREP)

> Partners 9 (5 industries) / 6 countries

  – Research/academic organisations

  – Infrastructure software providers

  – Vertical software providers and ASPs

  – Industrial associations

  – Characteristic user

Partners expertise

engineering

engineering applications

Web Services,
project Webs, collaboration

ontologies, classification,
conceptual modeling

engineering and
general purpose databases

core grid technology

virtual
organization

SOF

CONJ

OPB

Industrial Advisory Board

TUD

VTT

ESoCE

LJU

EPM

PSNC

www.InteliGrid.com

> *Grid promise:*
> Grid concept is coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations … (Ian Foster, The anatomy of the grid)

> *Grid reality:*
> high performance computing, static virtual organisations

> What are the real problems outside of high science?

www.InteliGrid.com
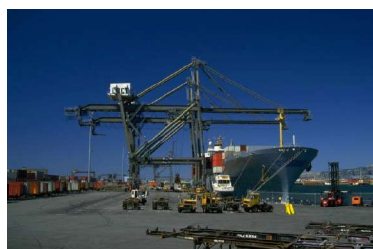
> InteliGrid promise:

... to provide industries with challenging integration and interoperability needs a flexible, secure, robust, ambient accessible, interoperable, pay-per-demand access to information, communication and processing infrastructure

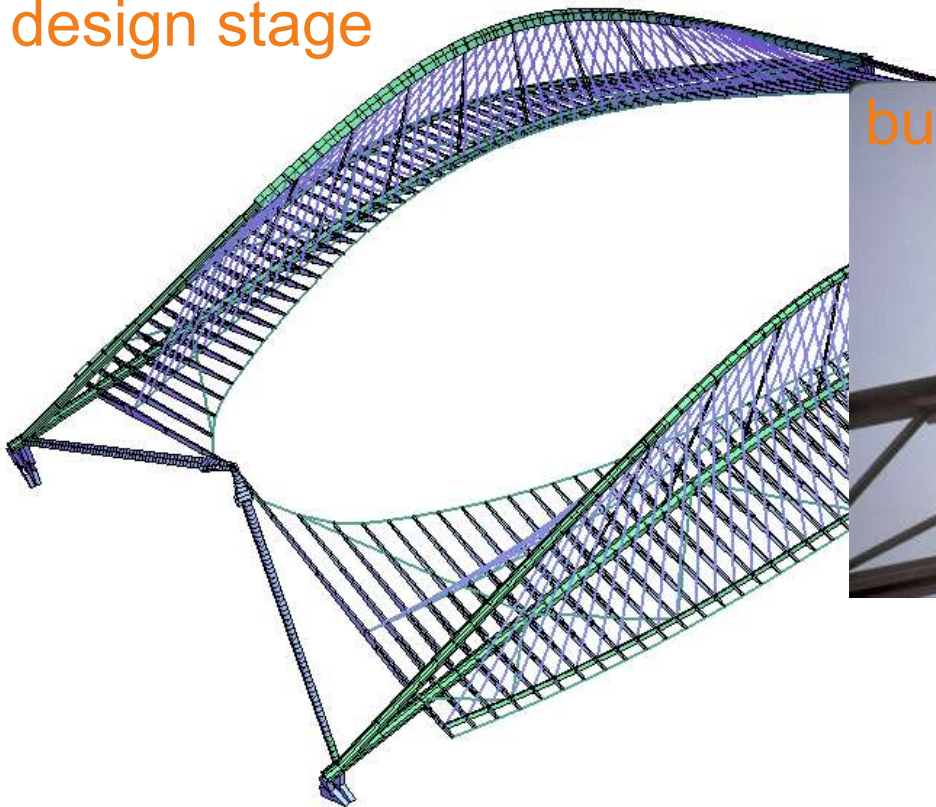> The hypothesis: Grid technology has the potential to provide such infrastructure.

www.InteliGrid.com

design stage

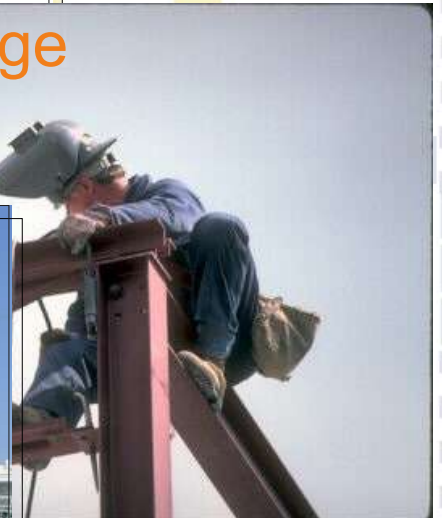www.InteliGrid.com

design stage

building stage

www.InteliGrid.com
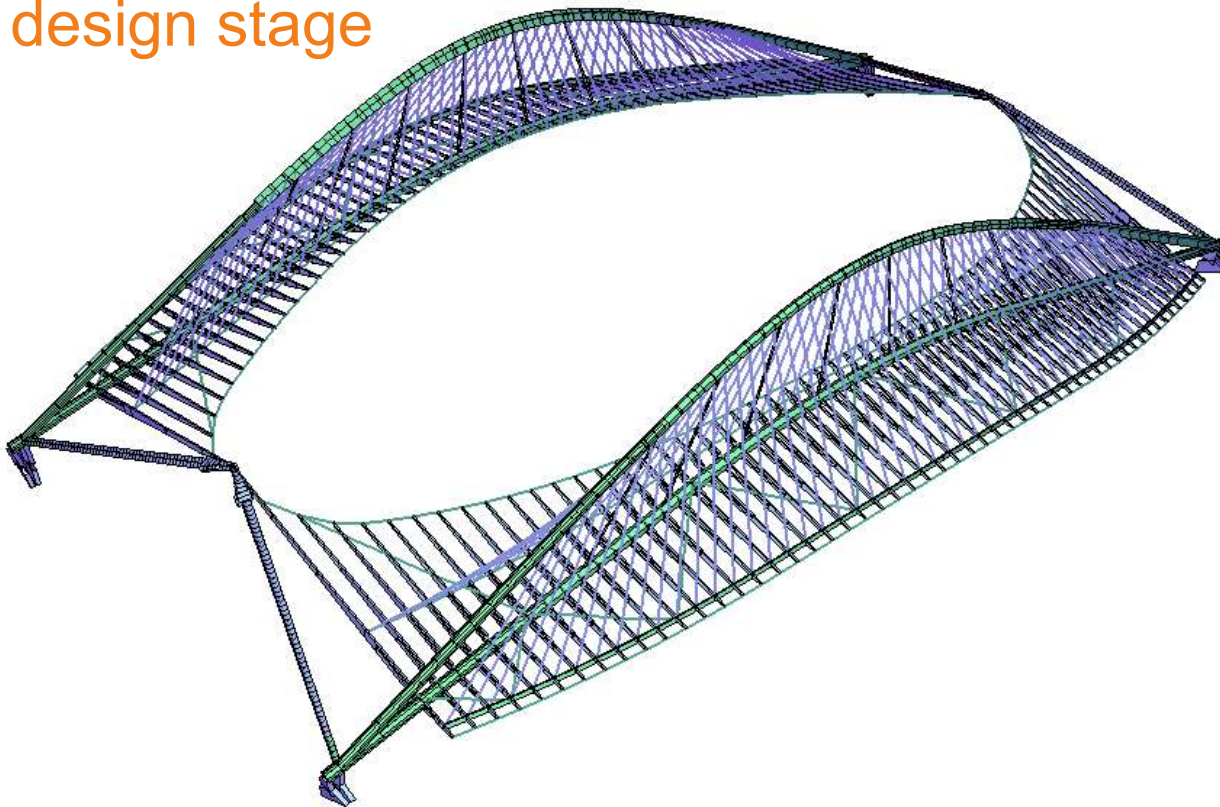
design stage

building stage

operation stage

10 / 90% rule

www.InteliGrid.com
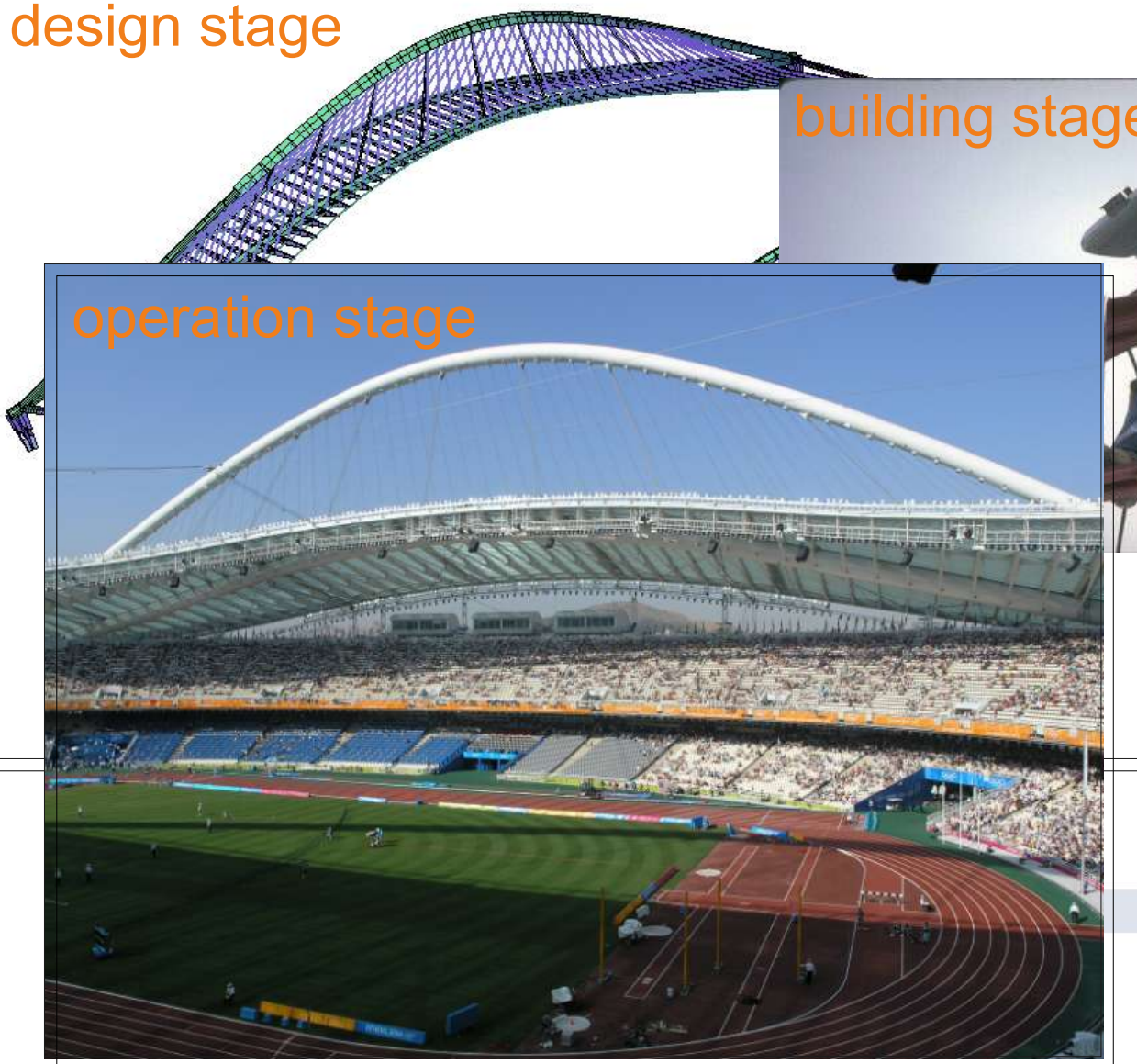
> some high performance computing in a context of day to day engineering

> complex products
  – series of one or few
  – described in highly structured databases production (1000+ classes/concepts)

> production process
  – unique, one of a kind (in the AEC case)

> virtual organization
  – unique, dynamic, short term membership
  – members joining and leaving just in time
  – members involved in several VO at the same time

> grid as semantic collaboration platform

— for day-day interoperability that includes high performance stuff sometimes

> semantic

— entire grid committed to an ontology combining IT and professional concepts

— user > actor, file > document, line > object, record > business object

> collaboration

— shared access to grid resources – information and computation – to members of the VO

> platform

— shared toolkit code on servers and clients for grid access; committed to the ontology

www.InteliGrid.com

www.InteliGrid.com

> not a typical grid project
  – strong industrial involvement
    • industry has different priorities then research
  – dynamic collaboration / computational platform

> virtual organisations
  – highly dynamic
  – members involved in several VO at the same time (with different roles)

> using unproven technologies
  – ontologies / semantics
    • based on semantic web experiences
    • different understanding of ontologies
  – grid technology
    • flashback to FP5 ISTforCE Project (www.ISTforCE.com)

www.InteliGrid.com

> Industry IT

– not able to handle grid complexities

– outsourcing

> sharing

– scientific community: yes

– industry: not really (give as little as possible)

– Resources

- licensing problems

- strict access level control (different roles)

- I want my data on my machine.

> Technical problems

– resources are behind firewalls

Draft InteliGrid architecture

... from the DOW

applications
application grid
adapters

server grid
adapters
server side
software

structural design
architectural design
FM

generic client interfaces

semantic grid infrastructure

generic server interfaces

OGSI/WSRF or similar

appl.

facility mngmnt.

project space

product data grid

ontology services

Objectives ➡ Results

> an ontology committed grid

  – grids aware of business concepts like airplane fuselage or reinforcement steel

> augment grid architecture to include an ontology layer

> make it generic so that an arbitrary ontology can be plugged in

➡ > prototype impl. of platform

  – architecture engineering aerospace naval

➡ > draft standard for ontology committed grid middleware

➡ > generic integration for an arbitrary OWL defined ontology

www.InteliGrid.com

> ## More at
> ### www.InteliGrid.com

InteliGrid Newsletter

Issue 1 November 2004

Welcome!

Welcome to the 1st issue of the InteliGrid Newsletter. Over the coming two years, the newsletters will keep you up to date with one of the most challenging IT research topics of today - the semantic resource sharing in virtual organisations. InteliGrid research and development is interdisciplinary. It will build upon and extend knowledge in the areas of information technology (particularly semantic grids), in virtual organizations and in large scale engineering - for industries that create most challenging engineering products including high-rise structures and passenger jets. We look forward to reaching across these communities. To stay in touch with us do not forget to subscribe to the alerting service and further issues of the newsletter at www.InteliGrid.com.

Žiga Turk, coordinator

Towards Semantic Grids

The long term, stable business relations of the past are rapidly being replaced by temporal partnerships all across the industries. Working in such virtual organizations has been known in engineering for decades, however, enabled by the developments in information technology, such partnerships are becoming more and more common.

The temporal involvement of a partner in a virtual organization needs to be set up quickly. In such contexts a grid based approach is appropriate. Supporting VOs has been central in grid technology development. However, most practical results to date were related to a high performance distributed computation and storage.

The goal of this project is to provide a grid-based integration and interoperability infrastructure and thereby exploit the potential of grid technology to complex industries such as construction, automotive and aerospace. Our vision of future engineering is a flexible, secure, robust, ambient accessible, interoperable, pay-per demand access to information, communication and processing infrastructure.

Scientific research and technical development will advance the state of the art in the field of semantic grids, web services and interoperable ICT infrastructures for VOs. The key scientific question is how grid technology can be used to address the interoperability of software and services working with complex and semantically rich information.

In addition, the software and services need distributed power to process information in an environment that is characterised by data structures that are undergoing a dynamic evolution.

A specific technological goal is to make the grid infrastructure available to the mostly small to medium enterprise (SME) companies that are providing the engineering software. The core competency of these companies are topics like structural mechanics or 3D solid modelling and not the latest trends in middleware technology. The project will help SMEs to enhance their applications with grid-computing capabilities.

The project will demonstrate how typical server side applications can be made grid-computing compatible and how the mostly client side Computer Aided Design (CAD) applications can interface with the grid. The demonstration will show the next generation of key engineering collaboration software using the InteliGrid middleware, an ontology service, a product model database server, a project Web collaboration service and characteristic computer aided design software.

The main results of the project are the generic business-object-aware extensions to grid middleware, implemented in a way that allow grids to commit to an arbitrary ontology. These extensions are propagated to toolkits that allow hardware and software to be integrated into the grid.

Key Project Figures

Partners:	9 from 7 countries
EU funding:	2.1 MEuro
Total funding:	3.1 MEuro.
Effort:	360 person months
Duration:	30 months
Start-end:	1.9.2004 - 28.2.2007

The InteliGrid team at the kick off in Munich, Germany, Sept.2nd, 2004.