



Forschungszentrum Karlsruhe
In der Helmholtz-Gemeinschaft

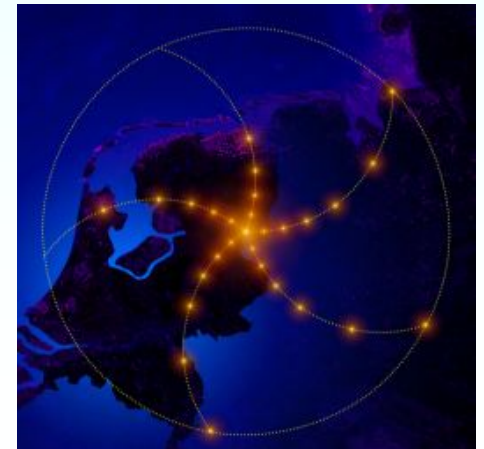
Institute for Data Processing and Electronics

GRID Computing at Forschungszentrum Karlsruhe suitable for LOFAR

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Institute for Data Processing and Electronics

Institute for Scientific Computing



Contents

0. LOFAR & GRID computing (at Forschungszentrum Karlsruhe)
1. Dynamic integration of desktop computer systems
2. GRID services library:
High Throughput Data Processing and Analysis



Computational requirements for LOFAR

- Software radio telescope
- Wide area sensor network: 1000 km

- Antennae data rate: 1.8 Gbit/s
- Station data rate: 220 Gbit/s
- Max. expected data rate: 26 Tbit/s

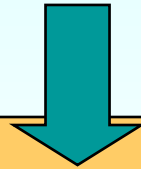
- Data storage: approx. 1 Pbyte

- Massive processing power: > 40 Tflops



Software requirements for LOFAR

- Innovative software systems planned:
 - Full distributed control
 - Simulation & modeling
 - Calibration
 - Imaging
 - Data mining and visualization
 - Flexible data processing
 - „Virtual instrument“
 - „Virtual Observatory (VObs)“



- Heterogeneous computing environment
- Heterogeneous software environment
- Distributed data management
- Quality of Service (realtime)
- Portals provide data access and analysis

GRID

GRID Computing

Idea: To provide worldwide computing & information resources in gigantic quantities

Two basic principles:

1. Cooperative usage of distributed computing resources

→ Short term accumulation of computer capacities

Dynamic integration of idle desktop computer systems

2. Virtualization

→ Conceals

- Technical details
- Geographical distribution

High throughput data processing and analysis services lib.

GRID at Forschungszentrum Karlsruhe

Manpower: approx. 70

- **GridKa**

LHC: 4000 Nodes, 1Pbyte online (2007)

- **CampusGrid**

Virtualization of an heterogeneous IT environment

- Vector computers
- Computing clusters
- Fast memory systems
- High speed networks
- Middleware



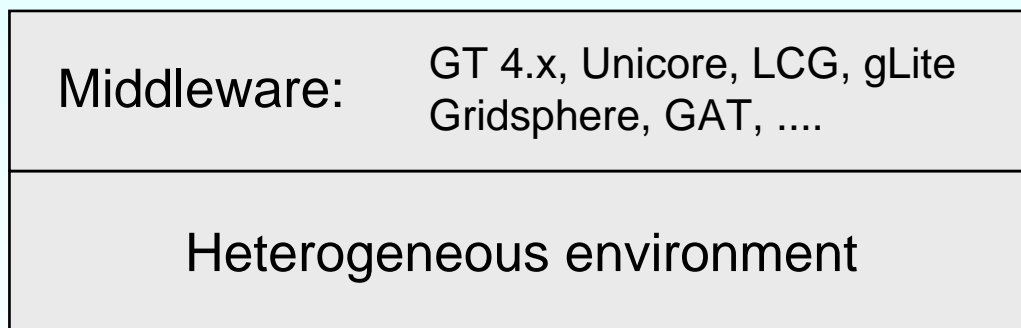
GRID infrastructure, support infrastructure

- Integration Project (DAG)
- GACG (ASTROGrid-D)

- Virtual organisations (EGEE)

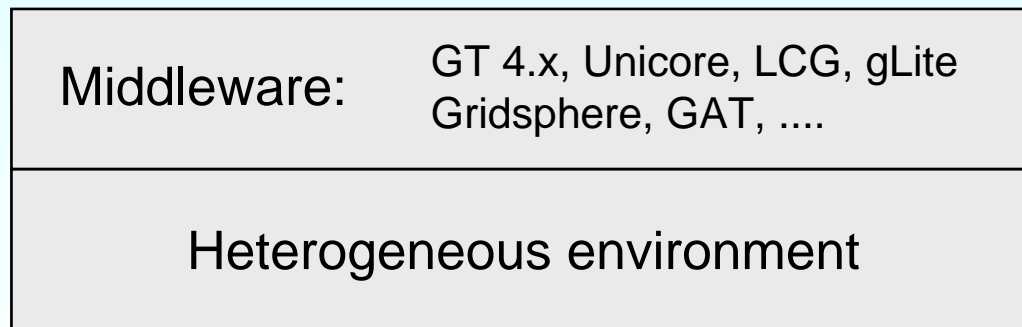


GRID structure for scientific computing

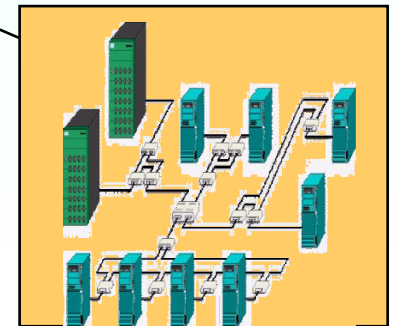


Dynamic integration of idle desktop computer systems

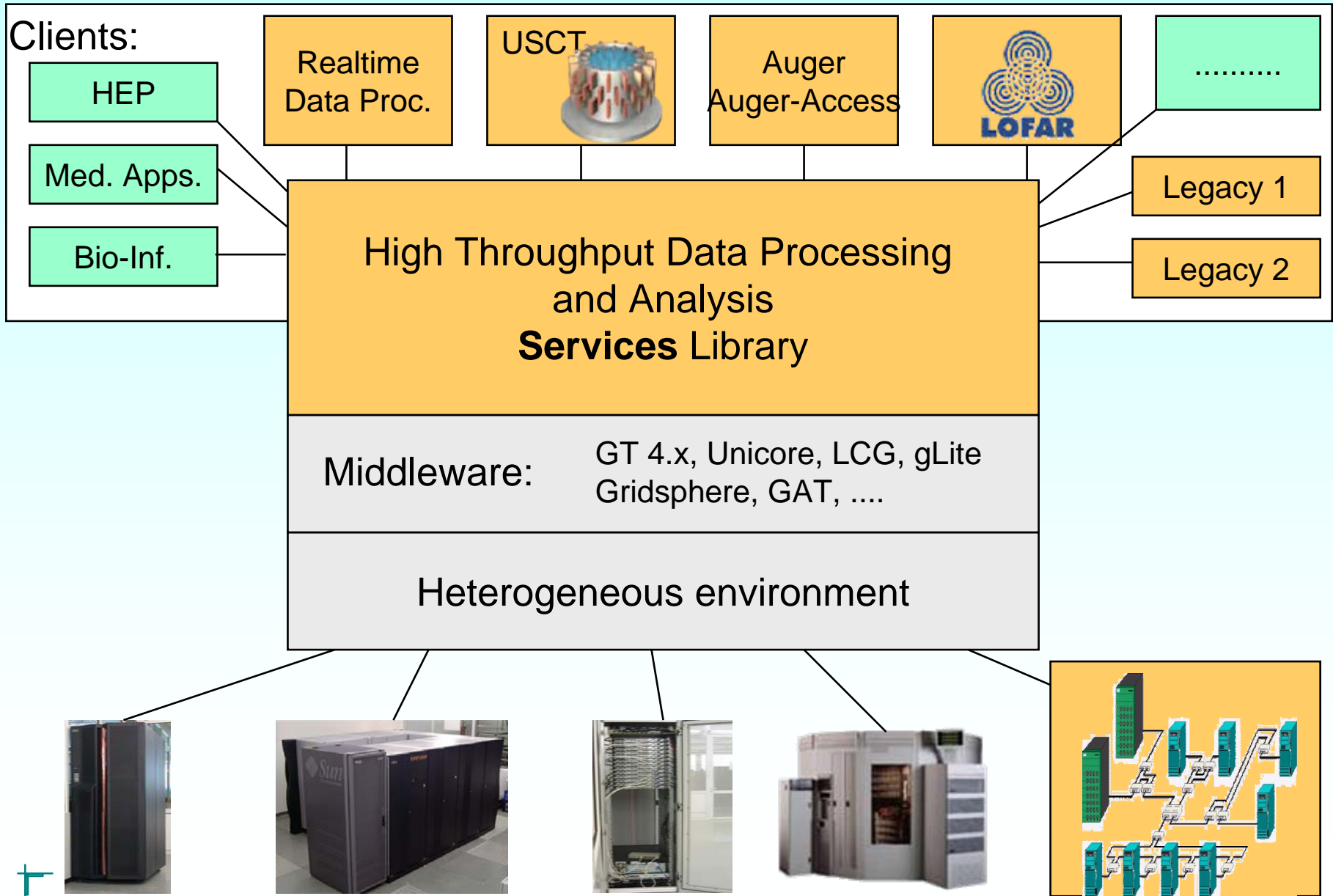
- Office desktop computer systems: Linux, Windows, Macs, ...
- High idle times, standby
- Huge computing power resource
 - Integration (SETI@home)
 - Dynamic**, top priority to the owner



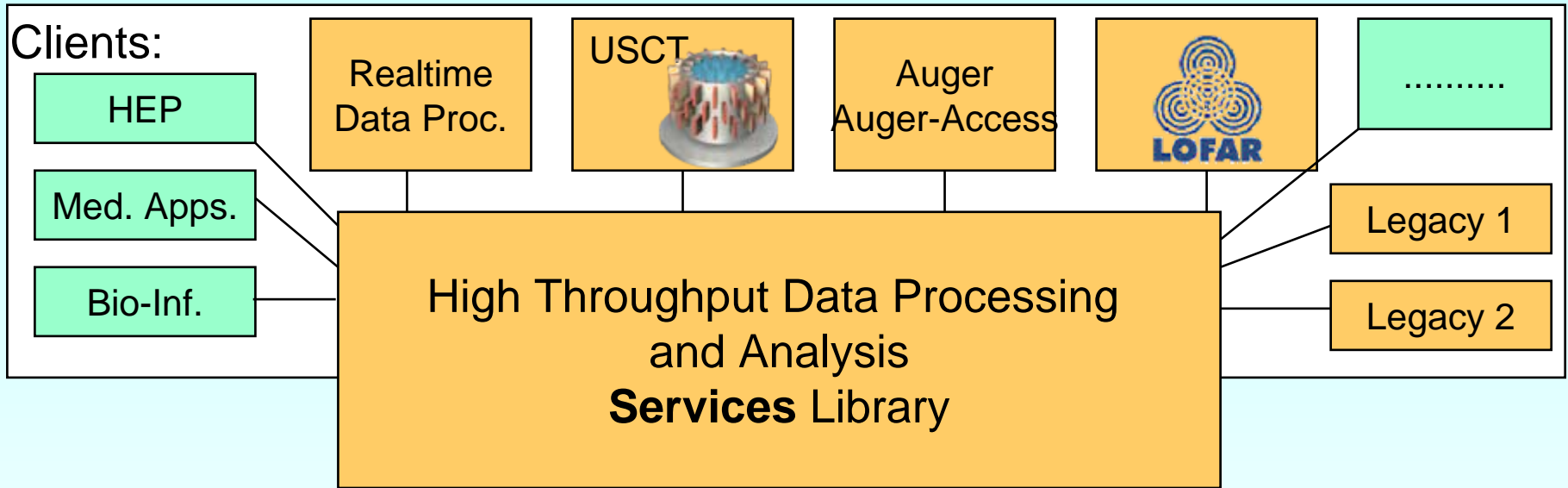
Desktop
computer
systems



GRID structure for scientific computing



Services Library

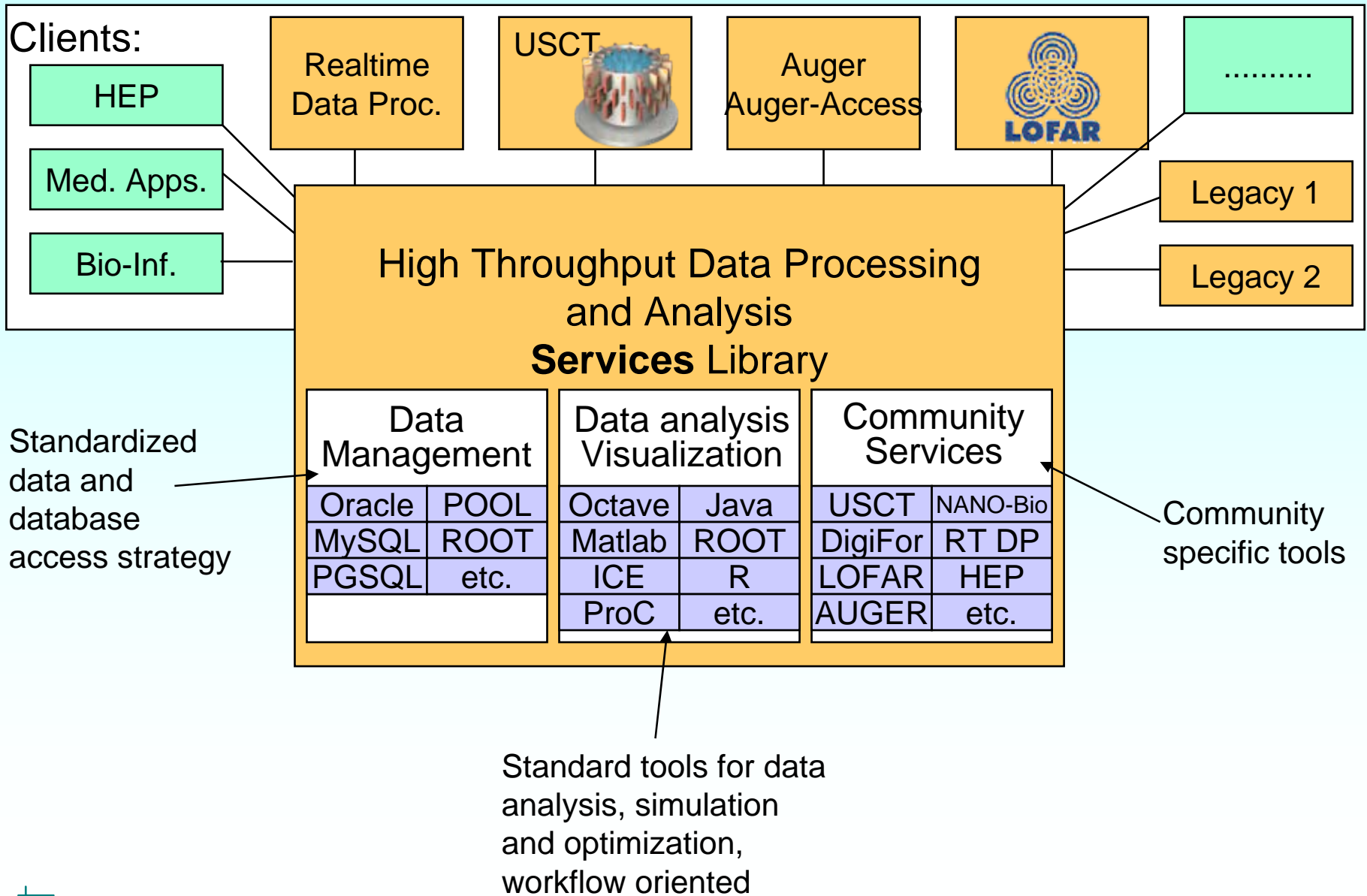


Services library:

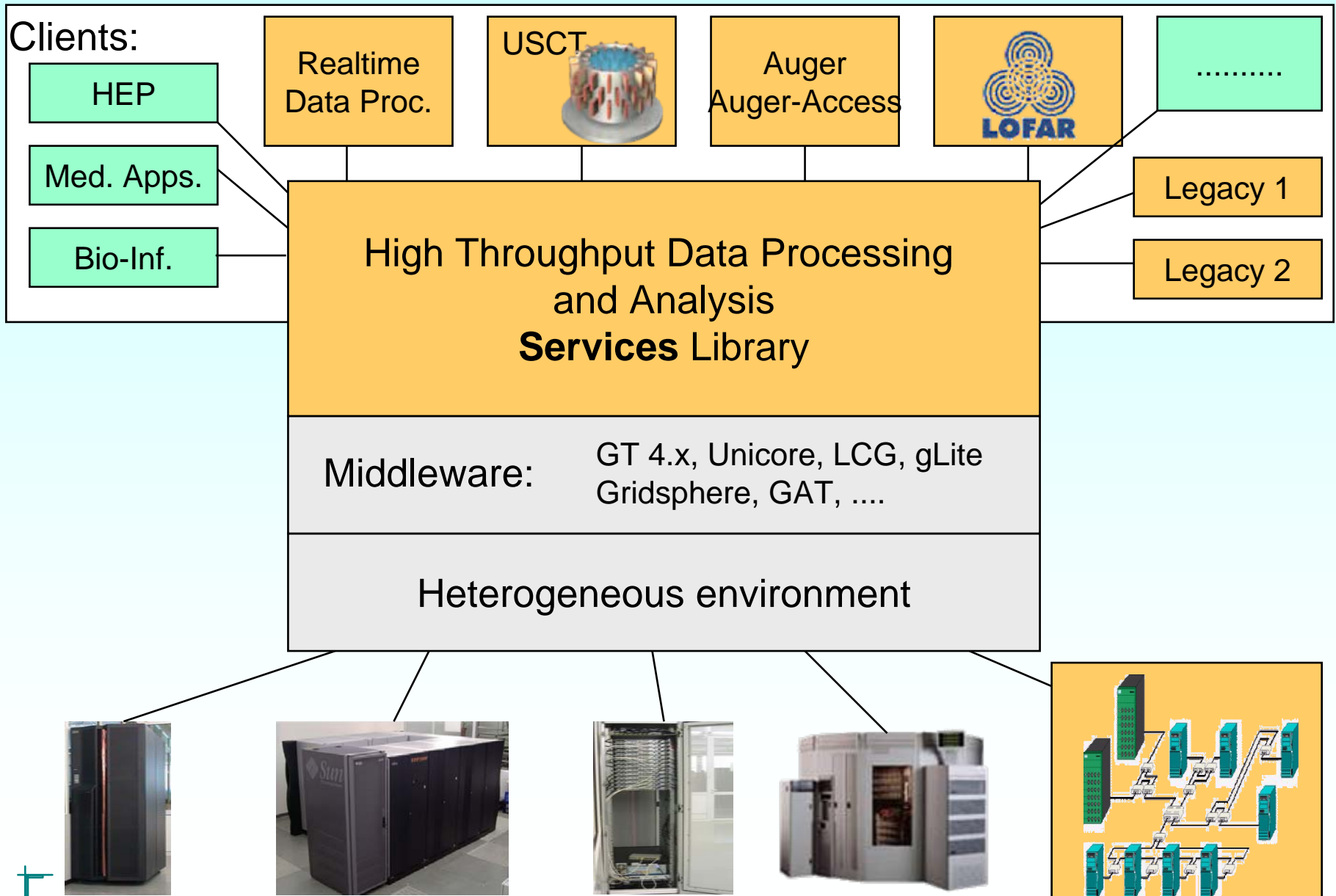
- Toolkit with basic services
- Easy and standardized access to services
- Clients: platform independent, programming language independent
- Availability, reliability, high data throughput

- Algorithm development using work-flows
- Simple deployment

Services Library

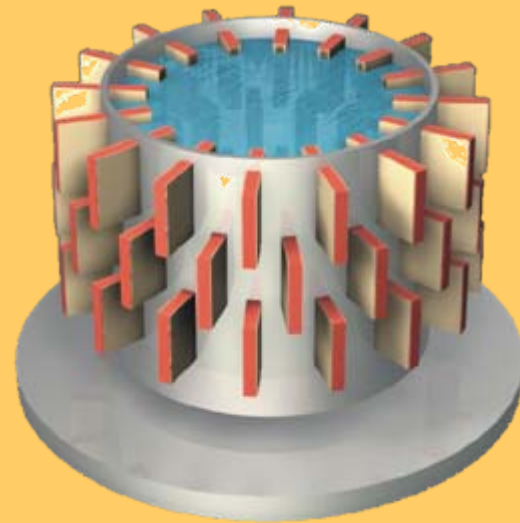


GRID structure for scientific computing



Ultrasound computer tomography

- Full synthetic aperture
- Max. data rate: 2.4 Tbit/s
- Image reconstruction:
2 weeks comp. time (single PC)
- Algorithms similar to LOFAR



Summary

Forschungszentrum Karlsruhe:

- CampusGrid resources:
512 nodes Opteron cluster until 2008

Extension of CampusGrid:

- Dynamic integration of idle desktop computer systems
- High throughput data processing and analysis services library

Close cooperations with MPA Garching, AI Potsdam, FZ Jülich, etc.
(D-Grid ASTROGrid-D):

- Common software structure
- Integration of ProC, work-flow engine