



# Service-Concepts for Industrial HPC.

T-Systems Solutions for Research GmbH.  
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# Outline

## Business-Objectives and Basic Concept

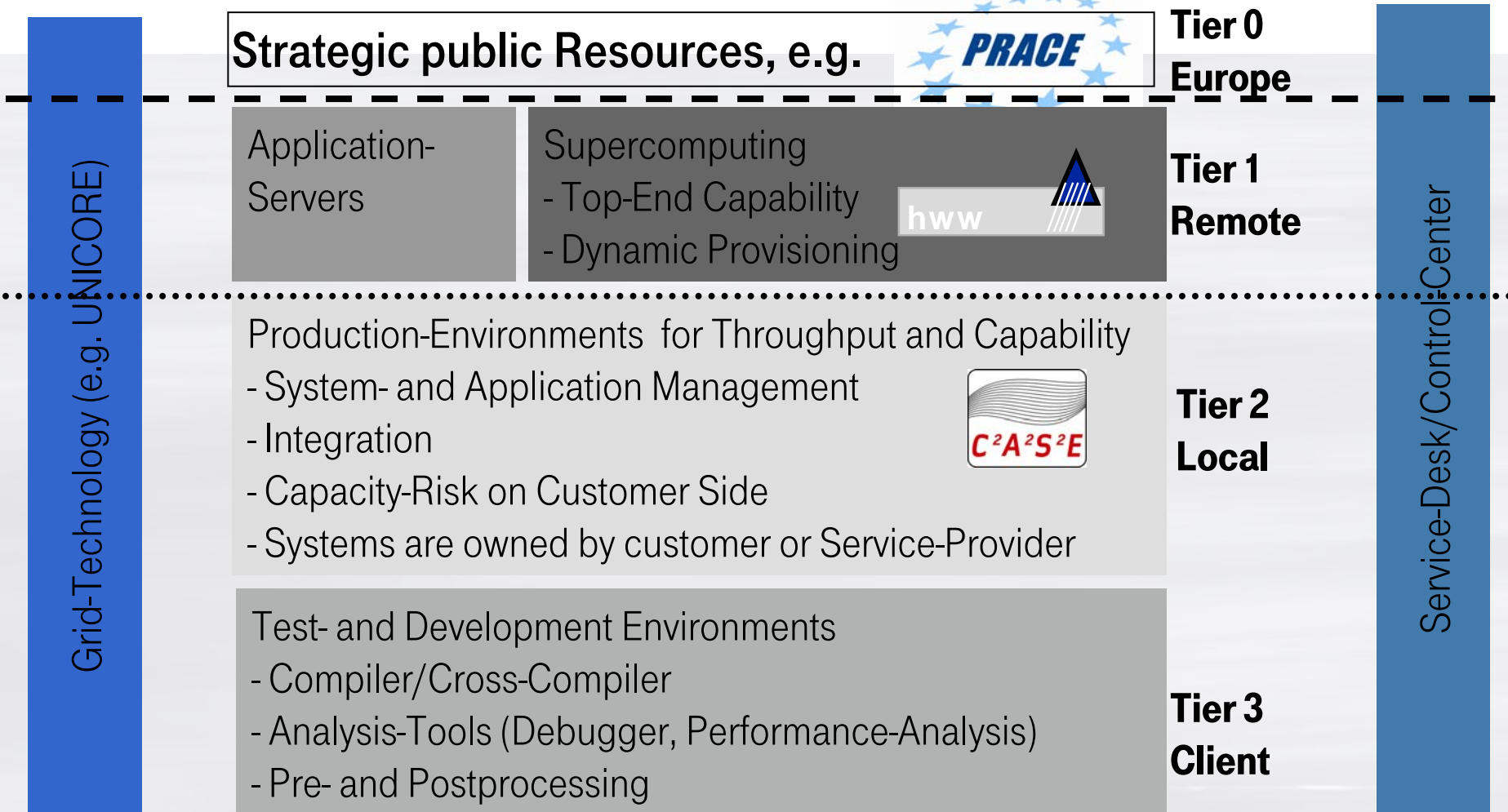
## Portfolio for industrial HPC-Services

## HPC as a Grid-Service

## Customer-Scenario: The C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E HPC-Service

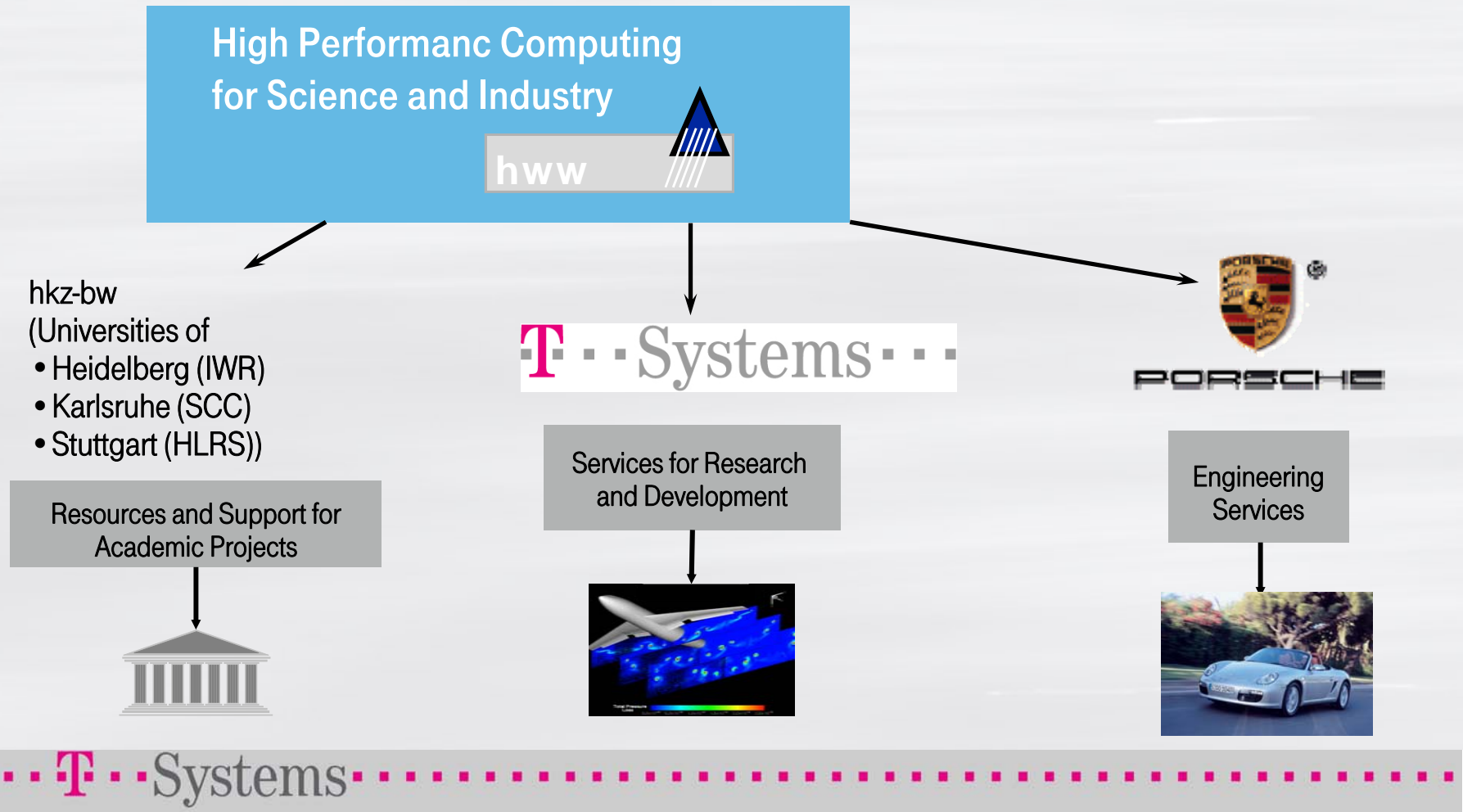


# Service-Concept for the Provisioning of HPC-Resources to Industrial Customers: 4-Tier Architecture.



# HPC-Services Tier 1.

## hww: The flexible HPC-Factory.



# Outline

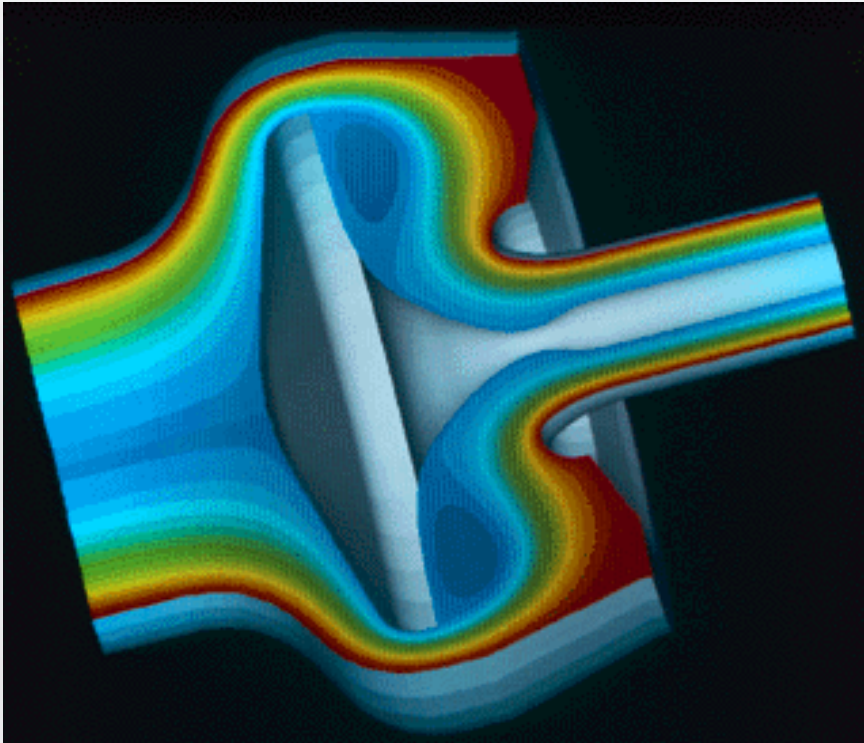
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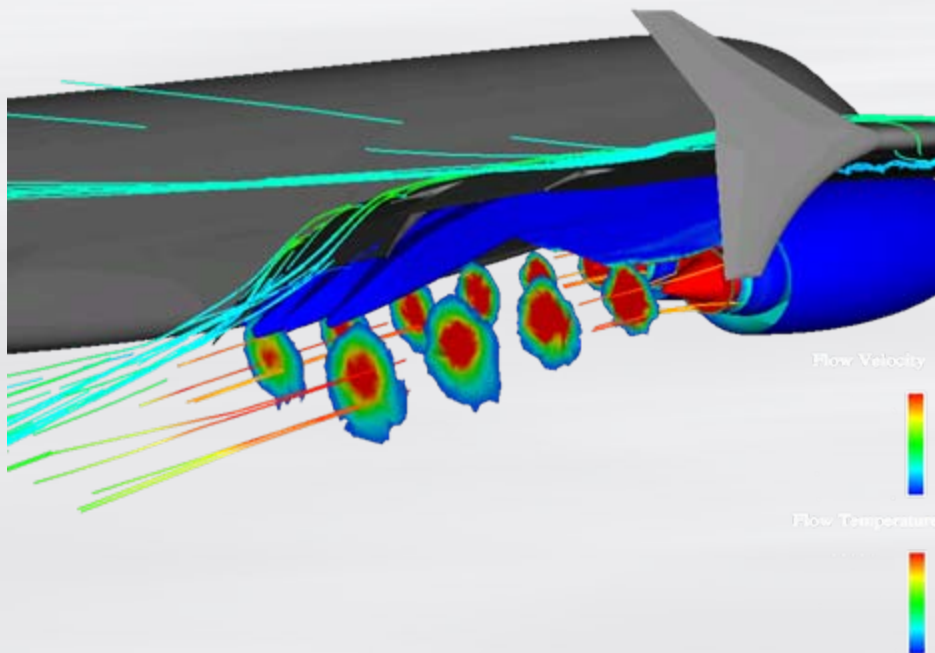
**Customer-Scenario: The C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E HPC-Service**

# Portfolio: Support for CAE-Applications.



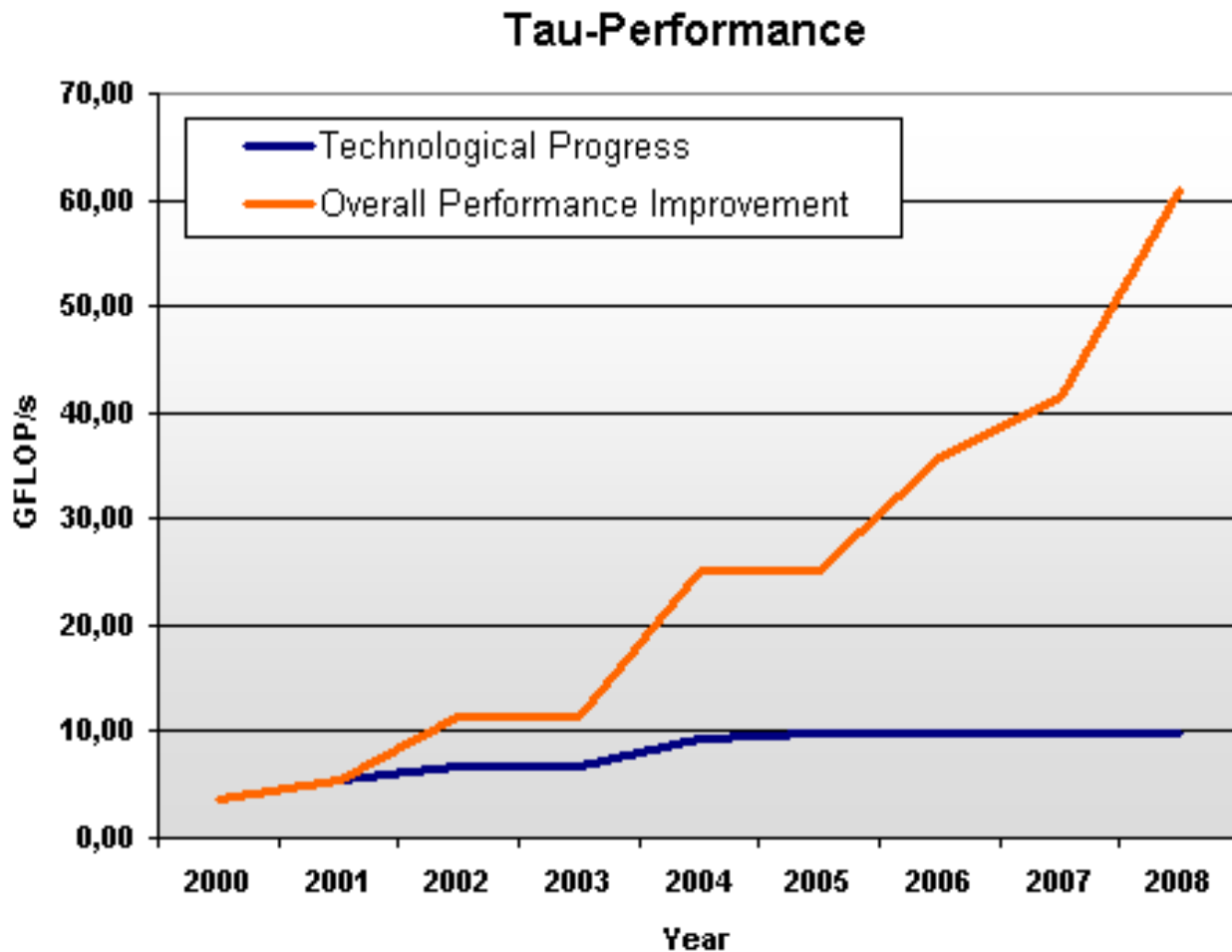
- MSC-Nastran, Actran
- Abaqus
- Ansys
- LS-Dyna
- PAM-Crash
- RADIOSS
- MADYMO
- Faust
- Star CD
- SYSNOISE
- DBETSY
- TPNOLI
- AKUSMOD
- DADS
- ST-ORM

# Portfolio: Support for Software-Developpers.



- 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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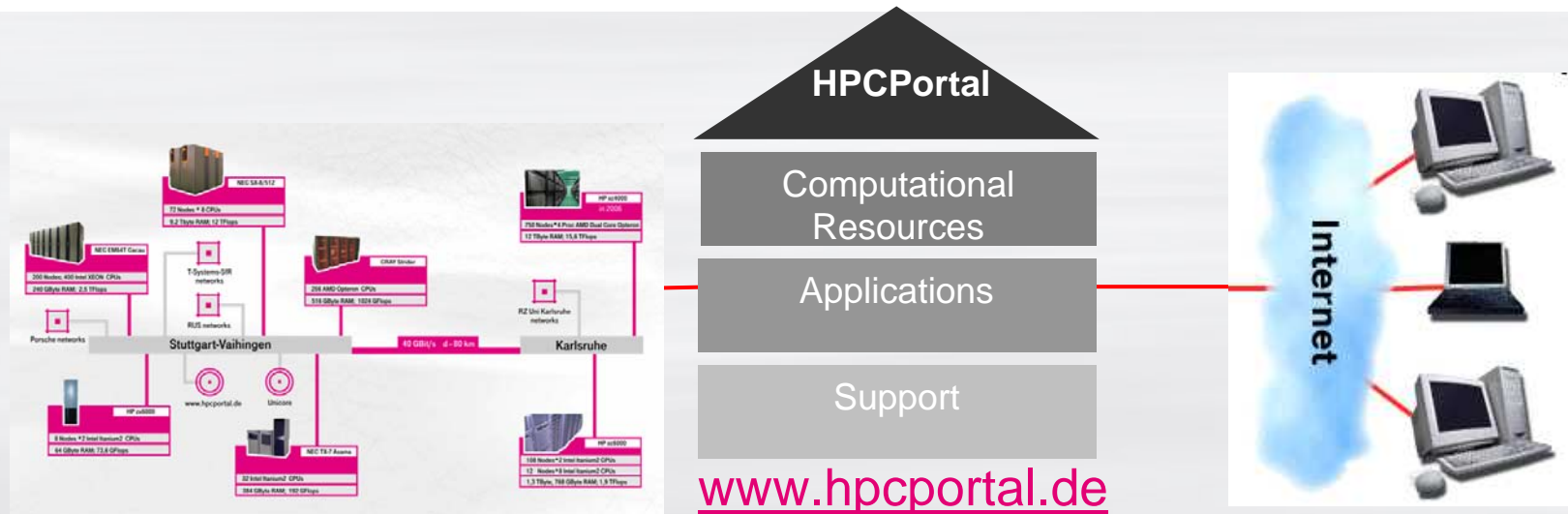
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# Evolution of industrial grids 1/2

- **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: + Heterogeneity, Networking, Data-Staging, Architecture
  - Middleware/Technology: LSF (enhanced by multilevel, data-staging), Synfiniway, Moab, UNICORE, InnerGrid/Fura



# HPC as a Grid-Service. HPC-Portal.

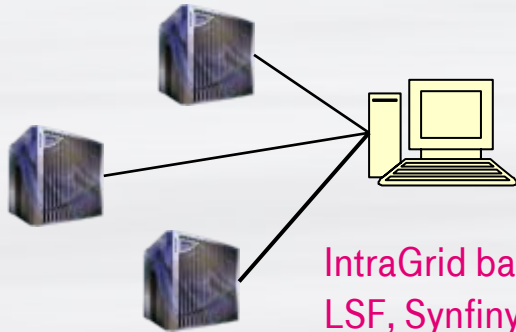


- Easy Access to high-performance computational capabilities
- Maximum data security
- Pay per Use: No risk at moderate cost
- No capacity constraints by use for peak demand
- Flexibility in choice of hard- and software
- Initially realized in the context of the EUROGRID-project

# SOA-based Integration.

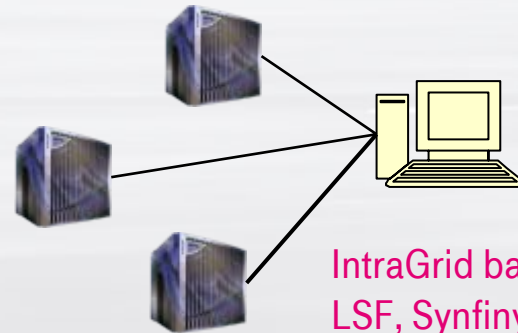
## The classical grid-approach

### Organisation A



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

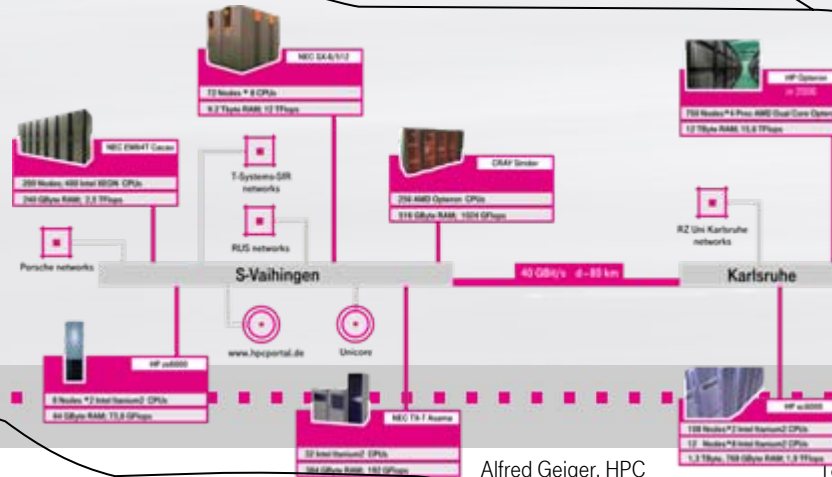
### Organisation B



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

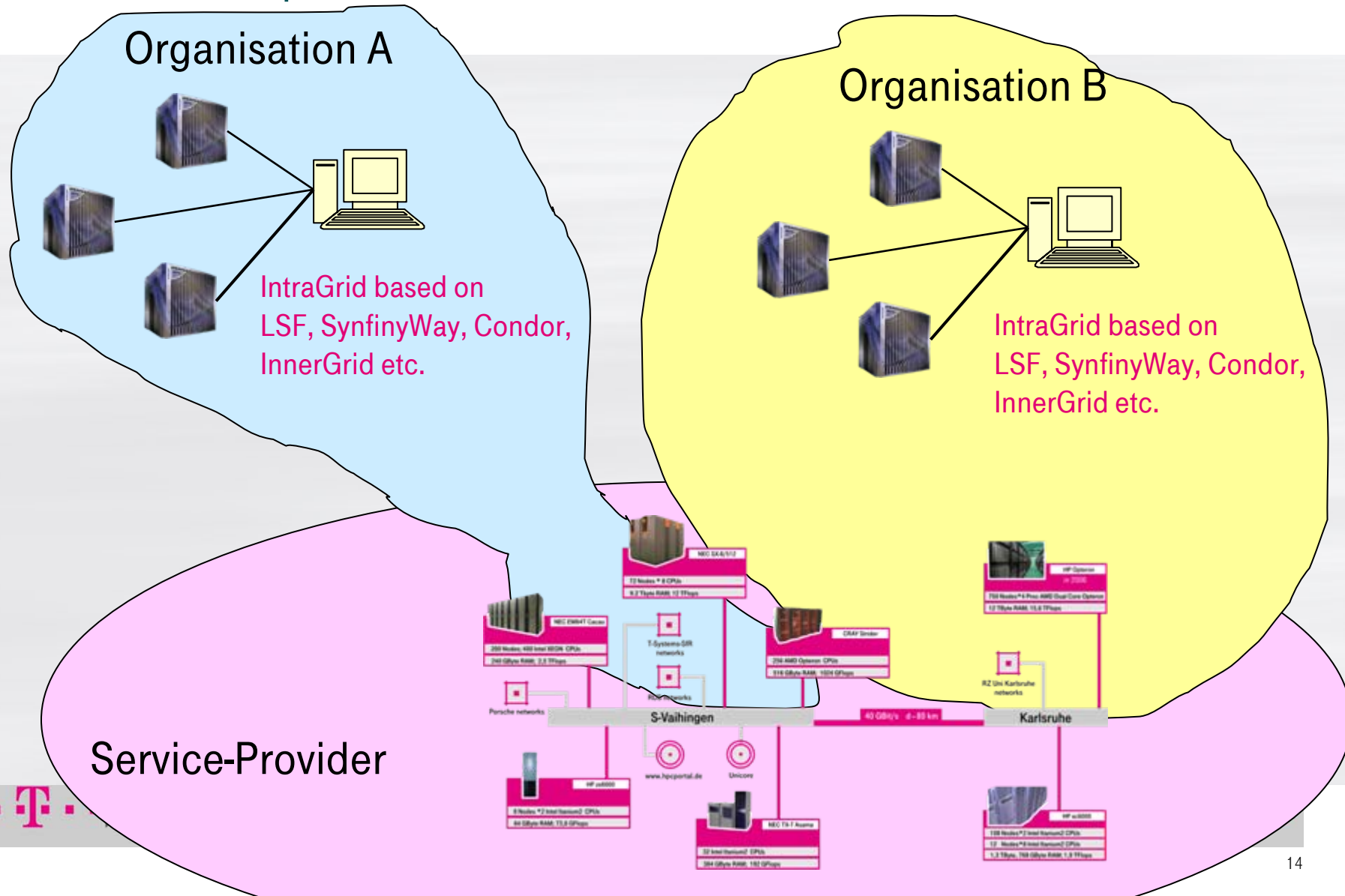
Utility-Grid (e.g. UNICORE)

### Service-Provider



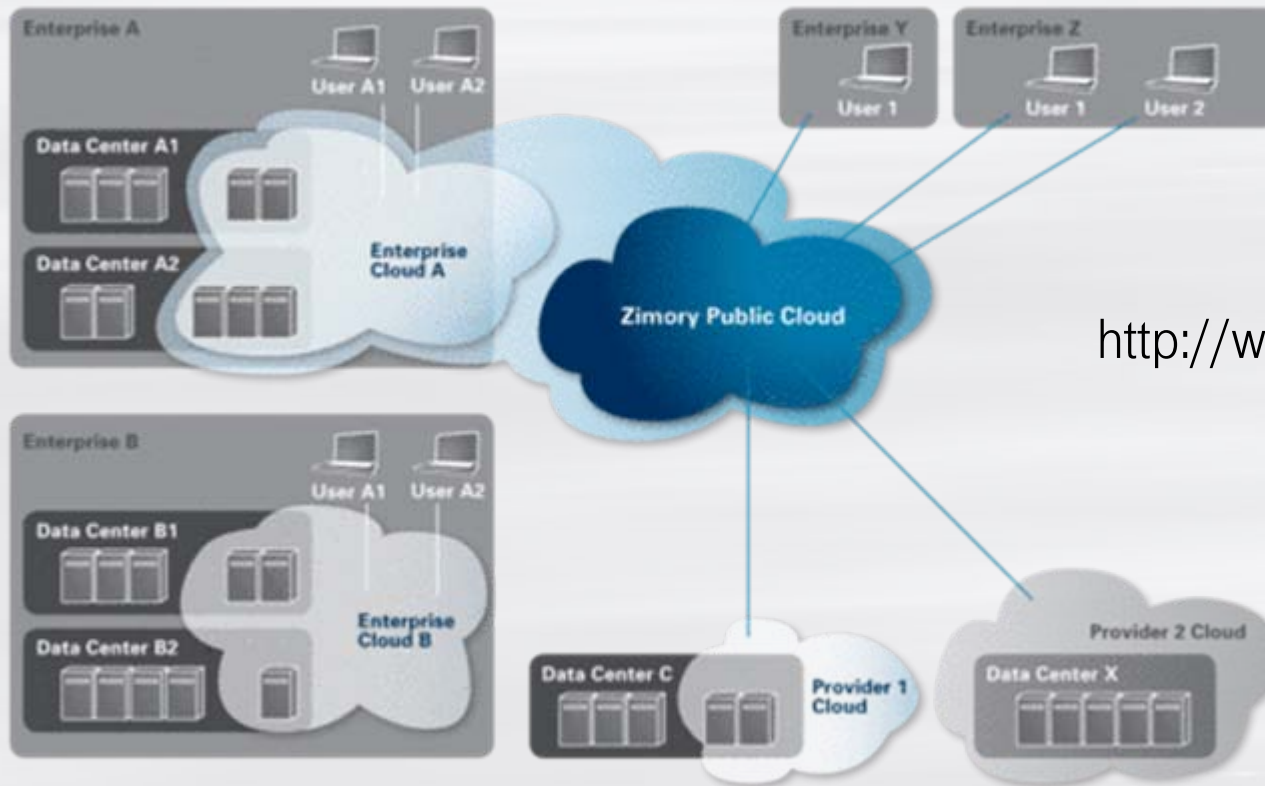
# SOA-based Integration.

## Customer-Requests and Cloud-Solution





# Public and Community Clouds



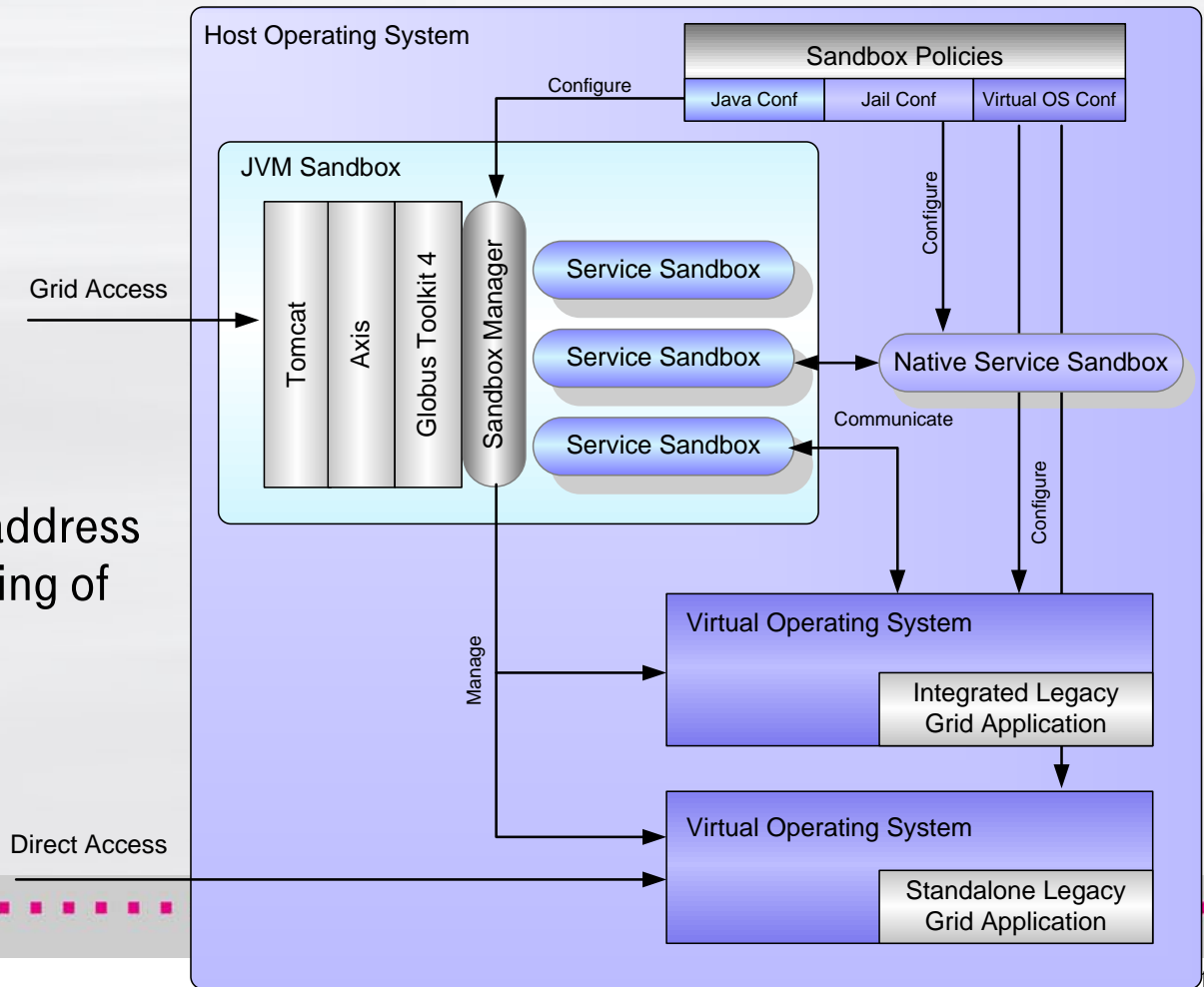
<http://www.zimory.com>

# 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*

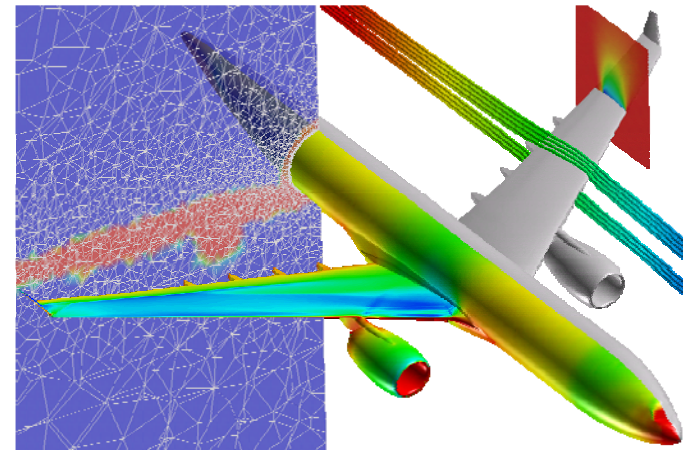
### Idea

- 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



**C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E** - Bremen/Braunschweig

- Comprehensive solutions for most relevant aircraft applications
- Technology integration
- Concentrated world-class expertise
- Powerful HPC center




- Multi-Disciplinary Integration  
- FlowSimulator Software Backbone

**DOVRES** - Getafe/Madrid

- Virtual Reality for Design
- Field Programmable Processors
- CFD Specific Hardware

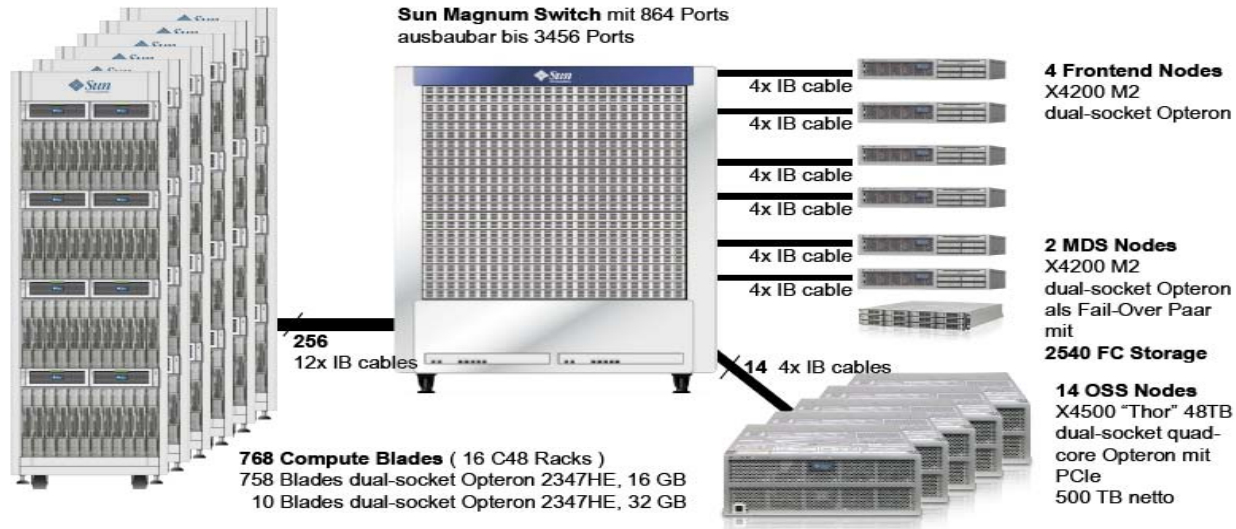
**Mosart** - Toulouse/Paris

- Parallel Simulation Architecture Improvement
- CFD Components Improvement
- High Bandwidth Access to Remote Computers

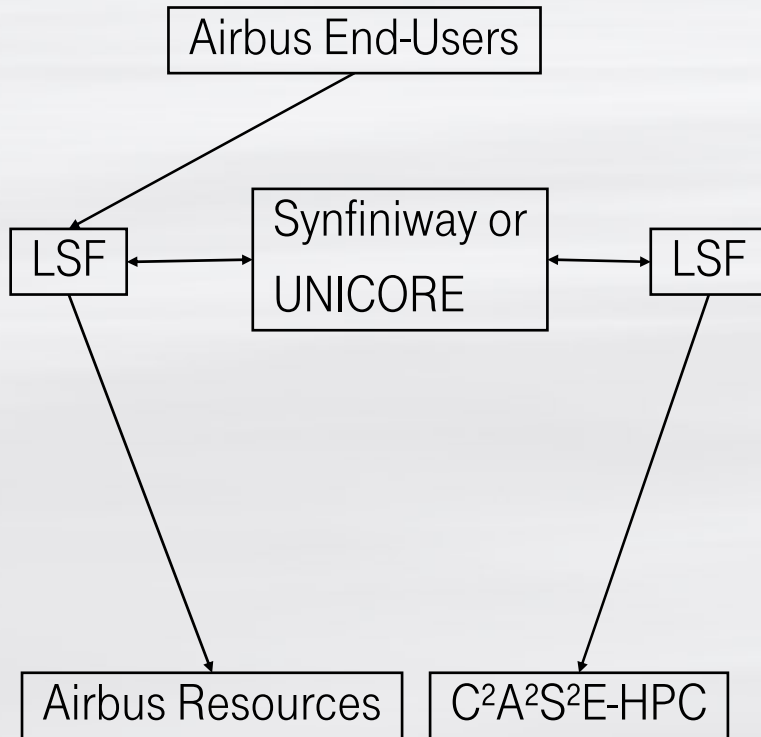


# HPC-Services for C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E: A Tier 2 Example.

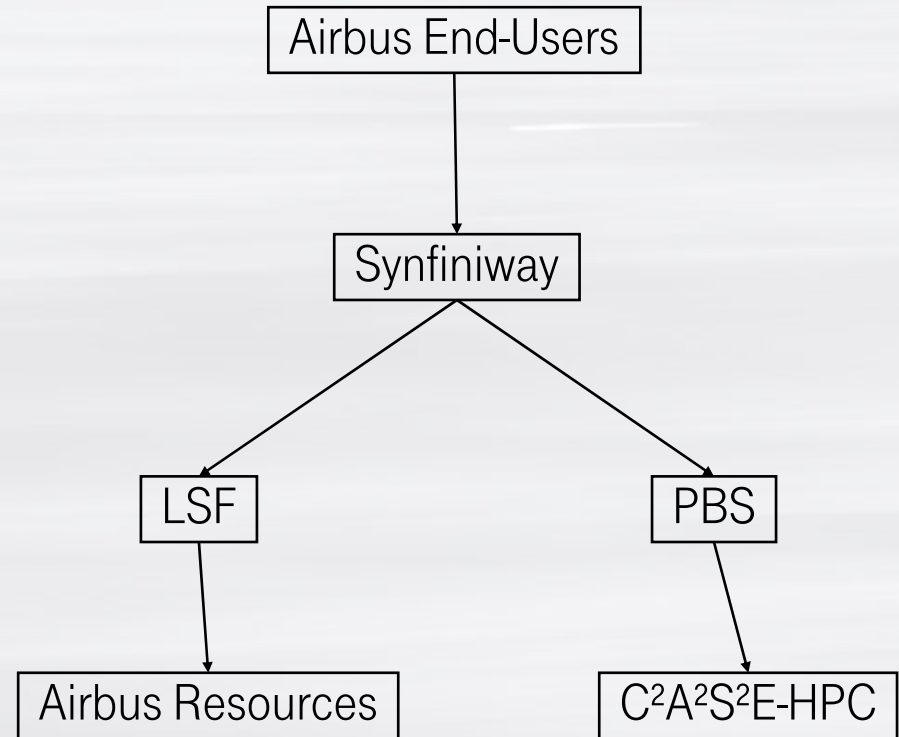
## Configuration of 47 TFlop/s System



# Embedding in Industrial and Research Environments: Grid Software-Stack for Airbus - Alternatives

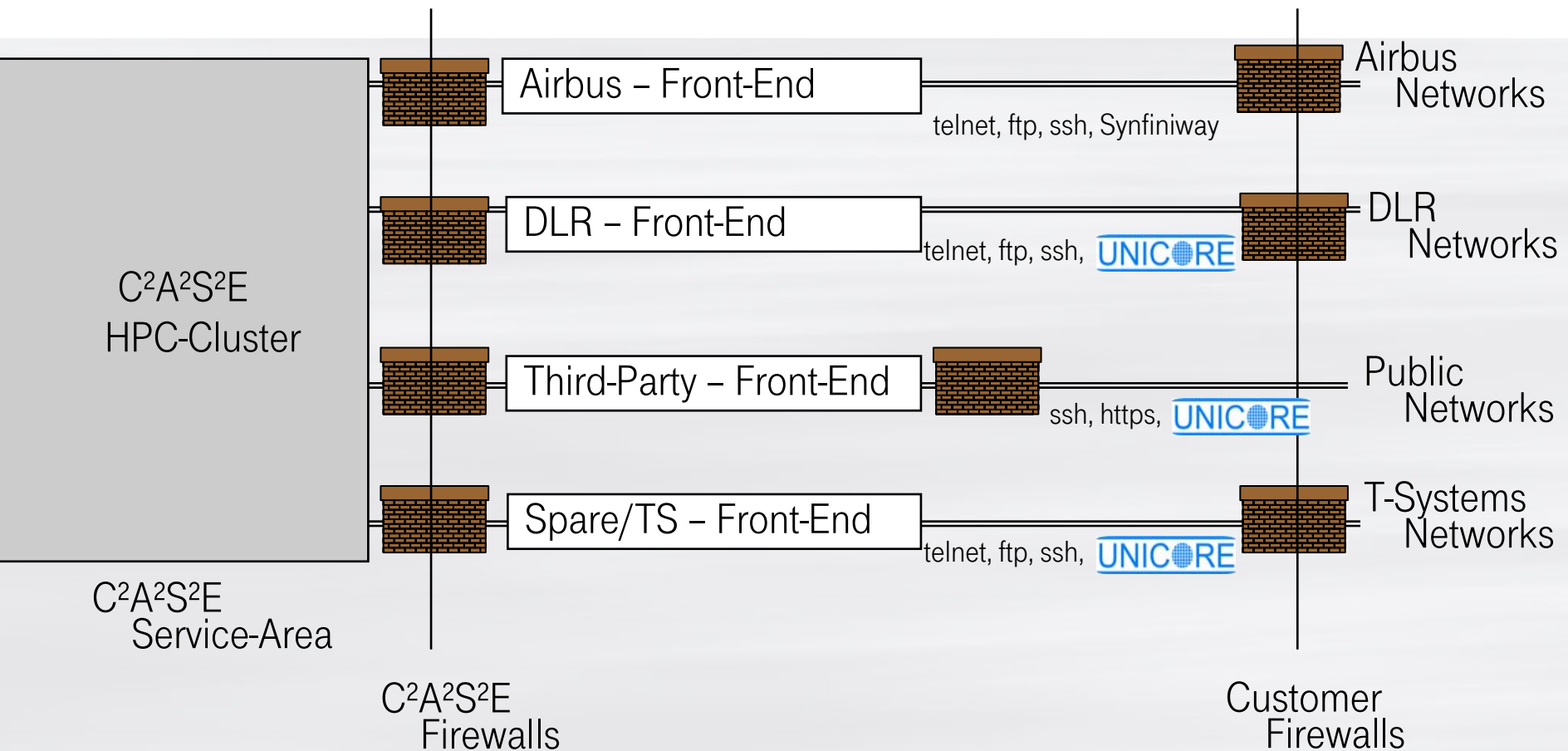


**Alternative A**



**Alternative B**

# Embedding in Industrial and Research Environments: Access to C<sup>2</sup>A<sup>2</sup>S<sup>2</sup>E-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

