Grid Components and Tools

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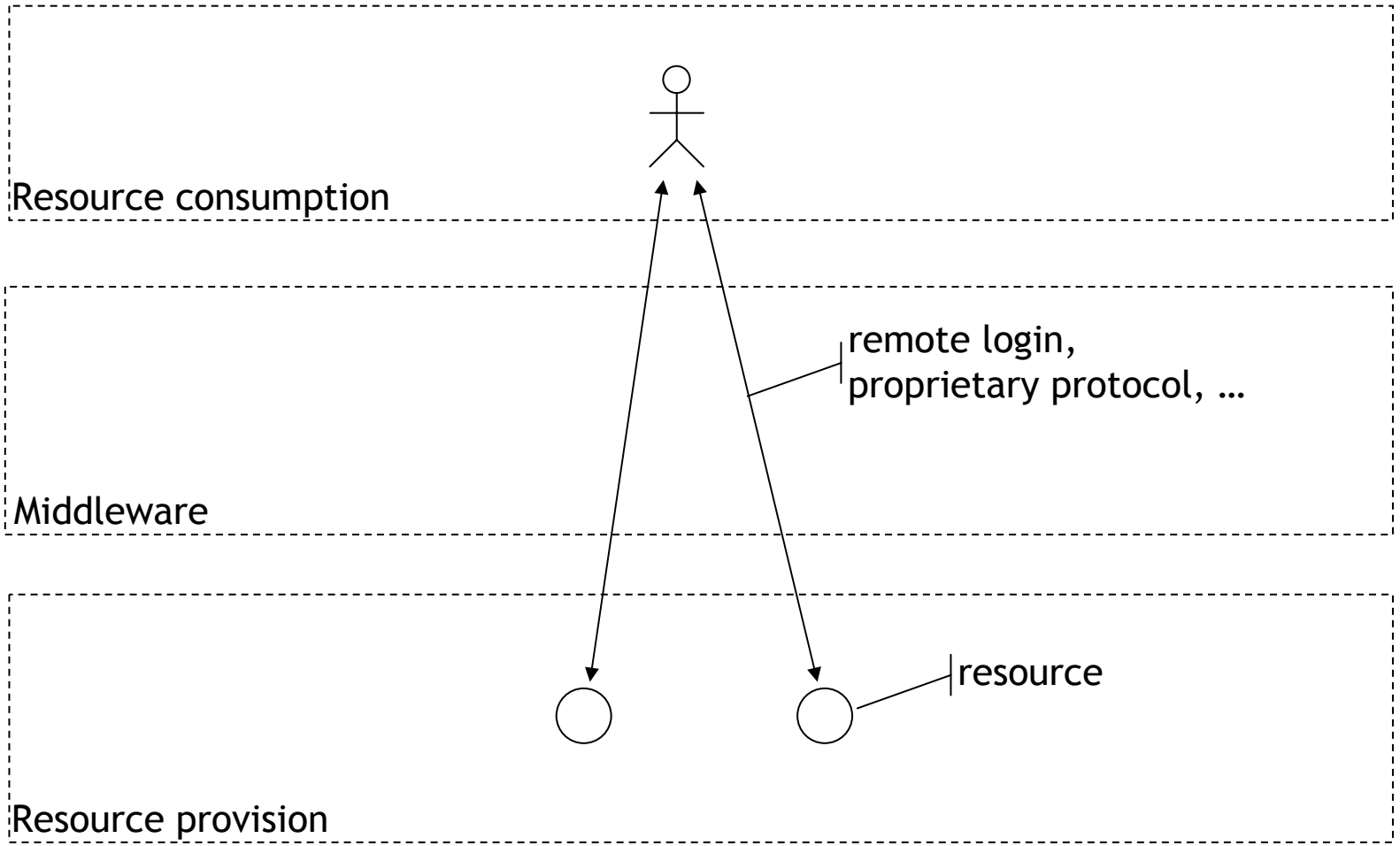
Grid: Vision

"… as today's enterprise systems are transformed from separate computing resource islands to integrated, multitiered distributed systems, service components can be integrated dynamically and flexibly, both within and across various organizational boundaries." Foster et.al., "The Physiology of the Grid"

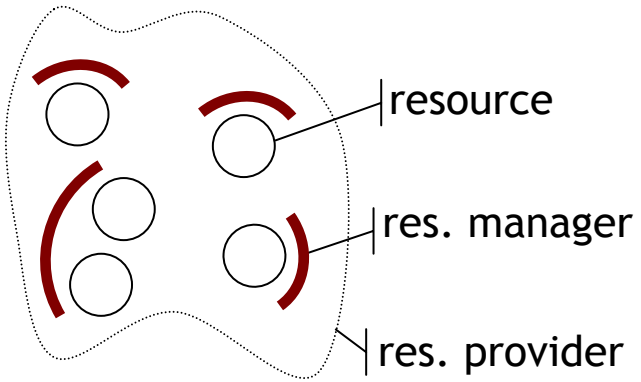
- Co-ordinated sharing of resources
- Dynamic virtual organisations
- Interoperability & standards

Grid: Landscape



Components I: Resource provision

- Resource types:
  - Computing, data, network, software, ...
  - … but also: sensors, instruments, humans
- Resource managers:
  - Provide abstraction layer
  - Access point for middleware
- Resource providers:
  - Autonomy
  - Max. utilisation/profit/…



In general: Resources not exclusively for Grid use

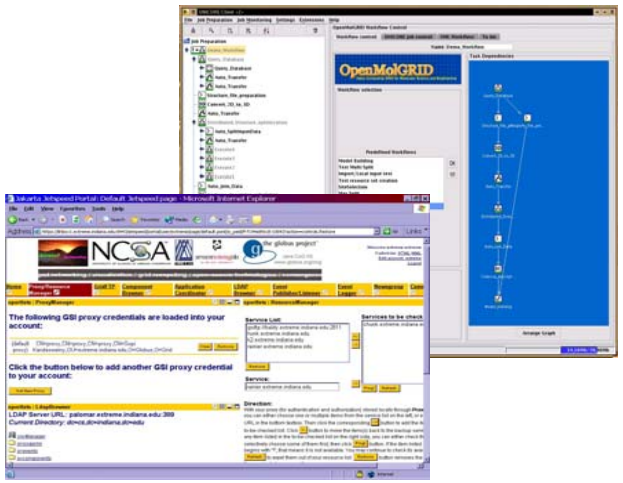
Components II: Middleware

- Provide information
  - Dynamic resource/user/… information
- Manage resources
  - Broker, scheduler, ...
- Support work flow execution
  - Orchestration & co-ordination of Grid components
  - Control flow of work
- Enable Virtual Organisations
  - Ad-hoc creation of Grids

Middleware should be transparent

Components III: Resource consumption

- APIs & SDKs
  - Integration of Grid functions into applications
  - Standard API for user interaction desirable
- Work flow components
  - Providing Grid functions to end-user
  - Work flow submission, monitoring, control
- Portals
  - Grids for communities



Decrease user effort to Grid utilisation

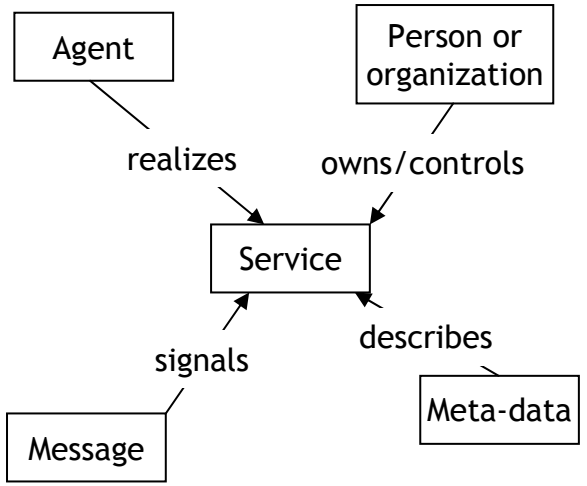
Common properties

A Grid has to be

- **Easy-to-use**: end-users, but also developers
- **Open & pervasive:** see WWW
- **Interoperable:** protocols, languages, semantics
- **Secure:** AAA, trust-models, integrity, …
- **Scalable:** increase of Grid “nodes” transparent
- **Reliable:** complex Grid ≠ complex failure modes
- **Persistent**: personal, local & global

The Service Approach

- Web Services
  - Technological foundation of many Grid developments (WSDL, SOAP, …)
  - Inheritance of pro.s (tooling, ..) and con.s (performance, …)
- Service Oriented Architecture
  - Component architectures easy portable
  - Encapsulation of existing functionality as services

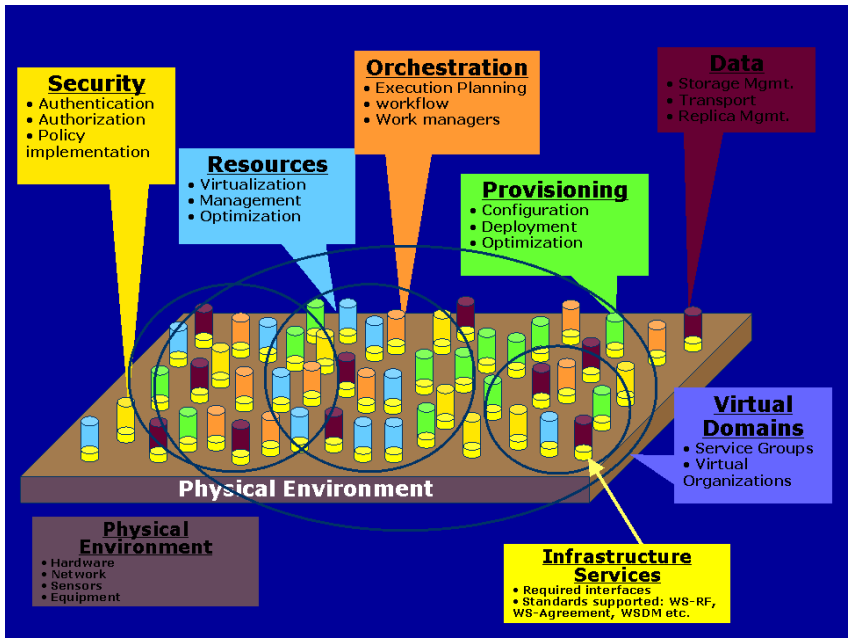


Service oriented model, Source: W3C, WS Architecture

Grid + WS + SOA = ?

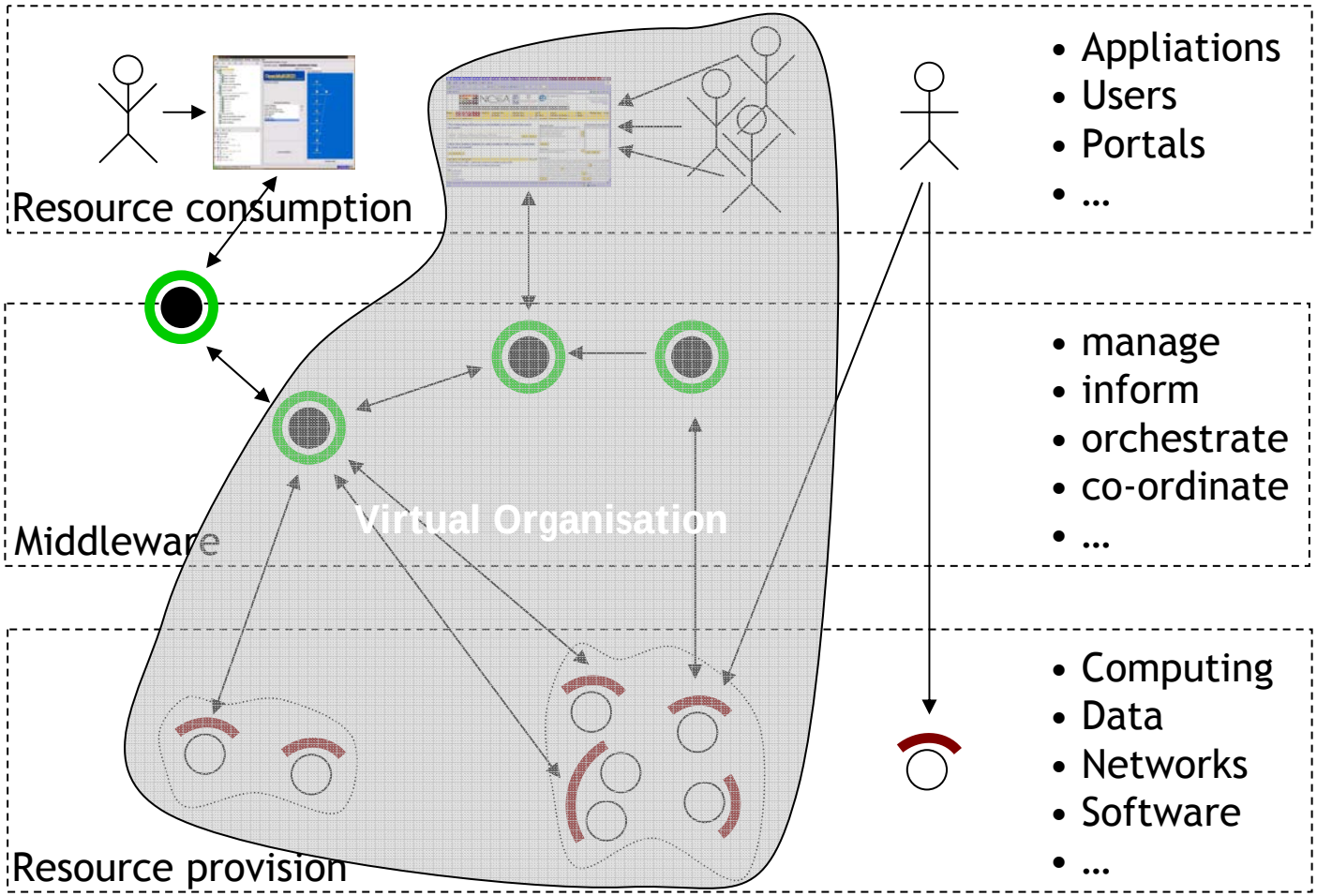
The Service-Oriented Grid

- Grid Service
  - An extended Web Service?
  - A service providing Grid functionality?
- Open Grid Services Architecture (OGSA)
  - Framework for integration, virtualisation & management of distributed systems
  - Definition of a core set of services (+ resource models, interaction, …)



"OGSA framework", OGSA version 1.0, © Global Grid Forum

Putting it together …



Tool selection: criteria

- Which components are provided?
- Extensibility
- Is all necessary functionality exposed?
- Standards compliance
- Interoperability with other tools
- As well as:
  - License (open source, commercial, …)
  - Support (community, professional, …)
  - In-house knowledge
  - Documentation
  - Roadmap
  - Stakeholder preferences

Selected tools (academic)

- Condor-G
  http://www.cs.wisc.edu/condor/condorg
- EGEE gLite
  http://glite.web.cern.ch/glite
- GridLab
  http://www.gridlab.org
- Globus & CoG Kit
  http://www.globus.org & http://www-unix.globus.org/cog/java/
- UNICORE
  http://unicore.sourceforge.net

Selected tools (commercial)

- Avaki
  http://www.avaki.com
- GridSystems
  http://www.gridsystems.com
- Platform LSF
  http://www.platform.com/products/LSFfamily
- Sun N1
  http://wwws.sun.com/software/n1gridsystem

What to expect in future?

- Present Grid systems:
  - Static, closed Grid installations often with one specific focus
  - Non-standard, monolithic, hard-to-install systems
  - Little interoperability by design
- Future Grid systems:
  - OGSA-compliance
  - Support for standards (GGF, OASIS, W3C)
  - Built-in interoperability
  - Semantic Grids
  - A Grid programming language, a Grid OS …?

Selected information sources

- Next Generation Grids 1 & 2
  http://www.cordis.lu/ist/grids/pub-report.htm
- National Science Foundation Middleware Initiative (NMI)
  http://www.nsf-middleware.org
- Baker et.al., “Grids and Grid technologies for wide-area distributed computing”
  www.buyya.com/papers/gridtech.pdf
- Philipp Wieder
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