The EDG Testbed

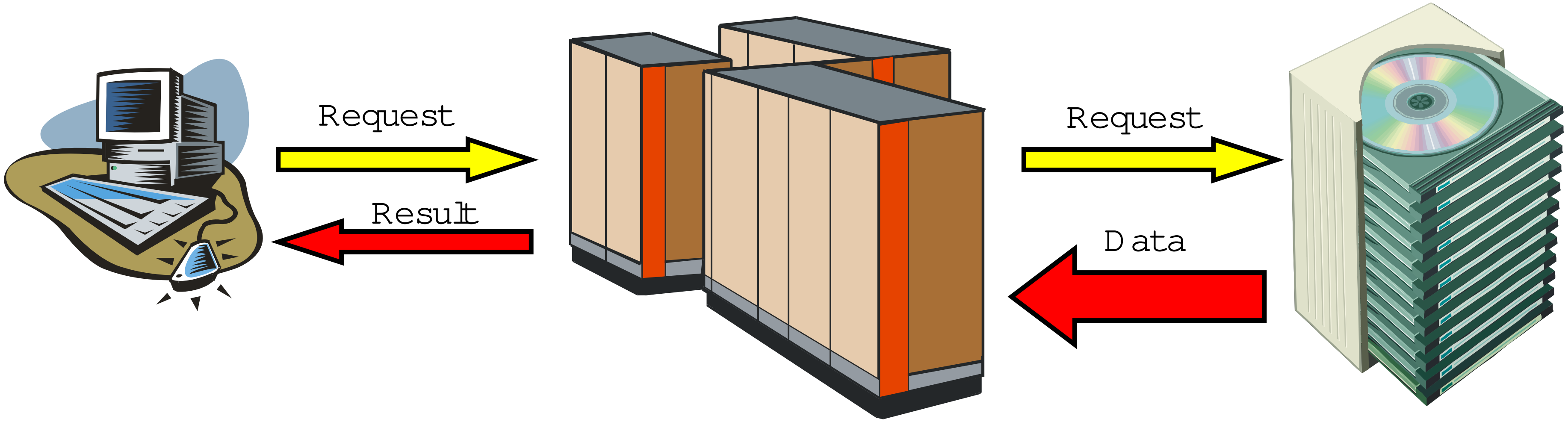
The European DataGrid Project Team

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


Request
Result
Request
Data

Client

Application Server

Data Server

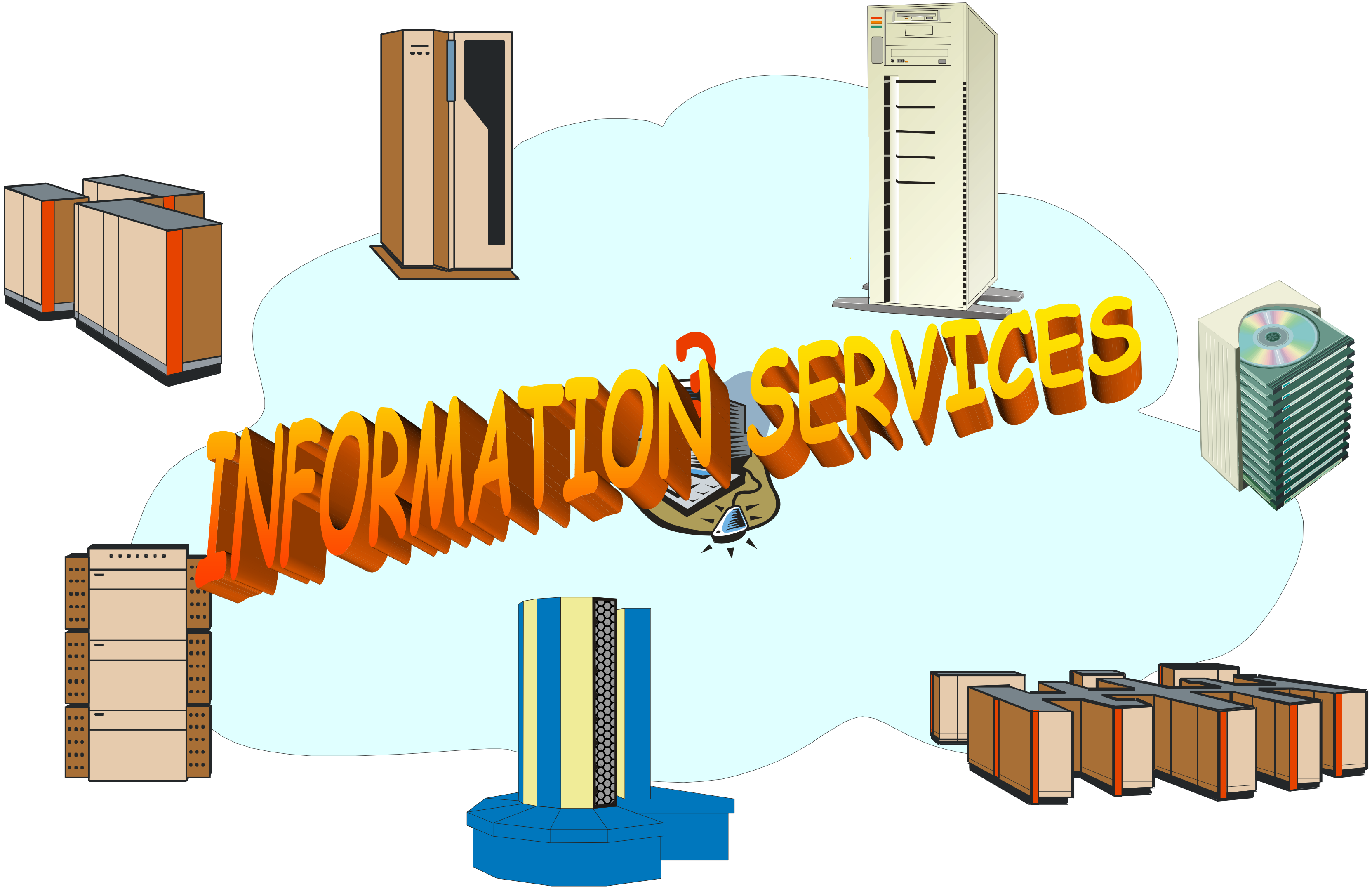
On the EDG:

User Interface

Computing Element/ Worker Nodes

Storage Element

Situation on a Grid


INFORMATION ? SERVICES

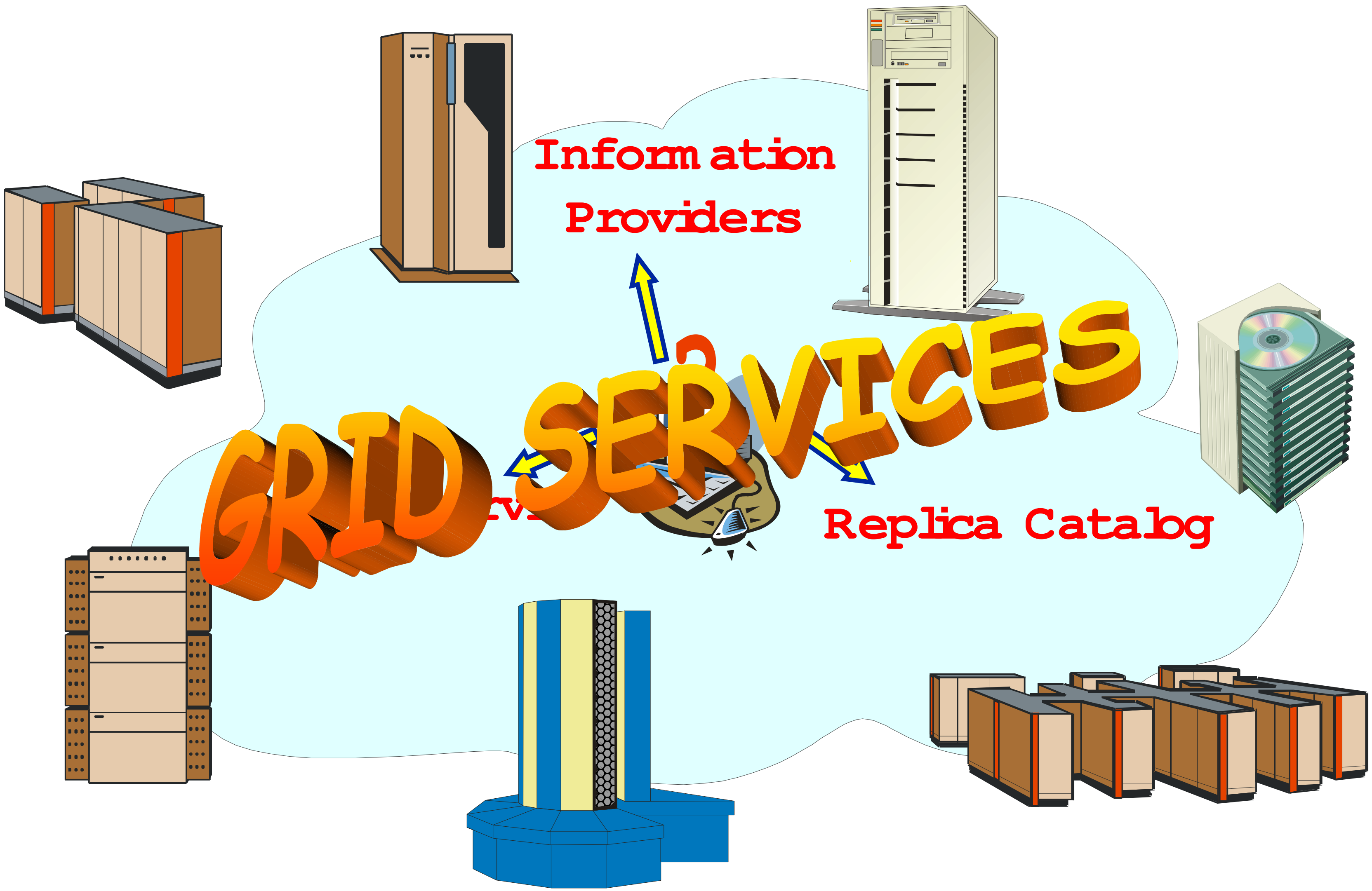
Information Services

- 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


GRID SERVICES

Information Providers

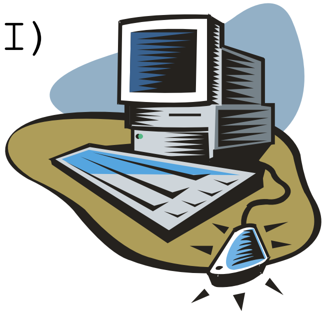
Replica Catalog

Main EDG Grid Services

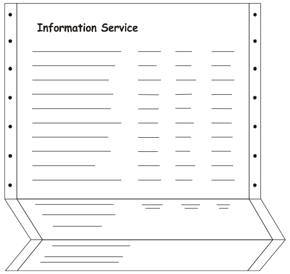
- Authentication & Authorization
- Job submission service
  - Resource Broker
- Replica Management
  - Grid Data Mirroring Package (GDMP)
  - EDG-Replica-Manager (Globus Replica Manager)
  - Mass storage system support
- Logging & Bookkeeping

EDG Logical Machine Types

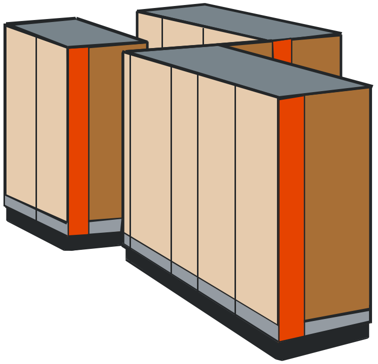
- User Interface (UI)



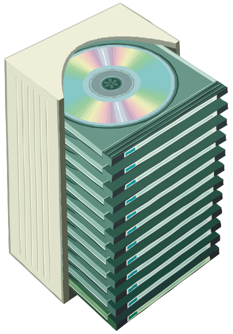
- Information Service (IS)



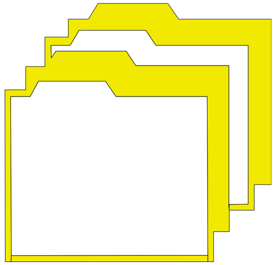
- Computing Element (CE)
  - Frontend Node
  - Worker Nodes (WN



- Storage Element (SE)



- Replica Catalog (RC)

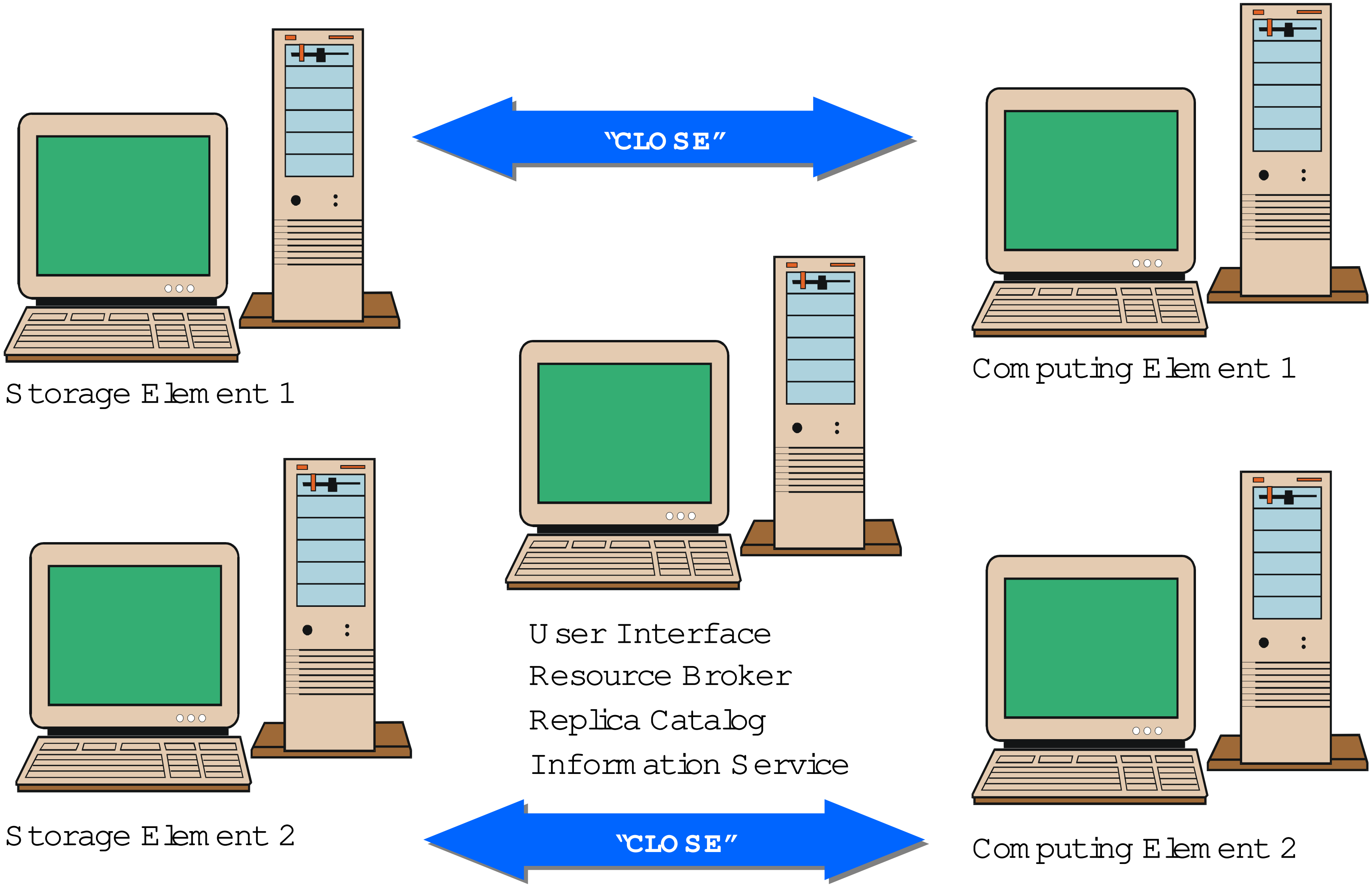


- Resource Broker (RB)

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	–	–	–	–	–	–	✓
Local Logger	–	–	✓	–	✓	–	✓
CRL Update	–	–	✓	–	✓	–	✓
Gridmapfile Update	–	–	✓	–	✓	–	✓
RFIO	–	–	–	–	✓	–	–
GDMP	–	–	–	–	✓	–	–

A Simple Testbed Configuration



Storage Element 1

“CLOSE”

Computing Element 1

User Interface
Resource Broker
Replica Catalog
Information Service

Storage Element 2

“CLOSE”

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

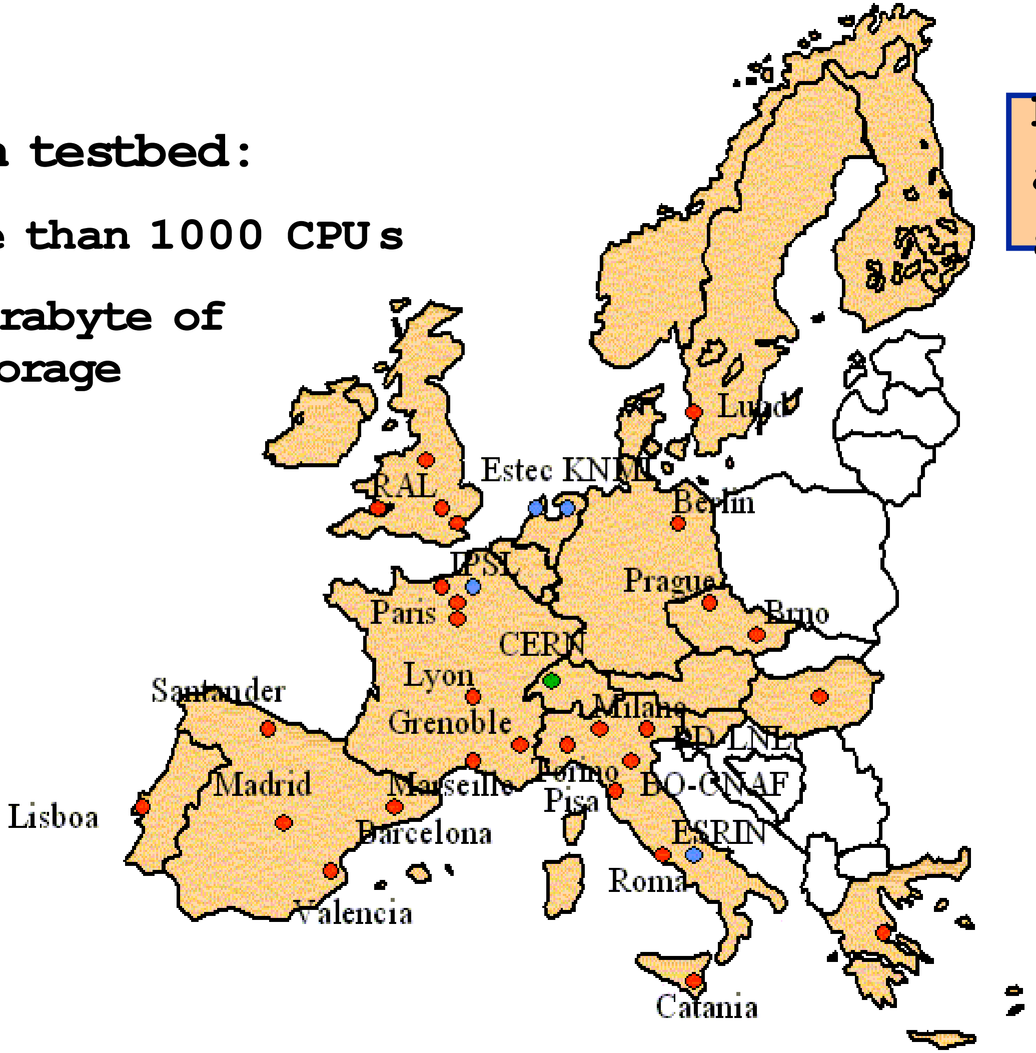
- Software: Bleeding edge versions.
- State: Varied; under control of middleware work packages.

DataGrid testbeds

Application testbed:

More than 1000 CPUs

5 Terabyte of storage


Lund
Estec
KNMI
RAL
Berlin
IPSL
Paris
Prague
Brno
CERN
Lyon
Santander
Grenoble
Milano
PD-LNL
Lisboa
Madrid
Marseille
Torino
BO-CNAF
Pisa
Barcelona
ESRIN
Roma
Valencia
Catania

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.

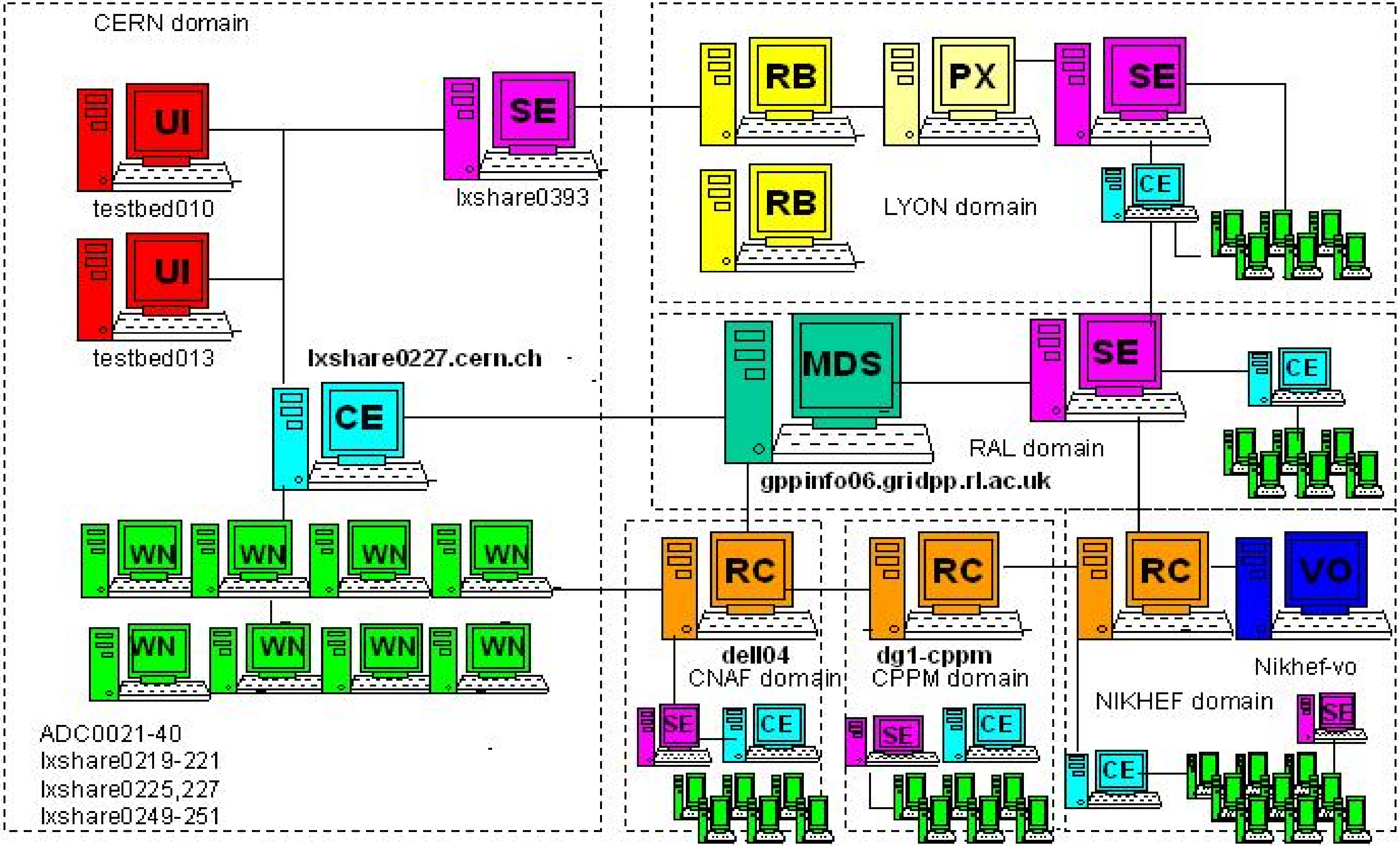
Hidden Infrastructure

- 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
Imperial Coll.	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

EDG production testbed EDG Release EDG 1.4.7
CERN Computing Element site and corresponding spread GRID services


CERN domain
UI
testbed010
UI
testbed013
SE
lxshare0393
lxshare0227.cern.ch
CE
WN
WN
WN
WN
WN
WN
WN
WN
ADC0021-40
lxshare0219-221
lxshare0225,227
lxshare0249-251
RB
PX
SE
RB
LYON domain
CE
MDS
SE
CE
RAL domain
gppinfo06.gridpp.rl.ac.uk
RC
dell04
CNAF domain
SE
CE
RC
dg1-cppm
CPPM domain
SE
CE
RC
VO
Nikhef-vo
NIKHEF domain
SE
CE

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 DOMCC-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 DOMCC-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

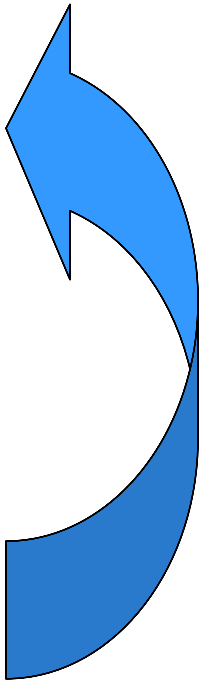
Automatic EDG Fabric Management

Setup Tasks

- Node Installation & Management
- Configuration Management

Runtime Tasks

- Monitoring & Fault Tolerance
- Resource Management

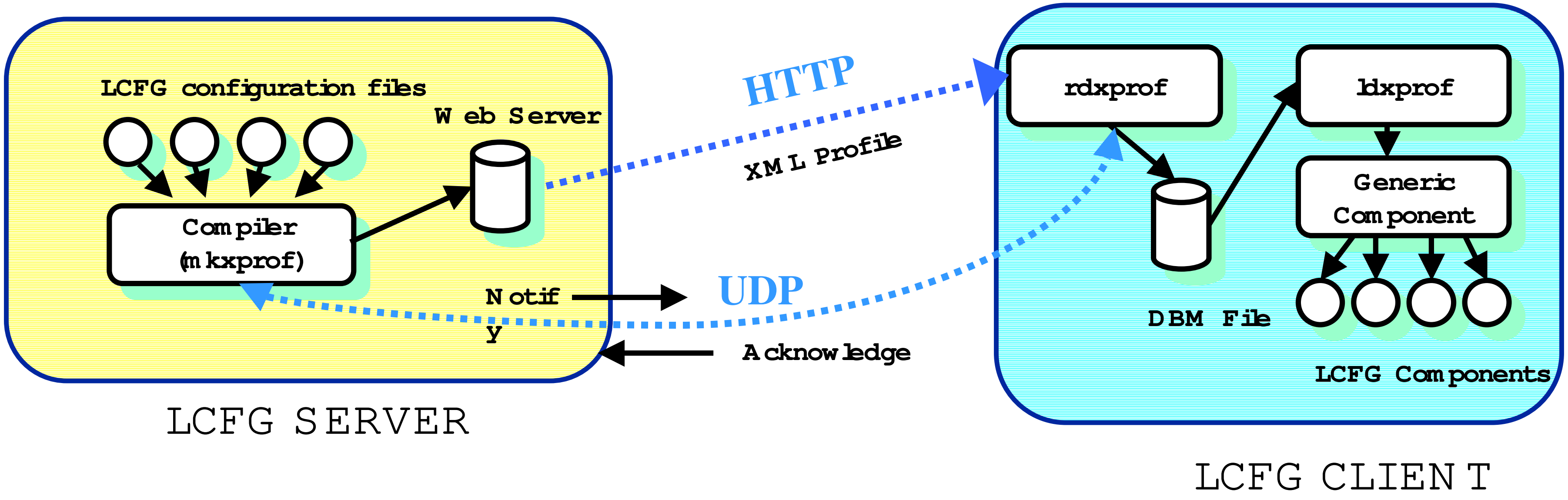


Runtime tasks may automatically trigger setup tasks

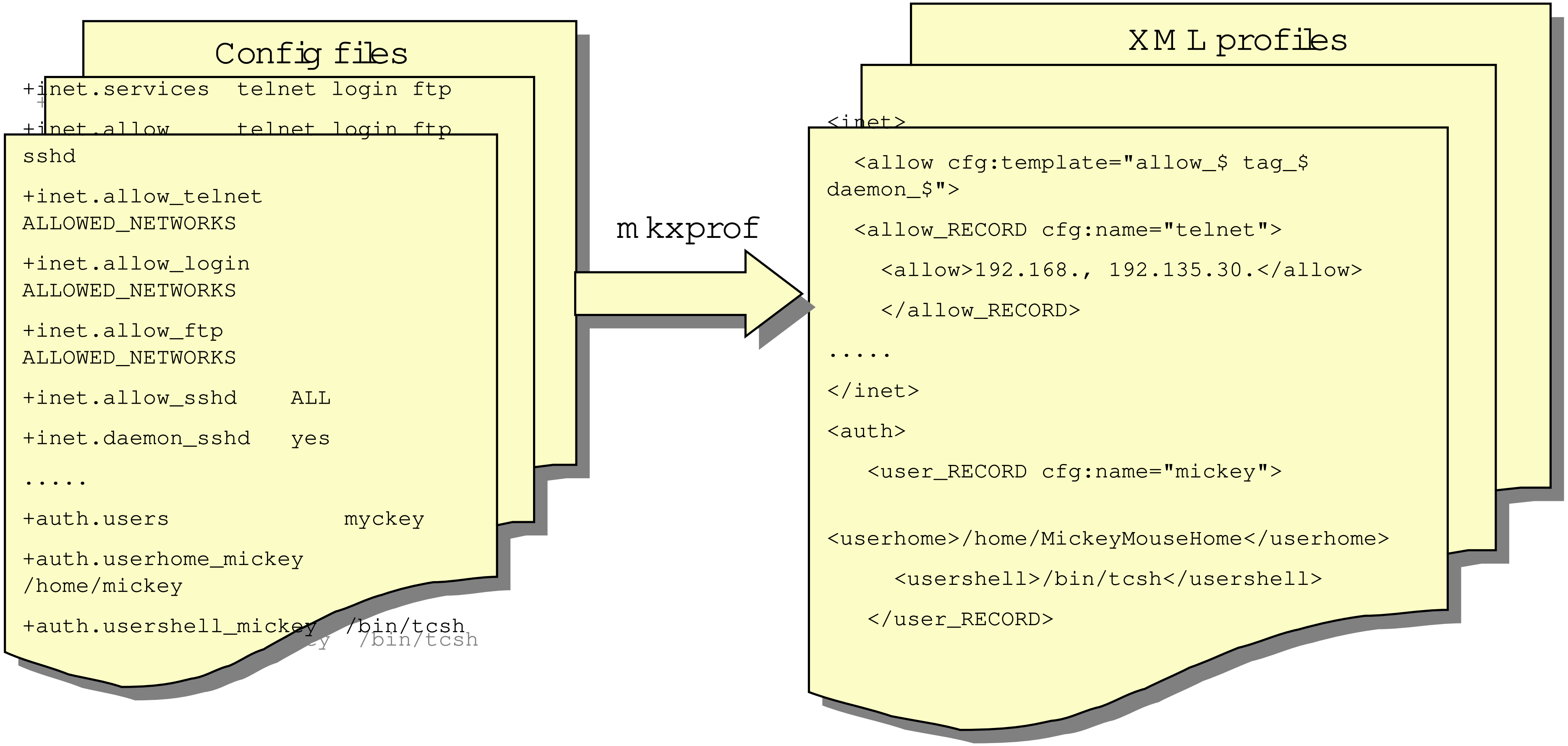
- **New machines join the grid**
- **Failure detection/repair (e.g. restarting daemons)**

LCFG (Local ConFiGuration system)

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


LCFG configuration files
Web Server
Compiler (mkxprof)
Notify
HTTP
XML Profile
UDP
Acknowledge
rdxprof
ldxprof
Generic Component
DBM File
LCFG Components
LCFG SERVER
LCFG CLIENT

Example LCFG Configuration File



Config files

```
+inet.services    telnet login ftp

+inet.allow       telnet login ftp
sshd

+inet.allow_telnet
ALLOWED_NETWORKS

+inet.allow_login
ALLOWED_NETWORKS

+inet.allow_ftp
ALLOWED_NETWORKS

+inet.allow_sshd     ALL

+inet.daemon_sshd    yes

.....

+auth.users              myckey

+auth.userhome_mickey
/home/mickey

+auth.usershell_mickey  /bin/tcsh
```

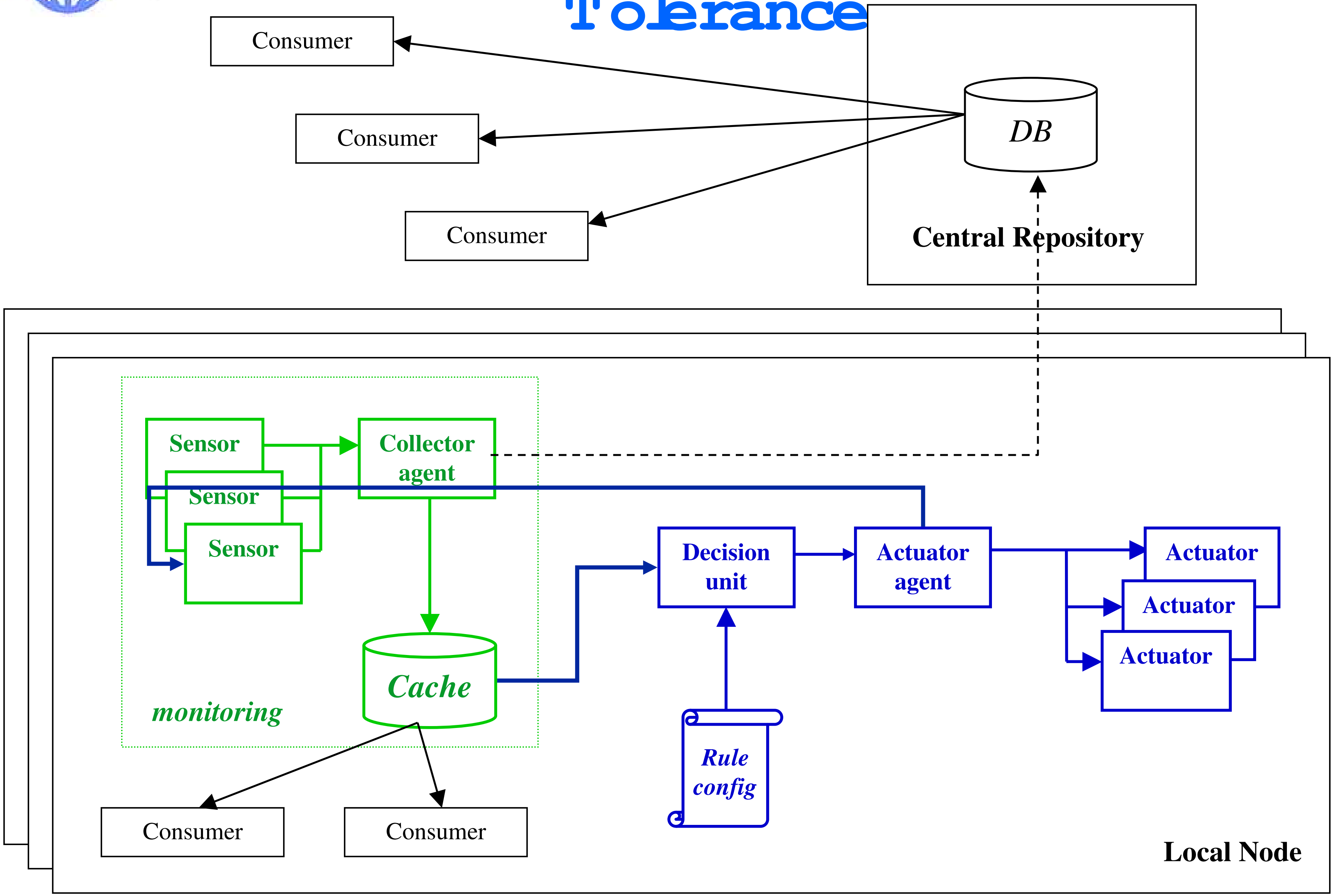
mkxprof

XML profiles

```
<inet>
  <allow cfg:template="allow_$ tag_$
daemon_$">
  <allow_RECORD cfg:name="telnet">
    <allow>192.168., 192.135.30.</allow>
    </allow_RECORD>
.....
</inet>
<auth>
   <user_RECORD cfg:name="mickey">

<userhome>/home/MickeyMouseHome</userhome>
     <usershell>/bin/tcsh</usershell>
   </user_RECORD>
```

Fabric Monitoring & Fault Tolerance


Consumer
Consumer
Consumer
DB
Central Repository
Sensor
Sensor
Sensor
Collector agent
Cache
monitoring
Decision unit
Actuator agent
Actuator
Actuator
Actuator
Rule config
Consumer
Consumer
Local Node

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 central edg 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 1.4.7 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/