



# GRID Seminar @ Norsk Regnesentral

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Norsk Regnesentral*

*contributions by*

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# Grid Seminar - Why

- invite
  - Technology providers,
  - infrastructure-providers,
  - users,
  - ...to talk about grid computing
- Present technologies and their use,
- Discuss use of grid and applications
- Inform public about emerging technologies

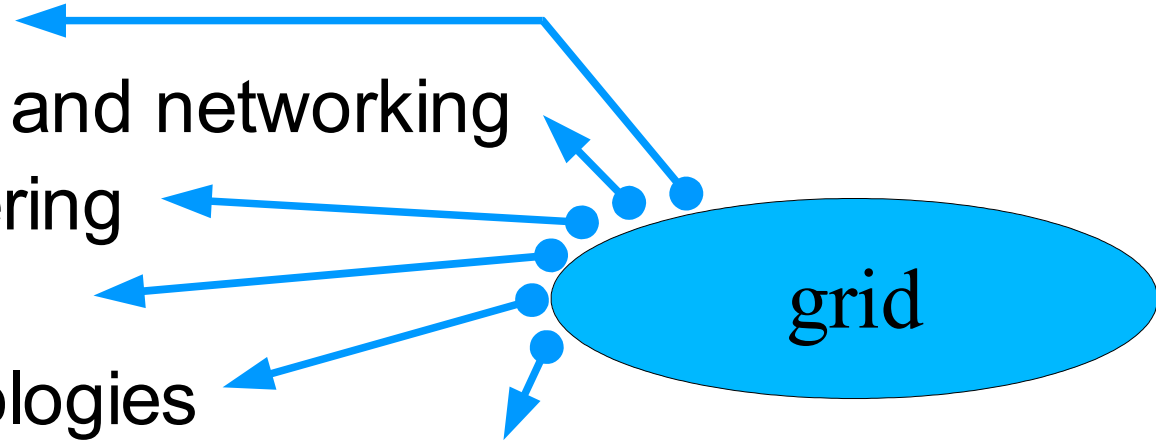
# Grid Seminar - Program

- Kl. 0930 Frammøte, kaffe +
- Kl. 1000 Presentasjon av NR v/ Lars Holden
- Kl. 1015 Introduksjon v/ Wolfgang Leister
- Kl. 1030 Muligheter innen grid v/ Jan Petter Strømsheim, KUF Dept.
- Kl. 1050 Grid aktiviteter i IBM, v/ Loek Vredenberg  
Grid prosjekt E-Diamond v/ Loek Vredenberg
- Kl. 1110 Grid aktiviteter i SGI, v/ Anders Øvreseth,
- Kl. 1130 Grid aktiviteter i USIT v/ Andreas Botnen
- Kl. 1150 Grid aktiviteter i NR v/ Wolfgang Leister, et.al.
- Kl. 1210 Lunch med oppsummering og framtidsvyer
- Kl. 1300 Slutt

# ICT @ NR

- Important Application Areas:

- Multimedia
- ICT Infrastructure and networking
- Software Engineering
- Security
- Emerging Technologies
- Learning and Knowledge Management



# Grid initiative @ NR

## why

- Identify Application areas for grid
  - (many advertise with use of Globus Toolkit)
  - (many advertise with use of grid technologies)
- Generate projects with research content in various application areas

- health care,
- banking and finance,
- visualization
- multimedia
- ...

# Grid initiative @ NR

## how

- Grid (definitions, philosophy, etc.)
- Experiences with Globus Toolkit GT3
- Definition of application areas (besides number crunching)
- Relations to other technologies (e.g., GT3, Web-Services, .NET, Java)
- Demonstrator applications
- Cooperation with technology providers (e.g., IBM, SUN, SGI) and infrastructure providers
- Cooperation with users of grid technologies

# What is grid?

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- Seamless access to all kinds of resources

**Related, but not identical with grid:**

- Distributed computing
  - RPC
- Autonomic computing
  - Corba
- Peer-to-Peer
  - .NET
- Load-balancing



# What is grid?

- **Grid** has focus on **coordinated resource sharing** among a **dynamic set** of entities, often referred to as a **virtual organization**.
- Resource management functionality:
  - Locating, initialization, coordination, query, monitoring, control, accounting, secure access, inter-organizational
- Security:
  - Authentication, secure data transfer, fine grain access control, delegation of credentials, management policies

# OGSA & OGSi

- OGSA = Open Grid Services Architecture
- **OGSA** supports, via **standard interfaces** and **conventions**, the **creation, termination, management** and **invocation** of **stateful, transient services** as named, managed entities with dynamic, managed lifetime.
- **OGSI** = Open Grid Services Infrastructure
- **Globus Toolkit** is an implementation of OGSi

# Application Example

- Image processing to detect features in medical images for diagnostics

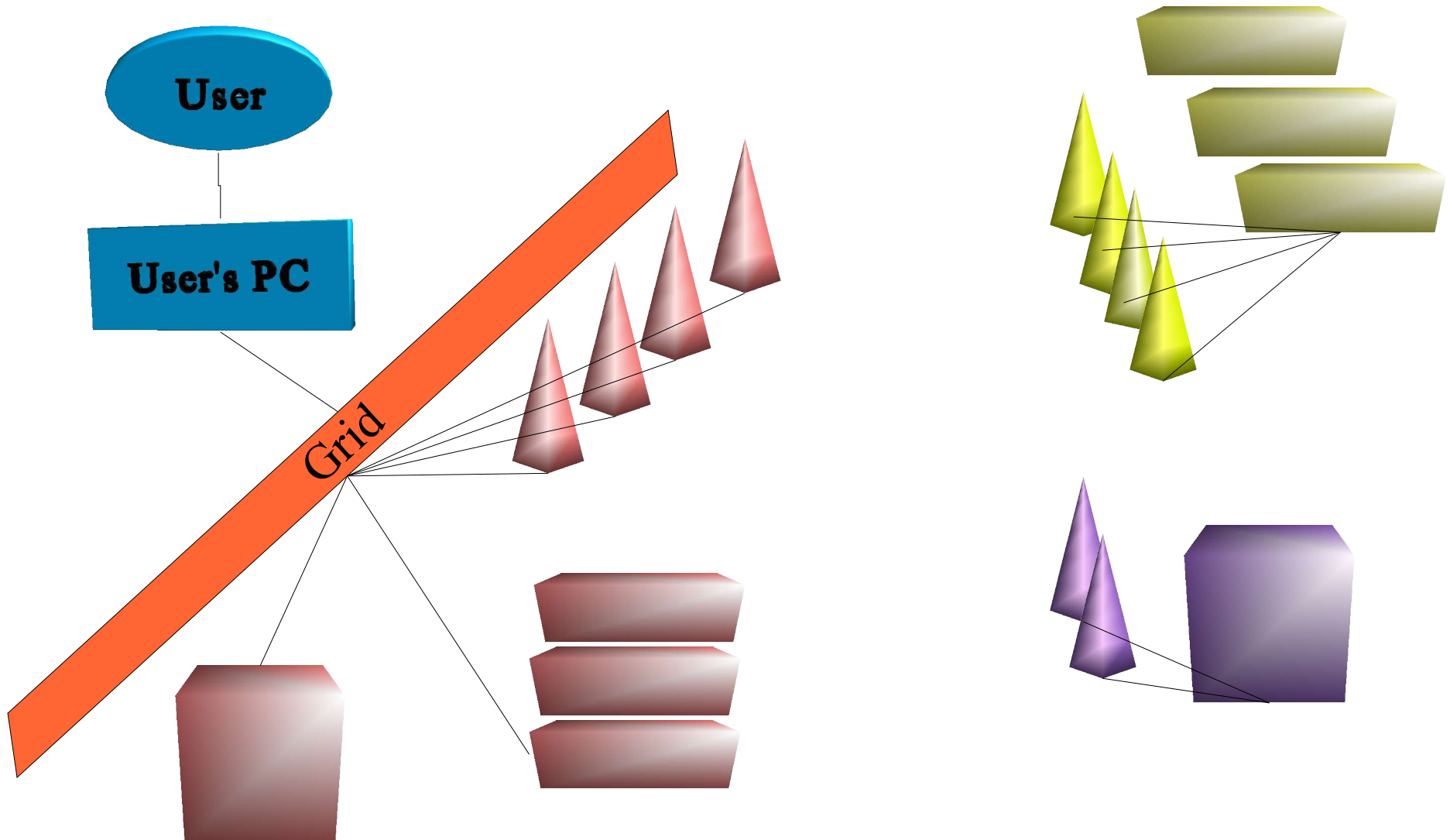
- Process on
  - Specialized hardware?
  - Cluster of machines?
  - Central Main Frame?
  - In house?
  - Outsourced?

## Better: Grid

- User sends application to grid;
- Grid finds appropriate resource, sends data and application there
- Some resource(s) perform operation
- User can survey operation
- Result is sent to user
- Bill is sent to users organization
- Security issues are handled



# Application Example (2)



# Globus Toolkit



- The Globus Toolkit (GT) is an open source software toolkit used for building grids.
- GT includes software services and libraries for
  - Resource monitoring, Information infrastructure
  - Resource Discovery Data management
  - Resource Management Communication
  - Security Fault detection
  - File management Portability.

# Globus Toolkit



- **GT 2.4** (*not longer developed*)
- **GT 3.0** (*current release*)
- *GT 4 ...*
  
- *Major changes between releases!*

# Globus toolkit



- GT components include:
  - MDS
  - GRAM, RSL, DUROC
  - GSI
  - GASS, GEM, RIO
  - GloPerf, HBM
  - *Monitoring / Discovery*
  - *Resource Allocation*
  - *Grid Security Infrastructure*
  - *File access, execution mgmnt, remote io*
  - *Performance mgmt, system health and status (Heart beat monitor)*

# GT Protocols

Application

...

...

GRAM

GridFTP

MDS

HTTP

FTP

LDAP

WSDL

Grid Services Abstraction

TLS/GSI / SOAP

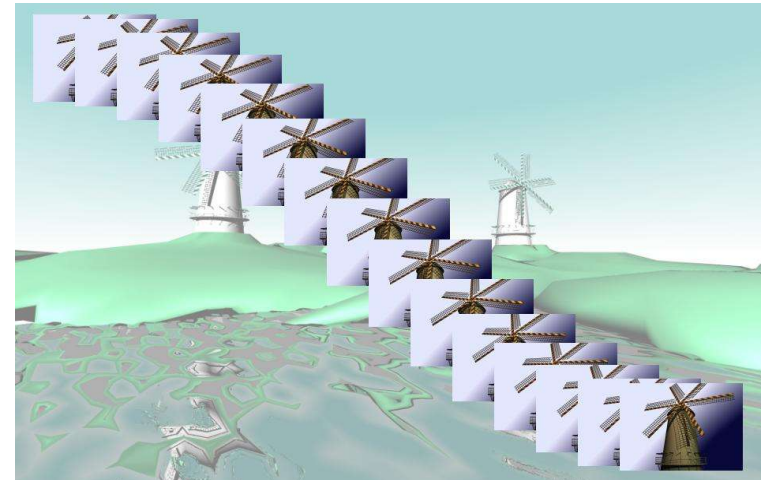
other transports

IP



# Other Grid Architectures

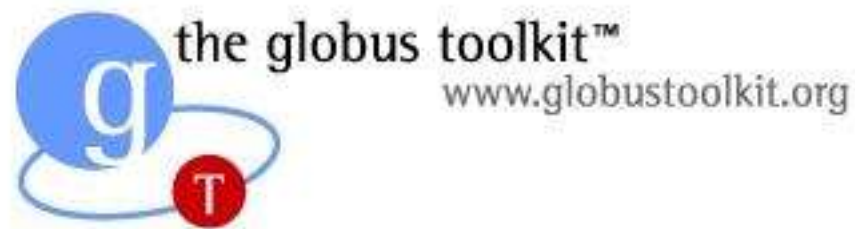
- Distributed or Autonomic Computing
  - Computer Animation Computation,  
e.g., netq (1987, Univ. Karlsruhe)



- SETI@Home, Folding@Home, ...
- Java Spaces
- ...

# END OF PART 1

## Grid Seminar @ NR



# NR PRESENTATION - PART 2

## Grid Seminar @ NR



# Grid Experiences @ NR

- Test grid installation based on GT 3
- Sample application based on GT 3 and Java/Linux
- Sample application based on .NET and Web Services
- Evaluations of GT and grid technology

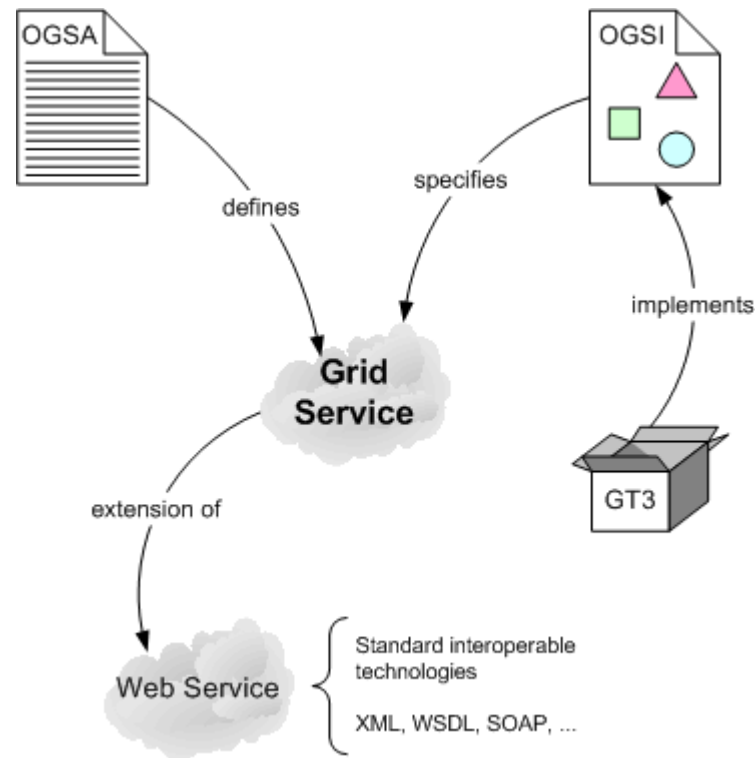
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# What is grid NOT ...

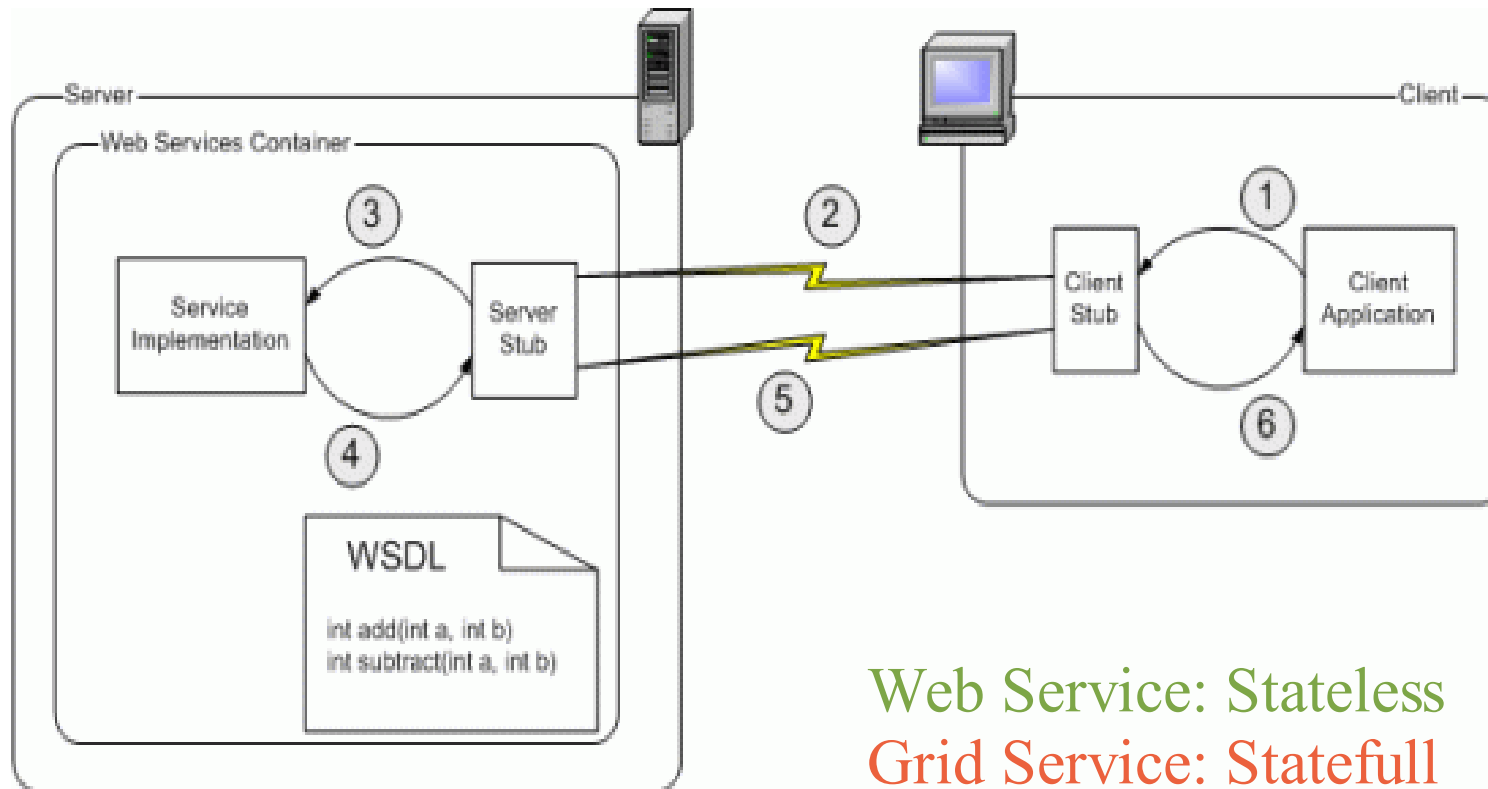
- ... division into partial problems
- ... computing cluster / distributed computing
- ... Peer-to-Peer / Autonomic computing
- ... compile once – run everywhere
- **Applications must be adjusted!**

# OGSA, OGSi, and Web Services



# Grid Service

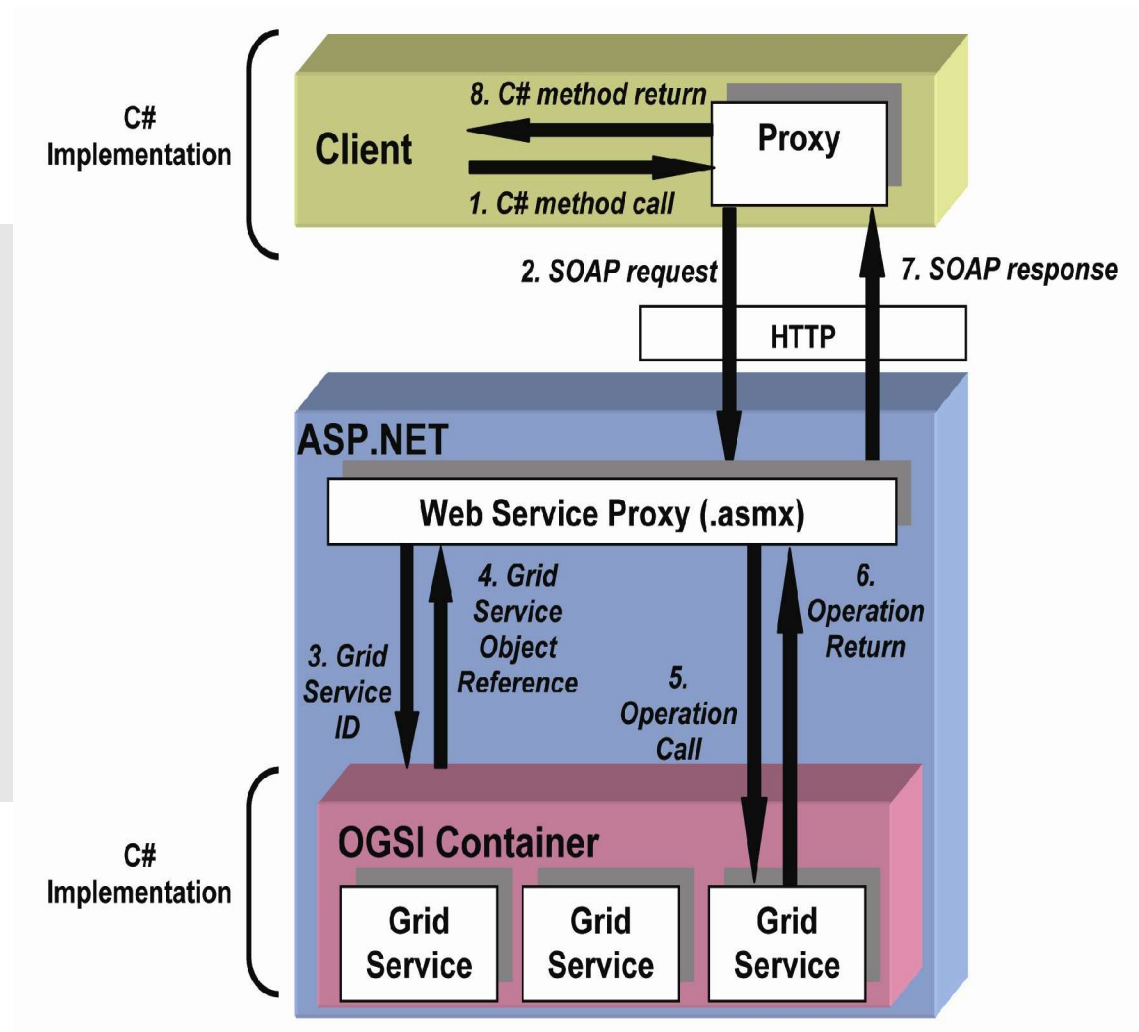
- **Grid service** is an extended **Web service**





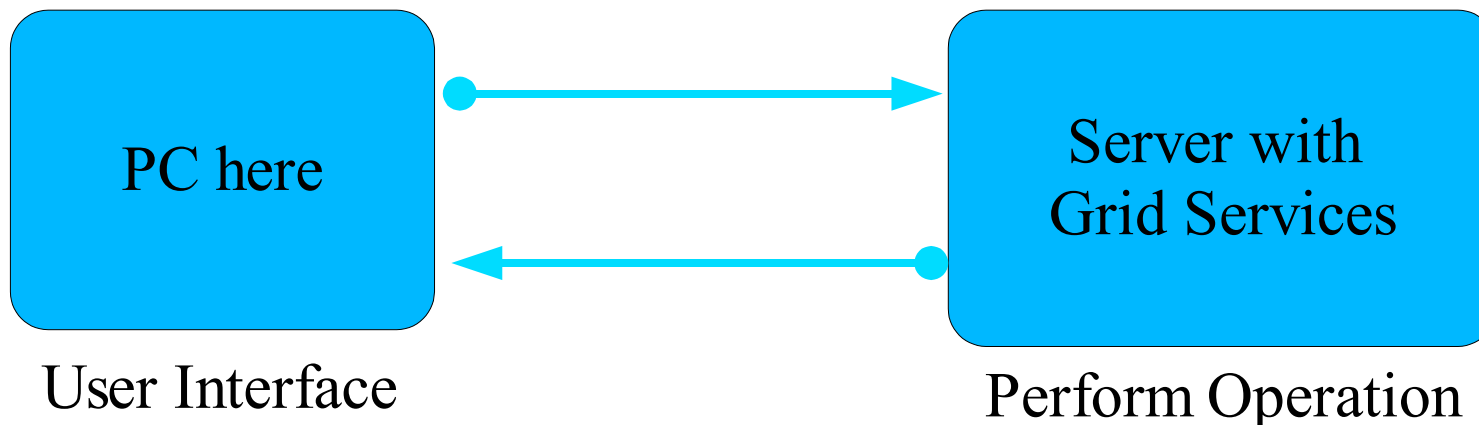
# Microsoft .NetGrid

- Cooperation between Microsoft Research UK and UK National e-science center
- Evaluation whether .NET suitable for development of OGSI services



# .NetGrid Demo

- Application implements a service to perform a simple transformation in an image
- Client software implemented in C#.
- Proxy classes generated by WSDL



# .NetGrid Conclusions

- MS.NetGrid is quite immature
- Many errors in documentation
- Configuration / setup of tools is time consuming
- Application development quite easy after configuration is done.

# Globus toolkit

- Collection of tools to implement grid
- Implementation of OGSI standard
- Core technologies: Java, XML, Web services, Internet
- Current Version: GT3 (30. juni 2003)
- Information infrastructure – how to find a resource
- Resource management – how to run a job
- Data management - how to distribute data
- Grid security infrastructure

# Information infrastructure

- MDS, Globus Monitoring and Discovery Service (GT2)
- Index service (GT3)
- Based on LDAP
- Grid Resource Information Service (GRIS):  
querying resources for their current status
- Grid Index Information Services (GIIS):  
knitting together arbitrary GRIS services

# Security infrastructure

- Two security infrastructures, both based on GSI (Grid Security Infrastructure) and PKI standards
  - Transport-level security. (httpg protocol, based on https)! **phased out!**
  - Message-level security (on SOAP level). Security per message

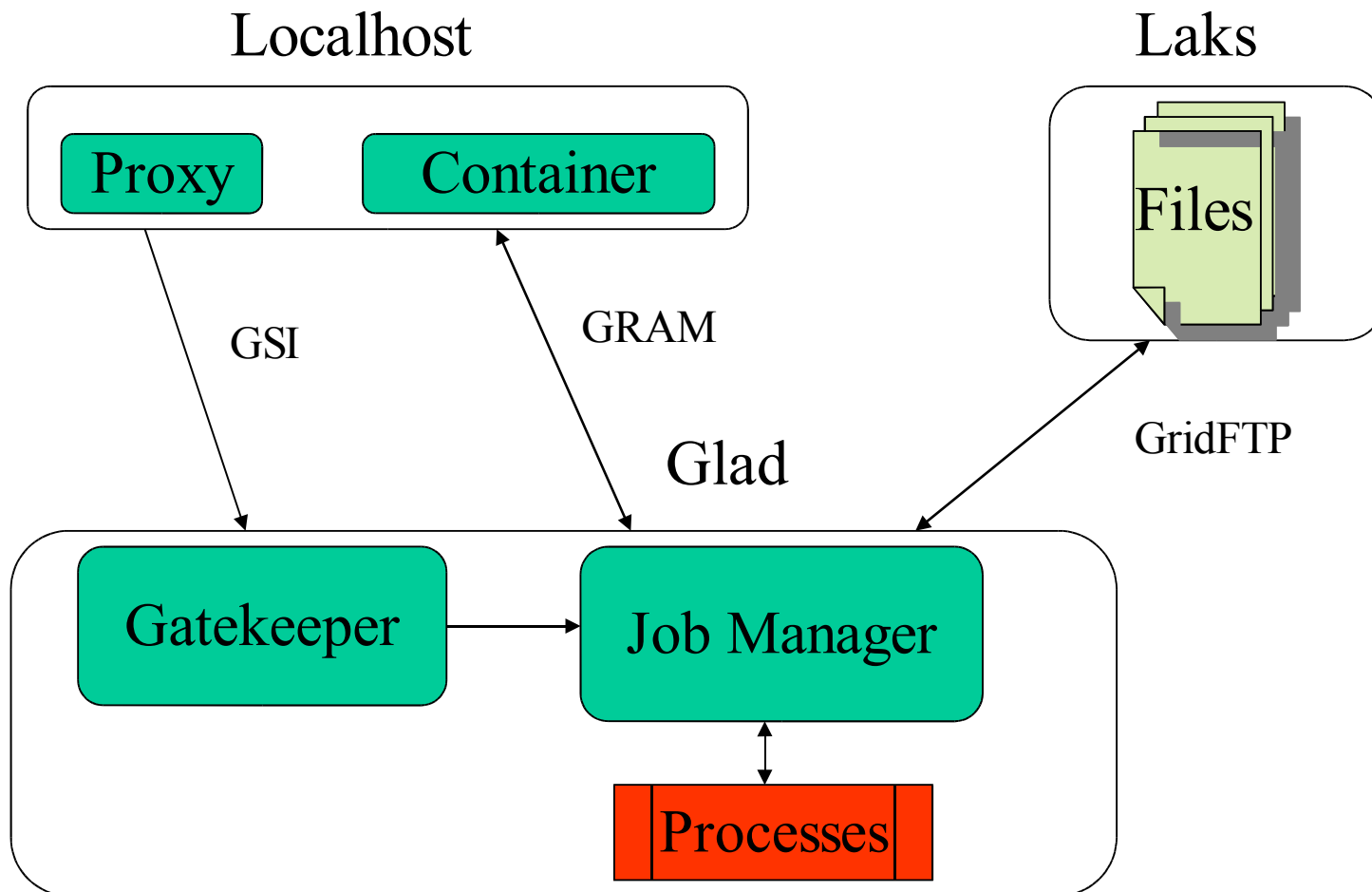
# Resource management

- GRAM, Grid resource allocation management (GT2)
- MMJFS, Master and managed job factory service (GT3)
  - Resource allocation
  - Submitting jobs (remotely running executables and receiving results)
  - Managing job status and progress

EXAMPLE: `$ globusrun -r glad -o '(&executable=gsiftp://laks/mydir/myprog)'`

# GRAM, how to run a job

EXAMPLE: `$ globusrun -r glad -o '(&executable=gsiftp://laks/mydir/myprog)'`





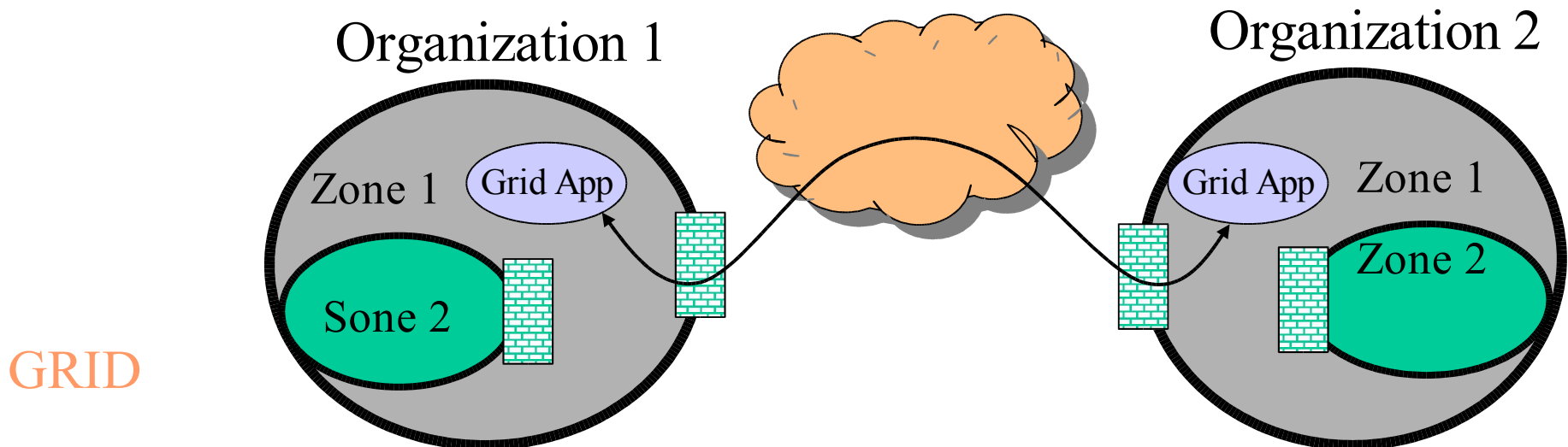
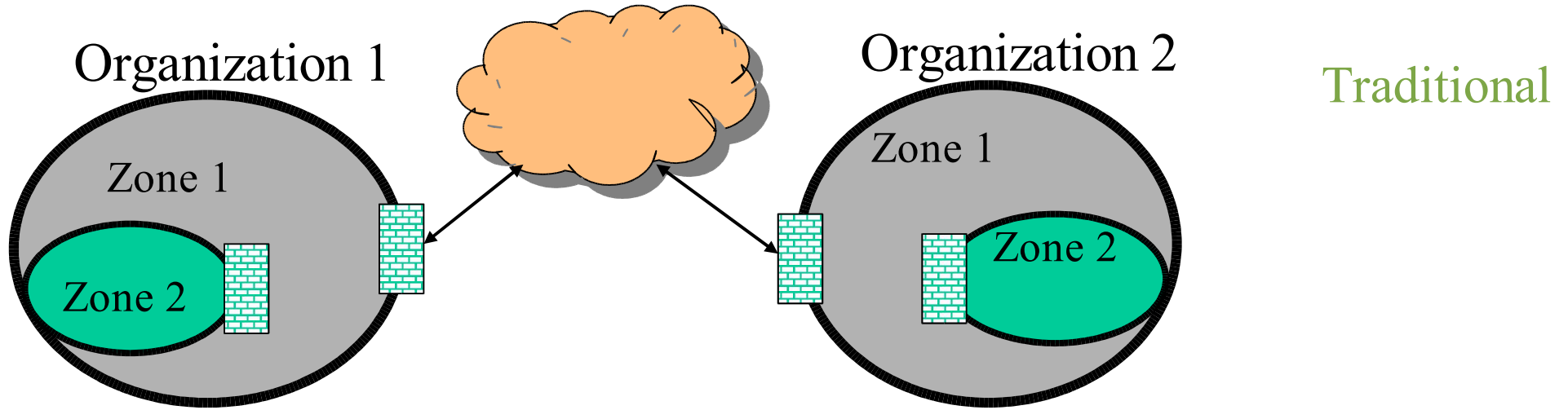
# Data management

- GridFTP, Grid File Transfer Protocol (GT2)
- RFT, Reliable File Transfer Service (GT3)

# Globus Toolkit Versions

	GT2	GT3
GSI	SSL, X.509	Same as GT2
GRAM	Port 2119	Web services + GT2
MDS	Port 2135	Web services + GT2
GridFTP	Port 2811	Same as GT2

# Security Models





# GT security infrastructure

- Each grid user has a unique identity
- Uses X.509 certificates
- Entities accepting each other's CAs can communicate
- Stolen keys (keys stored in software)
- Certificates revocation (CRL not checked)
- Based on a individual mapping from grid user identity to local user identity (many users to keep track of)
- Policy enforcement in virtual organizations

# OGSA Security

- New work to create a grid security architecture.
- Part of the OGSA specification
- Three main principles:
  - Integration (with existing security infrastructure)
  - Interoperation (with existing systems)
  - Trust (between endpoints, crossing organisation boundaries)

# Discussion

- What are the applications?
  - How can these be implemented?
  - GT 3 is a toolkit, applications must be adjusted
    - RESEARCH PROJECT 
- Which issues are not covered by grid?
  - But are needed ...
    - RESEARCH PROJECT 

# END OF PART 2

## Grid Seminar @ NR

