# The EDG Testbed

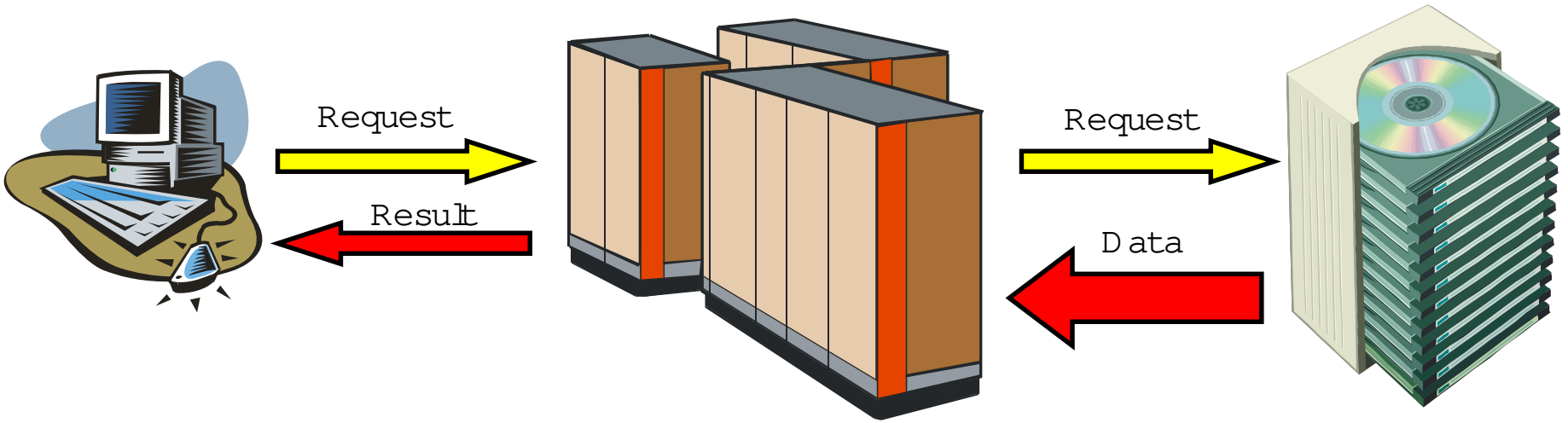
The European DataGrid Project Team

http://www.eu-datagrid.org

# Contents

- User's Perspective of the Grid
- Grid Services
- Hardware Components of an EDG Testbed
- The EDG Testbed Configuration
- How to set up an EDG Testbed
  - Obtaining code
  - Configuring different machines

# A 3 Tier Business Architecture




**Client**

**Application Server**

**Data Server**

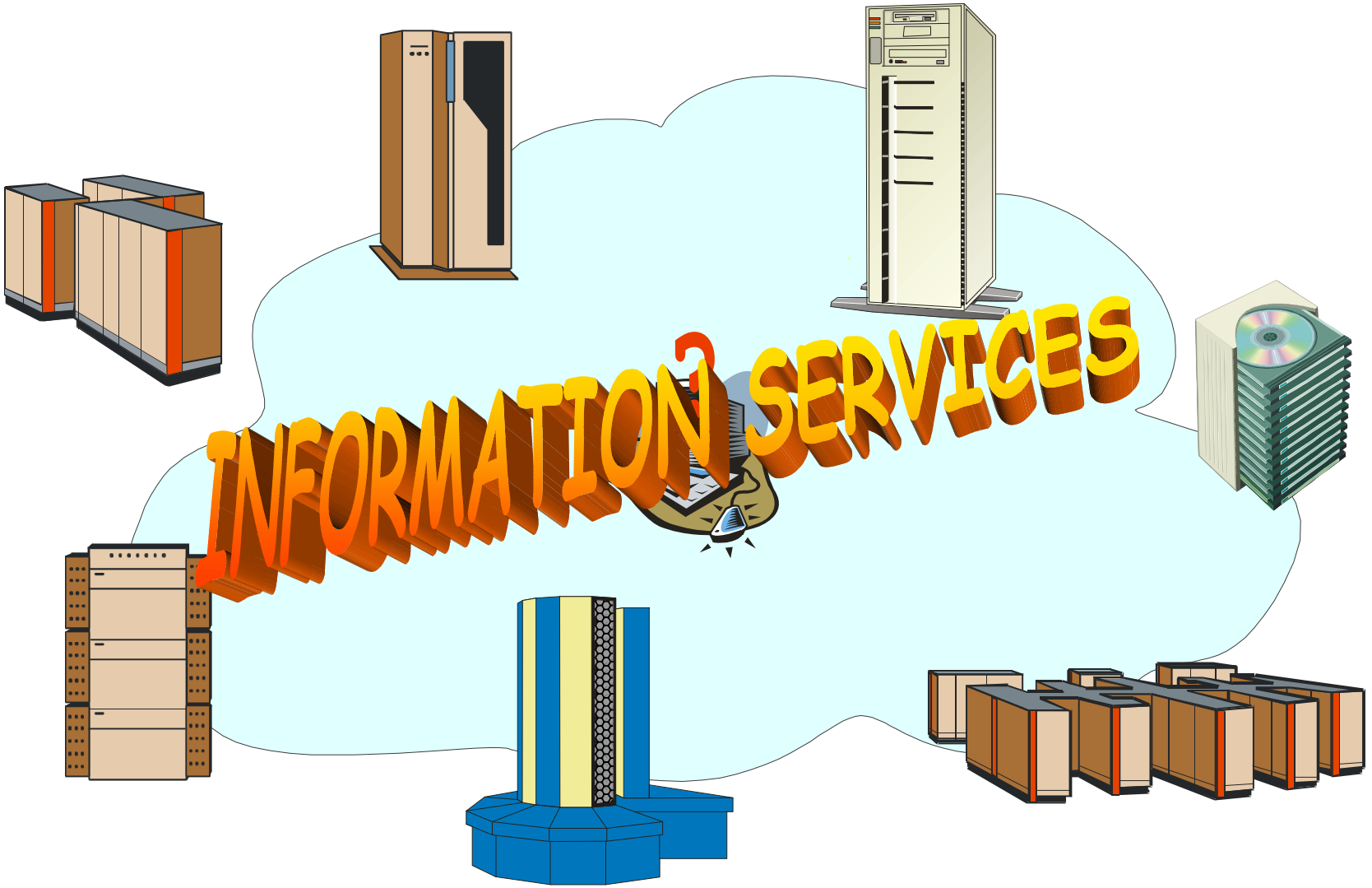
**On the EDG:**

**User Interface**

**Computing Element/ Worker Nodes**

**Storage Element**

# Situation on a Grid



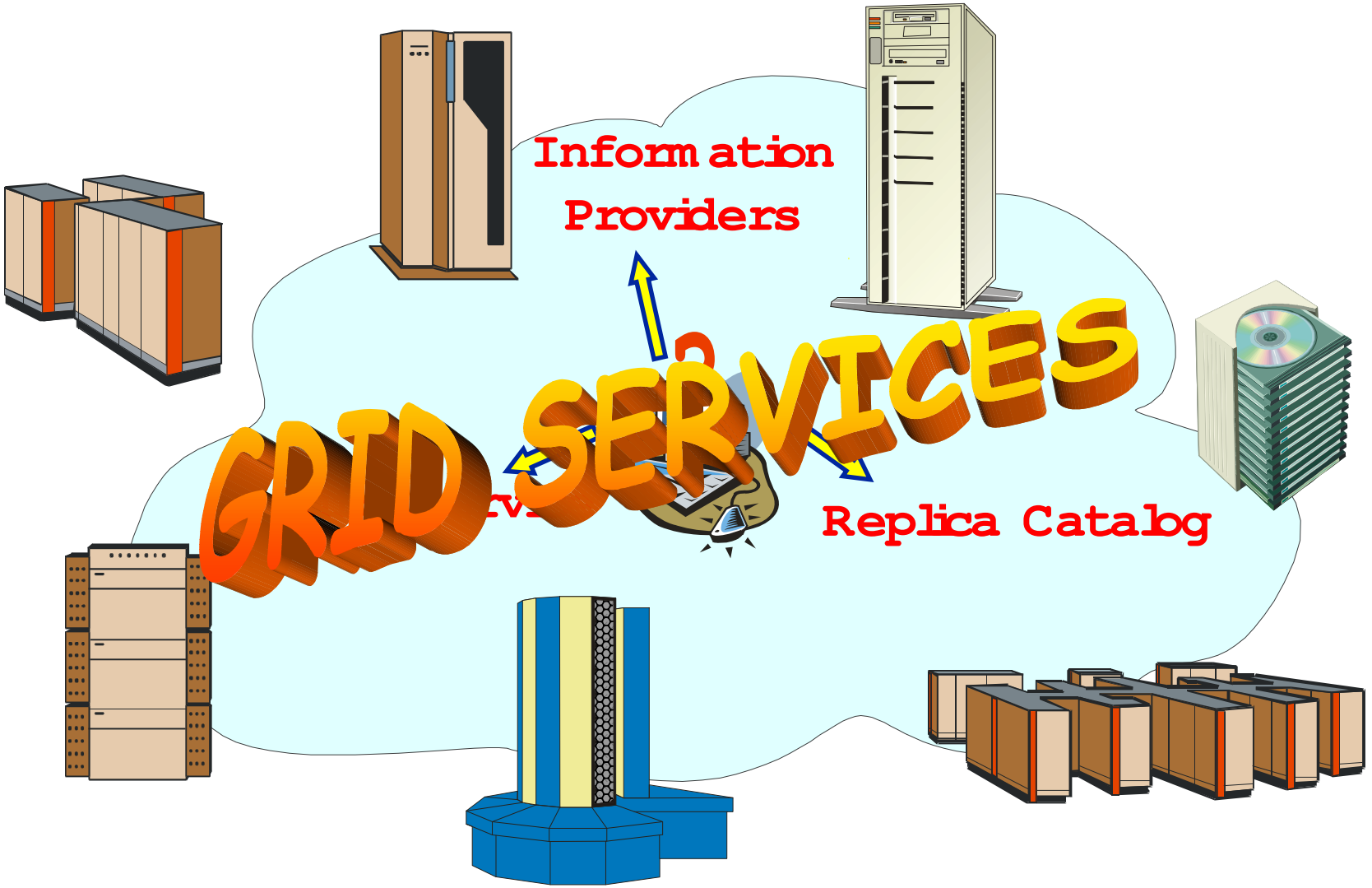
# Information Services

- Hardware:
  - EDG Information Service
  - Information Providers
- Data:
  - Replica Catalog
- Software & Services:
  - EDG Grid Services:
    - Information Service
  - Application Services:
    - Currently only EDG applications directly supported

Machine Types:

- Information Service (IS)
- Replica Catalog (RC)

# Situation on a Grid Cont'd

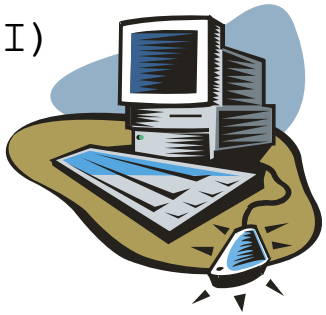


# Main EDG Grid Services

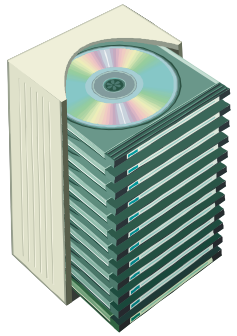
- Authentication & Authorization
- Job submission service
  - Resource Broker
- Replica Management
  - Grid Data Mirroring Package (GDMP)
  - EDG-Replica-Manager (Globus Replica Manager)
  - Mass storage system support
- Logging & Bookkeeping

# EDG Logical Machine Types

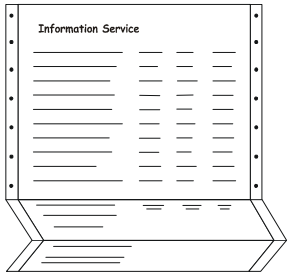
- User Interface (UI)



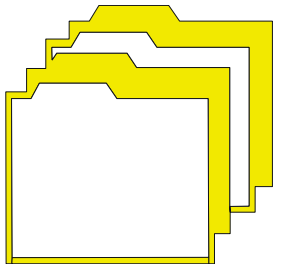
- Storage Element (SE)



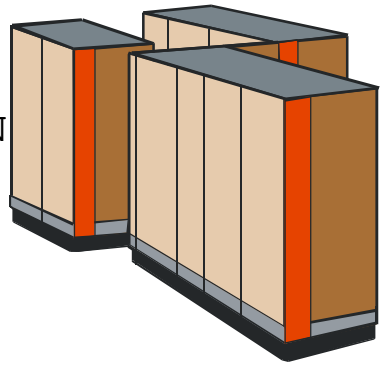
- Information Service (IS)




- Replica Catalog (RC)



- Computing Element (CE)
  - Frontend Node
  - Worker Nodes (WN)

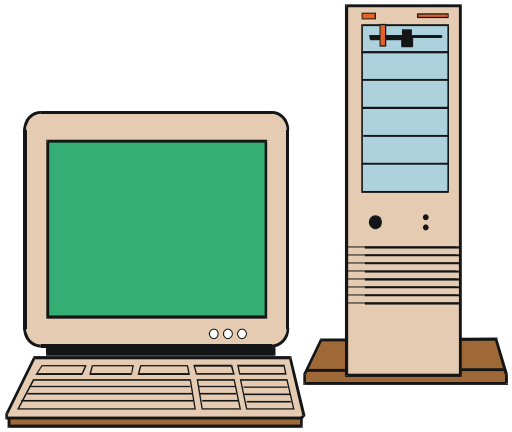


- Resource Broker (RB)

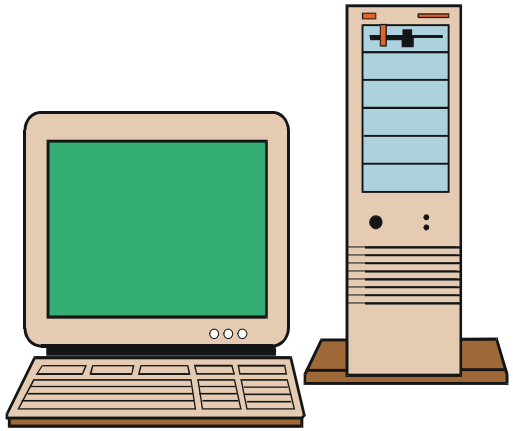
# Services per Machine Type

| Deamon | UI | IS | CE (frontend) | WN | SE | RC | RB |
|---|---|---|---|---|---|---|---|
| Globus Gatekeeper | – | – | ✓ | – | – | – | – |
| Replica Catalog | – | – | – | – | – | ✓ | – |
| GSI-enabled FTPd | – | – | ✓ | – | ✓ | – | ✓ |
| Globus MDS | – | ✓ | ✓ | – | ✓ | – | – |
| Info-MDS | – | ✓ | ✓ | – | ✓ | – | – |
| Broker | – | – | – | – | – | – | ✓ |
| Job submission | – | – | – | – | – | – | ✓ |
| Information Index | – | – | – | – | – | – | ✓ |
| Logging & Bookkeeping | – | – | – | – | – | – | ✓ |
| LocalLogger | – | – | ✓ | – | ✓ | – | ✓ |
| CRL Update | – | – | ✓ | – | ✓ | – | ✓ |
| Grid mapfile Update | – | – | ✓ | – | ✓ | – | ✓ |
| RFIO | – | – | – | – | ✓ | – | – |
| GDMP | – | – | – | – | ✓ | – | – |

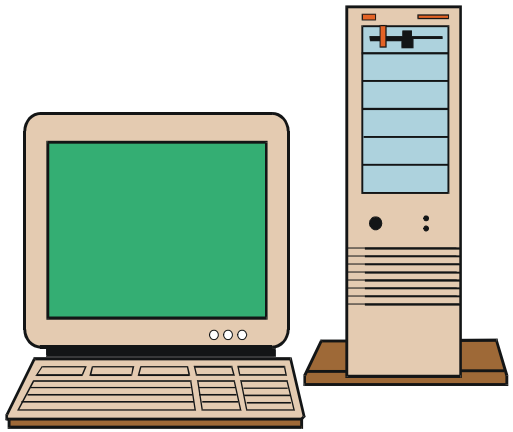
# A Simple Testbed Configuration



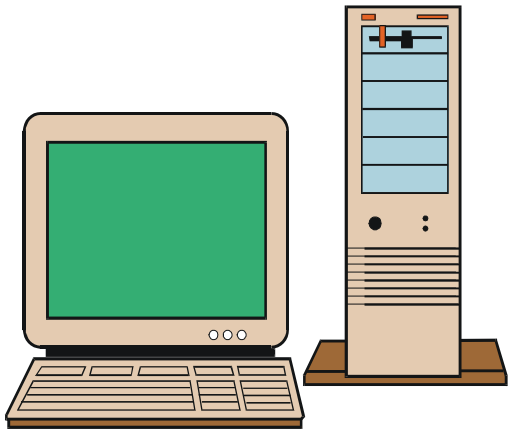
Storage Element 1



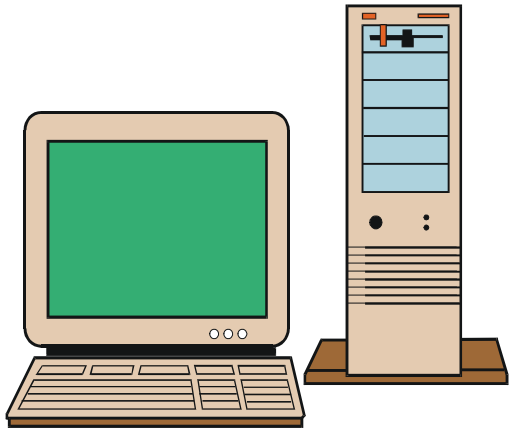
Computing Element 1



User Interface
Resource Broker
Replica Catalog
Information Service



Storage Element 2



Computing Element 2

# Testbeds

## Application Testbed: End-user Applications

- Software: Stable, certified release (EDG 1.4.3)

## Certification Testbed: Extended, Detailed Testing

- Software: Tagged release
- State: Starting...; Collaboration with Testing Group/LCG.

## Development Testbed: Integration & Evaluation of SW

- Software: Current tagged release + new pkg. → New tagged release.
- State: Active use; 5 sites involved.

## Development Machines: Testing of Middleware in Isolation

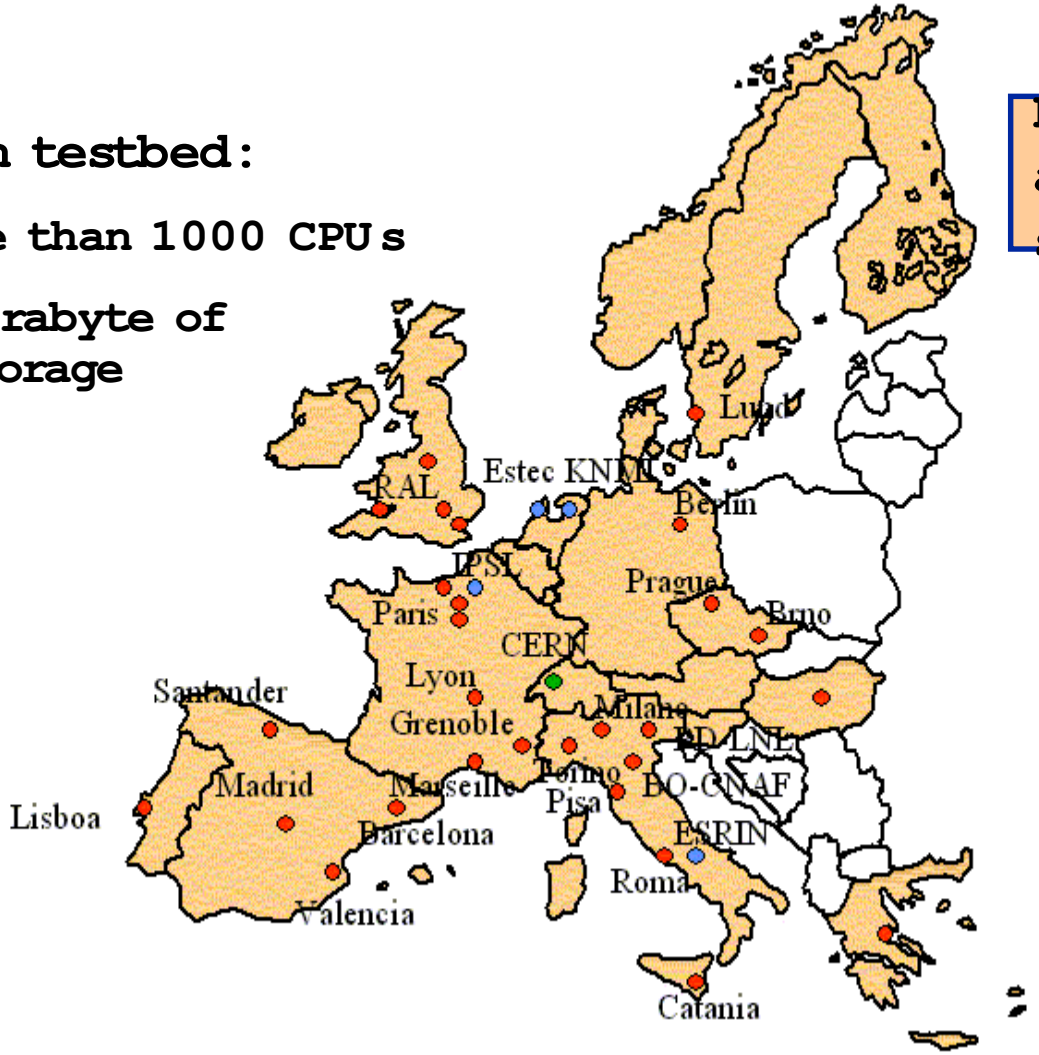
- Software: Bleeding edge versions.
- State: Varied; under control of middleware work packages.

# DataGrid testbeds

**Application testbed:**

**More than 1000 CPUs**

**5 Terabyte of storage**




**EDG sw installed at more than 40 sites**

- Dubna
- Moscow

- HEP sites
- ESA sites

# Application Testbed Resources

## Since Last Year:

- Improved software (EDG 1.4.3).
- Doubled sites. More waiting…
  - Australia, Taiwan, USA (U. Wisc.), UK Sites, INFN, French sites, CrossGrid, …
- Significantly more CPU/Storage.

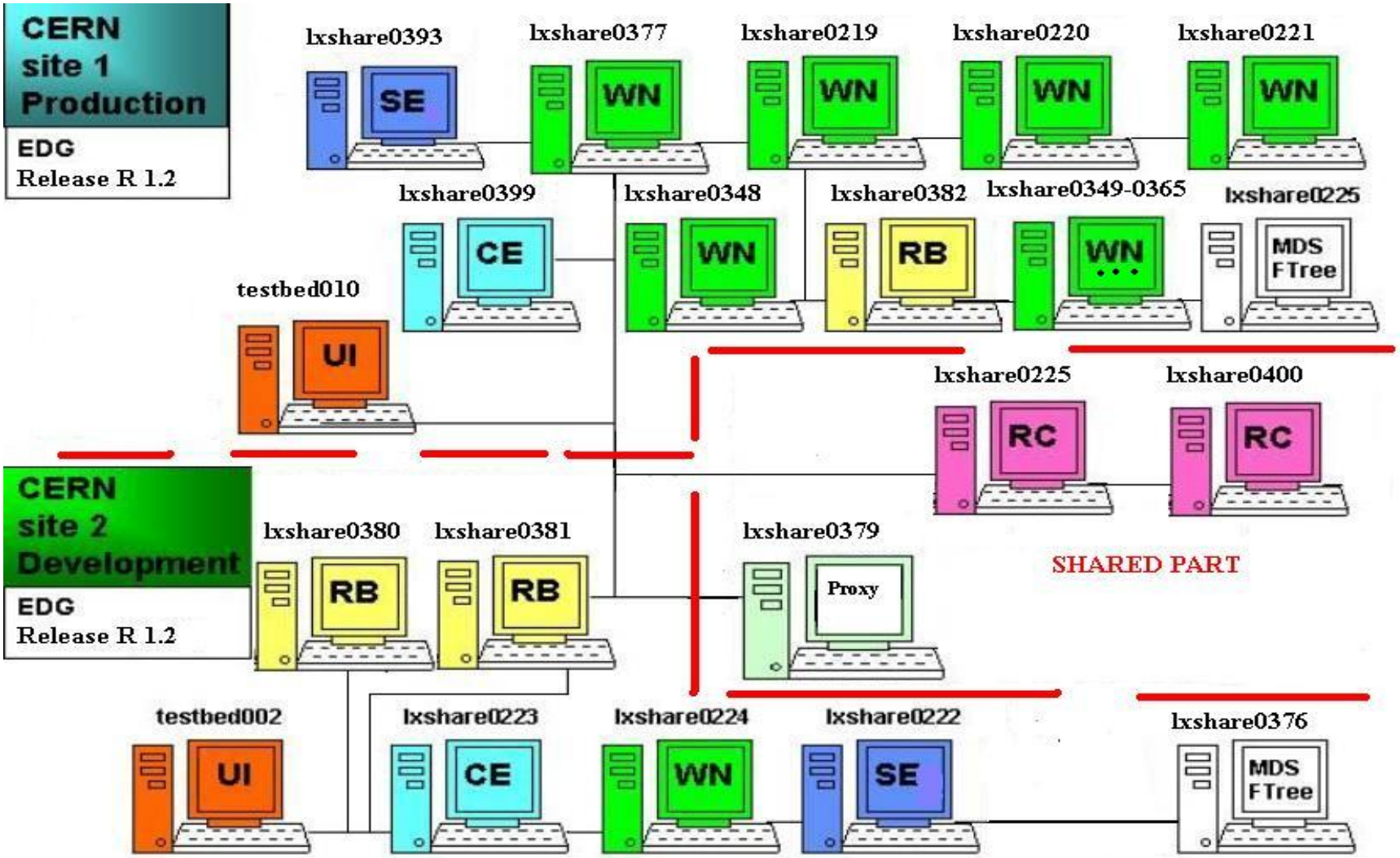
## Hidden Infrastructure

- MDS Hierarchy
- Resource Brokers
- User Interfaces
- VO Replica Catalogs
- VO Membership Servers
- Certification Authorities

| Site | Country | CPUs | Storage |
|---|---|---|---|
| CC-IN2P3* | FR | 620 | 192 GB |
| CERN* | CH | 138 | 1321 GB |
| CNAF* | IT | 48 | 1300 GB |
| Ecole Poly. | FR | 6 | 220 GB |
| ImperialColl. | UK | 92 | 450 GB |
| Liverpool | UK | 2 | 10 GB |
| Manchester | UK | 9 | 15 GB |
| NIKHEF* | NL | 142 | 433 GB |
| Oxford | UK | 1 | 30 GB |
| Padova | IT | 11 | 666 GB |
| RAL* | UK | 6 | 332 GB |
| SARA | NL | 0 | 10000+GB |
| TOTAL | 5 | 1075 | 14969 GB |

*also Dev.TB; +200 TB including tape

# Example CERN Testbed Structure



# Example IS Content

Site: NIKHEF

---

CE tbn09.nikhef.nl:2119/jobmanager-pbs-qlong:

- PBS queue "qlong" with 96 hours time limit
- Software installed: CMS-1.0.2 ATLAS-1.3.0 ALICE-3.07.01 LHCb-1.1.1 IDL-5.4 NIKHEF D0MCC-0.1-1
- There are 0 jobs running and 0 waiting, with 16 CPUs free

Close SE tbn03.nikhef.nl with mount point /flatfiles

---

CE tbn09.nikhef.nl:2119/jobmanager-pbs-qshort:

- PBS queue "qshort" with 240 minutes time limit
- Software installed: CMS-1.0.2 ATLAS-1.3.0 ALICE-3.07.01 LHCb-1.1.1 IDL-5.4 NIKHEF D0MCC-0.1-1
- There are 0 jobs running and 0 waiting, with 16 CPUs free

Close SE tbn03.nikhef.nl with mount point /flatfiles

---

SE tbn03.nikhef.nl close to 2 CEs:

- tbn09.nikhef.nl:2119/jobmanager-pbs-qshort
- tbn09.nikhef.nl:2119/jobmanager-pbs-qlong
- VOs supported: alice atlas biomedical cms earthob lhcb iteam
- gridftp on port 2811
- rfio on port 3147
- file
- 31744 Mb of free space

# EDG Software Distribution

- All software available as source & binary RPMs
- Binaries for RedHat 6.2 and RedHat 7.3
- >600 packages including
  - Complete globus distribution
  - EDG packages (~50 packages)
  - Support tools (perl, ant, jdk, ...)
- Pre-packaged for different machine types

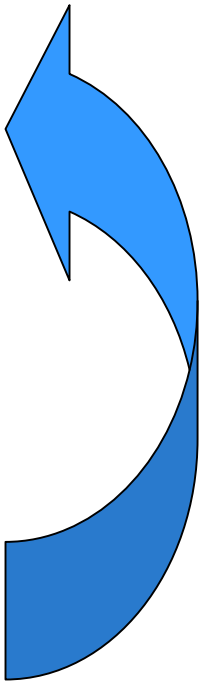
# Automatic EDG Fabric Management

## Setup Tasks

- Node Installation & Management
- Configuration Management

## Runtime Tasks

- Monitoring & Fault Tolerance
- Resource Management

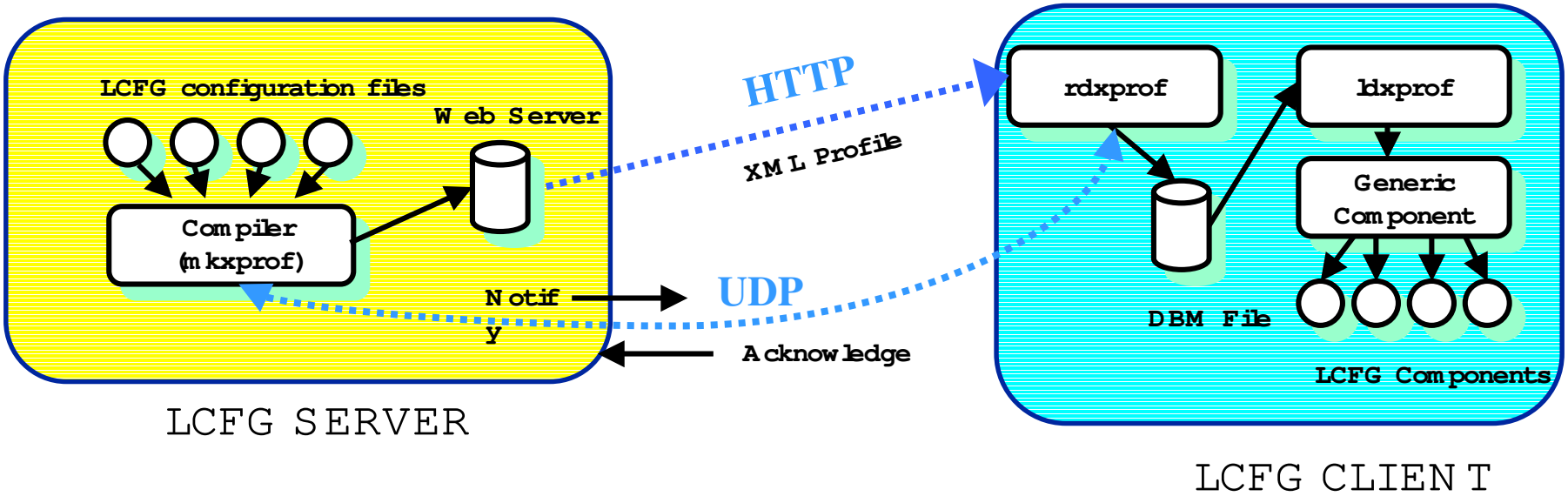


Runtime tasks may automatically trigger setup tasks

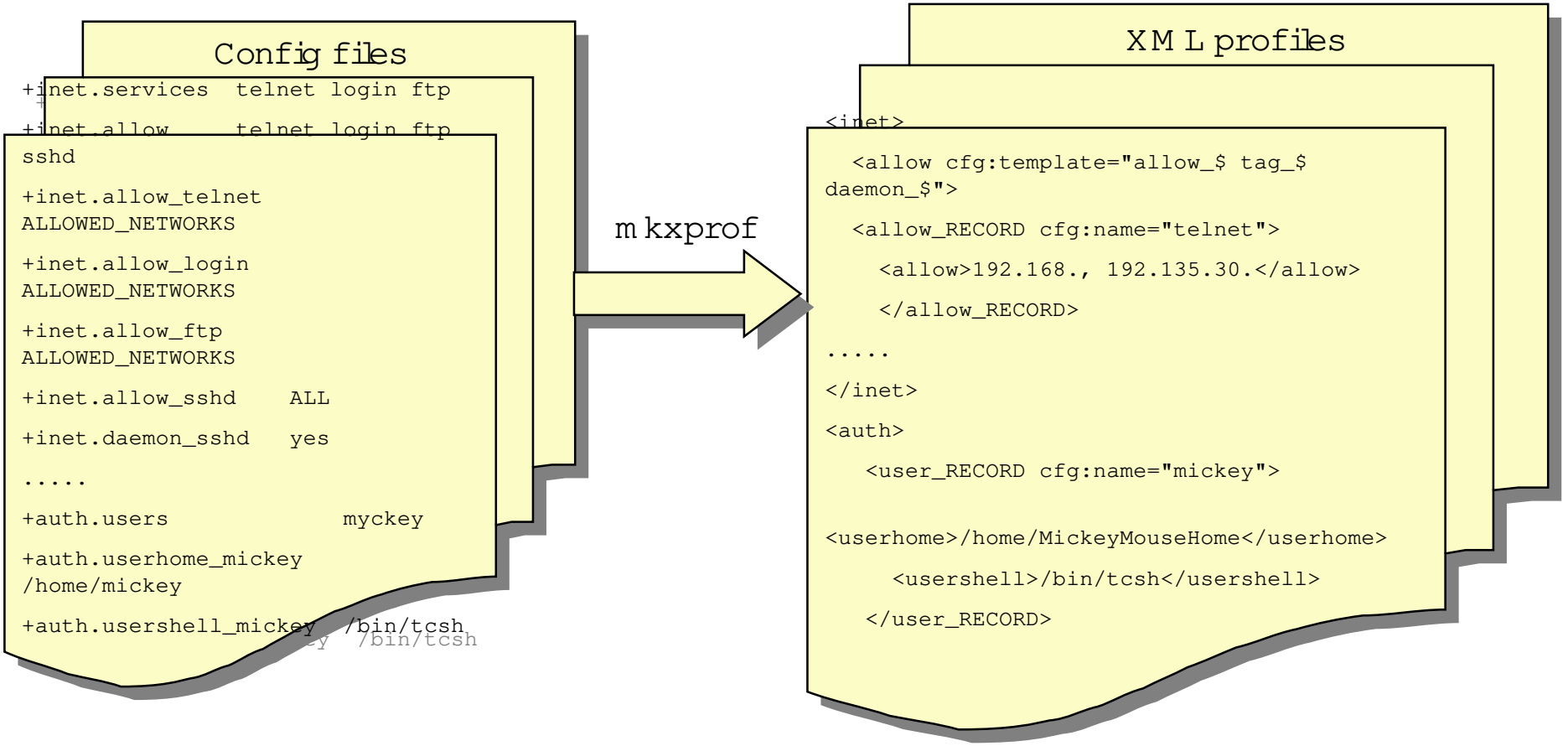
- New machines join the grid
- Failure detection/repair (e.g. restarting daemons)

# LCFG (LocalConFiGuration system)

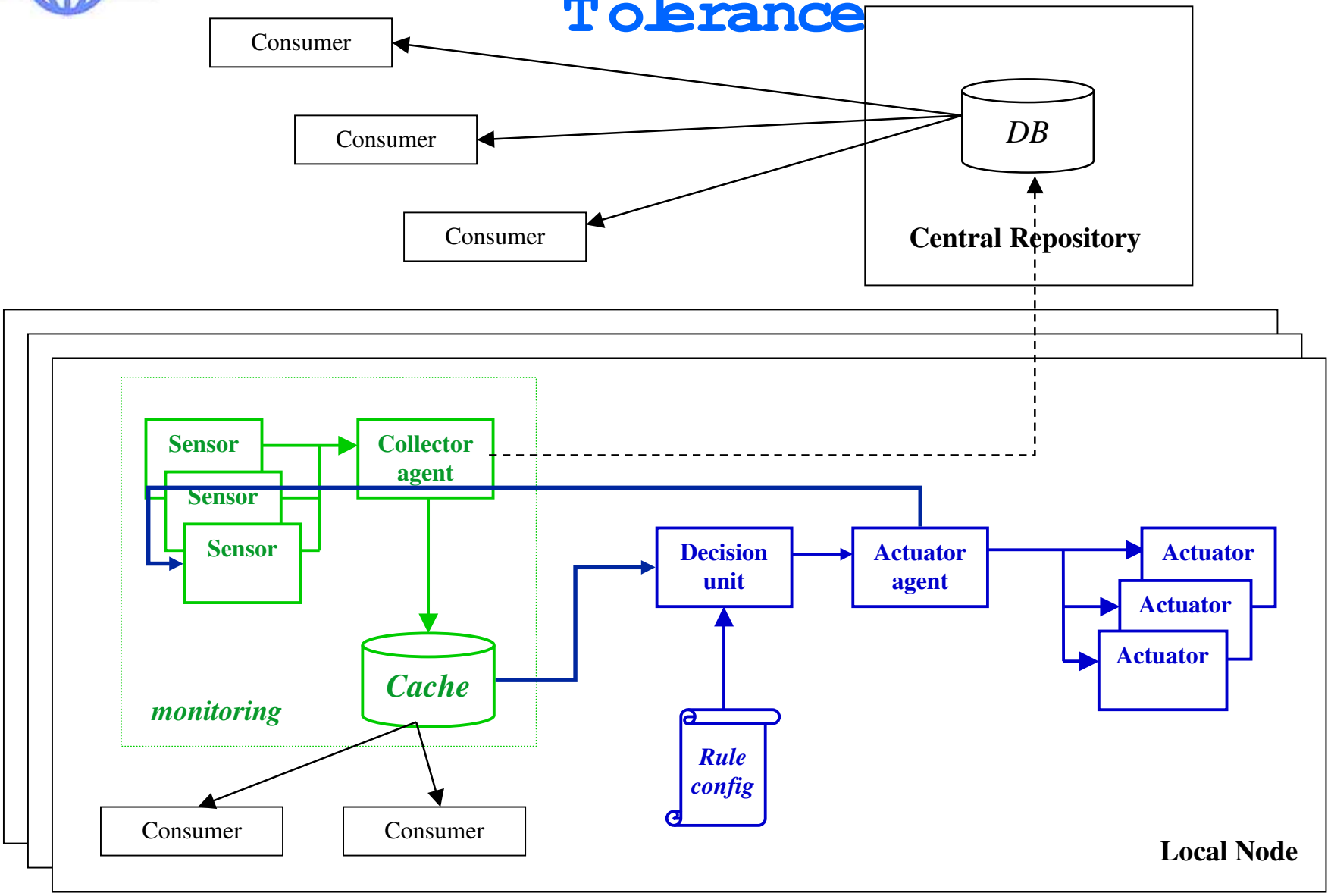
- Developed at University of Edinburgh
- Widely used fabric installation & configuration tool
- Automated installation and configuration in a very diverse and evolving environment



# Example LCFG Configuration File



# Fabric Monitoring & Fault Tolerance



# Wrap Up

- Logical machine types of an EDG Testbed
- Mapping of services to logical machines
- Example and current EDG Testbed configuration
- Code distribution strategy
- Fabric management strategy

➔ **How to set up an EDG Testbed**

# LCFG Installation

**Server setup:**

- Download rpms (perl + lcfg + apache)
- Install rpms
- Start http server (apache,...)
- Create configuration files
- Run mkxprof on them

**Client setup:**

- Download rpms (perl + lcfg)
- Install rpms
- Reboot (rdxprof will be started)

**Configuration management (server):**

- Update config files
- Run mkxprof

# EDG Machine Installation

## On the LCFG server:

- Create directories for rpms
- Download rpms from centraledg repository
- Create LCFG profile for each client machine:
  - Filename = hostname; includes machine type specific config file and site specific config file (needs to be customized!)
  - Example templates + rpm-lists are provided
  - Run mkxprof on each of these files

DONE

## On the LCFG clients:

- Setup clients as describe before

# Manual Setup (without LCFG)

- Download rpms directly on machine (RPM-lists per machine type exist)
- Install rpms
- Configure individual services (see installation guide)

# Issues when Adding new Sites to the Testbed

- EDG is currently setting-up procedures explaining how to add new sites
  - Variations already tested with Taiwan and Romania
  - Step-by-step instructions produced which we expect to become simpler over time
- Need to clarify the "*minimum requirements*" for a site to become a member of the testbed
  - A number of regular tasks have to be performed by the sites administrators
  - A maximum delay needs to be defined for responding to requests/problems if the testbed is to run efficiently
- Sites from new countries have to identify/create a supporting CA
  - Since CAs need mutual trust this could lead to an explosion of inspection activities
- Some tasks will fall on the people responsible for managing the VOs
  - HEP experiment secretariats already perform some level of authentication of their institutes and members. How an we get some leverage from this?

# Summary

- Logical machine types of an EDG Testbed
- Mapping of services to logical machines
- Example and current EDG Testbed configuration
- Code distribution strategy
- Fabric management strategy
- How to obtains EDG software
- How to automatically configure machines

# Outlook

- Release 1.4.3 currently deployed

- Release 2.0 (currently being deployed, rollout expected May 2003) will contain more advanced services
  - Advanced information systems (based upon relational databases)
  - Enhanced security
  - Optimization (resource broker and replica management)
  - Fabric management with monitoring, automatic fault detection & recovery

# Further Information

- EDG Testbed homepage:

  http://marianne.in2p3.fr/

- Fabric management:

  http://hep-proj-grid-fabric.web.cern.ch/hep-proj-grid-fabric/

- LCFG on EDG Testbed information:

  http://www.lnl.infn.it/datagrid/wp4-install/

  http://datagrid.in2p3.fr/distribution/datagrid/wp4/installation/doc/