Service-Concepts for Industrial HPC.

T-Systems Solutions for Research GmbH.
Alfred Geiger.
Outline

Business-Objectives and Basic Concept

Portfolio for industrial HPC-Services

HPC as a Grid-Service

Customer-Scenario: The C²A²S²E HPC-Service
Business-Objectives.

- **Base**
  - Customers from
    - Automotive
    - Aerospace
    - Public and Industrial Research

- **Goals**
  - Giving our Partners and Customers a competitive advantage
  - Provide a solution for a broad Range of Problems
  - Flexibility with Respect to our Customer´s Business
  - Performance
  - Availability and Reliability
  - Portfolio reflecting a Superset of User-Needs
  - Technical and economic Efficiency
Service-Concept for the Provisioning of HPC-Resources to Industrial Customers: 4-Tier Architecture.

Strategic public Resources, e.g. PRACE

<table>
<thead>
<tr>
<th>Tier 0</th>
<th>Europe</th>
</tr>
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<tbody>
<tr>
<td>Tier 1</td>
<td>Remote</td>
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<tr>
<td>Tier 2</td>
<td>Local</td>
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<tr>
<td>Tier 3</td>
<td>Client</td>
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Grid-Technology (e.g. UNICORE)

- Application-Servers
- Supercomputing
  - Top-End Capability
  - Dynamic Provisioning

Production-Environments for Throughput and Capability
- System- and Application Management
- Integration
- Capacity-Risk on Customer Side
- Systems are owned by customer or Service-Provider

Test- and Development Environments
- Compiler/Cross-Compiler
- Analysis-Tools (Debugger, Performance-Analysis)
- Pre- and Postprocessing
HPC-Services Tier 1.
hww: The flexible HPC-Factory.
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Portfolio:
Support for CAE-Applications.

- MSC-Nastran, Actran
- Abaqus
- Ansys
- LS-Dyna
- PAM-Crash
- RADIOSS
- MADYMO
- Faust
- Star CD
- SYSNOISE
- DBETSY
- TPNOLI
- AKUSMOD
- DADS
- ST-ORM
Portfolio: Support for Software-Developers.

- Compiler-Support
- Optimisation
- Parallelisation: MPI, OpenMP
- Vectorisation
- Load-Balancing
- Software-Engineering
- Performance-Analysis
- Debugging of parallel and distributed applications
- Visualisation
Code-Optimisation Example:
The Tau CFD-Code on x86
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Evolution of industrial grids 1/2

- **Phase 1: Data-Center Grids**
  - Goal: Efficient use of resources, Reduction of CAPEX, OPEX
  - Drivers: CIO, IT-Managers, Controlling
  - Problems: Technical, Skill-Management
  - Middleware/Technology: LSF, PBSpro, sge, Globus, Webservices

- **Phase 2: Campus-Grids**
  - Goal: Efficient use of resources, Reduction of CAPEX, OPEX
  - Drivers: CIO, Controlling
  - Problems: Governance, Cost-/ProfitCenters
  - Middleware/Technology: LSF (enhanced by deadline, fair share...), sge, InnerGrid/Fura

- **Phase 3: Corporate-Grids**
  - Goal: Efficient use of resources, Reduction of CAPEX, OPEX
  - Drivers: CIO, Controlling
  - Problems: + Heterogenity, Networking, Data-Staging, Architecture
  - Middleware/Technology: LSF (enhanced by multilevel, data-staging), Synfiniway, Moab, UNICORE, InnerGrid/Fura
Evolution of industrial grids 2/2

- **Phase 4: Partner-Grids**
  - Goal: Sharing of Resources and Knowledge
  - Drivers: Business/Engineering
  - Problems: Security, Heterogenity, License-Management
  - Middleware/Technology: LSF, Synfiniway, Moab, UNICORE

- **Phase 5: Supplier-Grids**
  - Goal: Flexibility
  - Drivers: CIO
  - Problems: Security, Heterogenity, License-Management
  - Middleware/Technology: like Partner-Grids

- **Phase 6: Service-Grids**
  - Goal: Flexibility on service-level, integration in SOC
  - Drivers: CIO, Business
  - Problems: Complexity........
  - Middleware/Technology: ????
HPC as a Grid-Service.
HPC-Portal.

- Easy Access to high-performance computational capabilities
- Maximum data security
- Pay per Use: No risk at moderate cost
- No capacity constraints by use for peak demand
- Flexibility in choice of hard- and software
- Initially realized in the context of the EUROGRID-project
SOA-based Integration. The classical grid-approach

Organisation A
IntraGrid based on LSF, SynfinyWay, Condor, InnerGrid etc.

Organisation B
IntraGrid based on LSF, SynfinyWay, Condor, InnerGrid etc.

Utility-Grid (e.g. UNICORE)

Service-Provider
SOA-based Integration.
Customer-Requests and Cloud-Solution

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Service-Provider
Evolution of industrial grids 2/2

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Public and Community Clouds

http://www.zimory.com
Bringing Grid and Cloud together. The XGE-Project

- Java Sandboxes
- Process Sandboxes
- OS Sandboxes
  - Xen
  - OS is part of xge job
  - Modification of sge
  - Each VM has its own IP-address (specific challenge: routing of customer IP addresses)
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Airbus FuSim – the Umbrella

Future Simulation Concept

Idea
- New simulation capabilities for Airbus
- New quality of tools
- Towards virtual design and analysis
- Long-Term: virtual certification

Concept
Network of expert centers with major partners involved that perform targeted research serving Airbus needs

• New speed
• New tools
• New way of working

Simulation capability increase by $10^6$
FuSim – Complementary Actions for the Whole

**CFMS - Filton/Bristol**
- Innovative overall system for product design
- Change in "Engineer’s way of working"
- IT architecture impact
- Powerful HPC center

**DOVRES - Getafe/Madrid**
- Virtual Reality for Design
- Field Programmable Processors
- CFD Specific Hardware

**C²AES²E - Bremen/Braunschweig**
- Comprehensive solutions for most relevant aircraft applications
- Technology integration
- Concentrated world-class expertise
- Powerful HPC center

**Mosart - Toulouse/Paris**
- Parallel Simulation Architecture Improvement
- CFD Components Improvement
- High Bandwidth Access to Remote Computers

**Parallel Simulation Architecture Improvement**
HPC-Services for C²A²S²E: A Tier 2 Example.
Configuration of 47 TFlop/s System
Embedding in Industrial and Research Environments: Grid Software-Stack for Airbus - Alternatives

**Alternative A**
- **Airbus End-Users**
  - LSF
  - Synfiniway or UNICORE
- **Airbus Resources**
- **C²A²S²E-HPC**

**Alternative B**
- **Airbus End-Users**
  - LSF
- **Airbus Resources**
- **C²A²S²E-HPC**
  - Synfiniway
  - PBS
Embedding in Industrial and Research Environments: Access to C²A²S²E-HPC
HPC-Services and Grid: What’s the difference between public and industrial R&D?

- The industrial agenda is mainly on
  - Reduction of CAPEX and OPEX
  - Service oriented Computing (not on Grid or Cloud)

- The academic agenda is mainly on
  - Collaboration
Thank you.