

Accounting Facilities and Policies used by DEISA

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www.deisa.eu



RI-222919



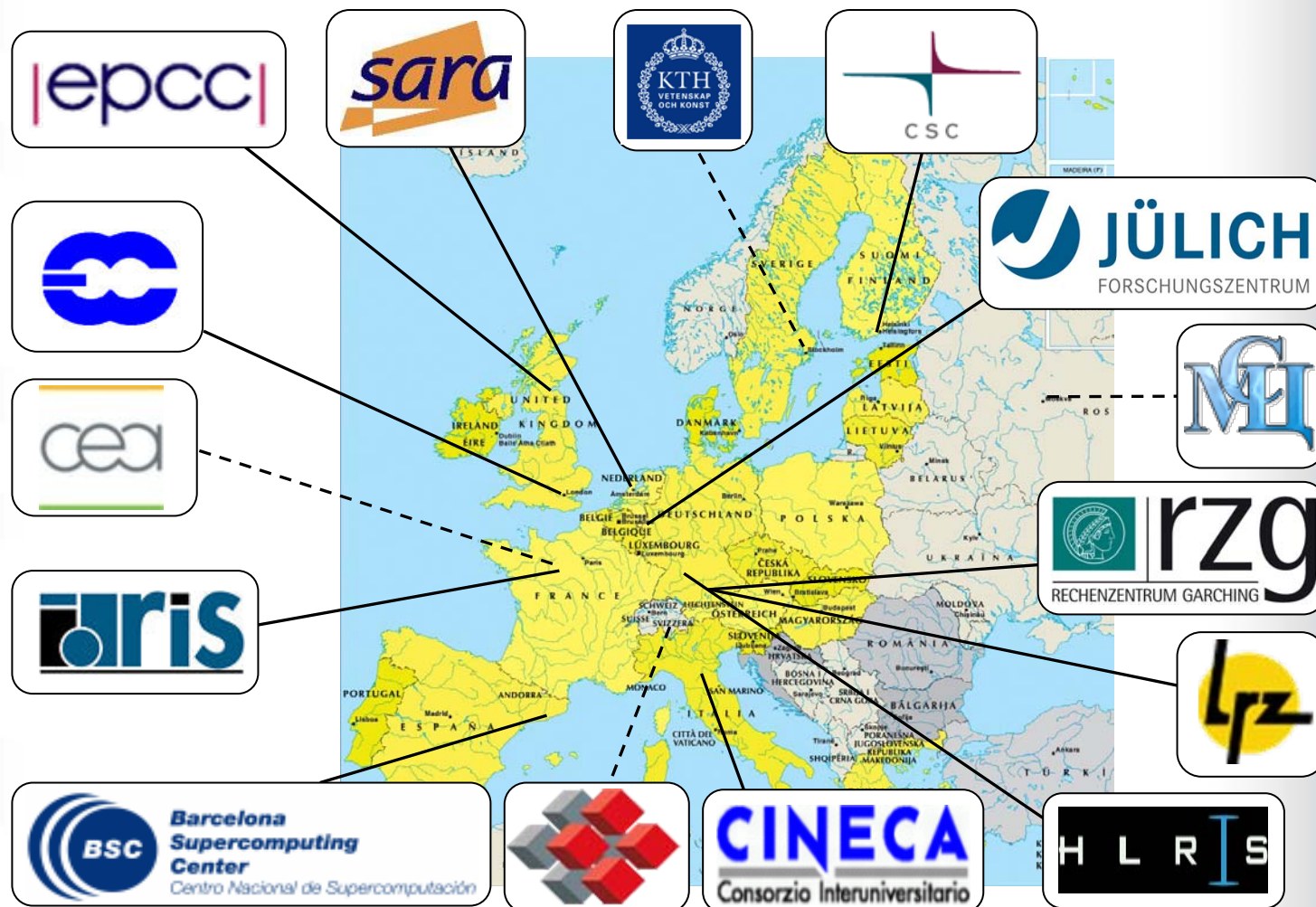
Agenda

- ⇒ DEISA – HPC Resources, Projects, Accounting Requirements
- ⇒ User administration: Projects, Users, Budgets
- ⇒ Accounting facilities
 - Site-local accounting tools (Accounting Data Provider)
 - Utilization of the OGF Usage Record format v1.0
 - Accounting Information Service
 - Accounting Reporting Tool (DART)
- ⇒ Procedures and Policies
- ⇒ Lessons learned and future Improvements

Agenda

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DEISA consortium



Principal partners

DEISA HPC compute resources

Site	Architecture	CPU@Clock	Tf/s	#Cores	Memory
BSC	IBM PowerPC	PPC@2.3	94.2	10240	20.0
CINECA	IBM Blade Center	Opt. DC@2.6	26.6	5120	10.0
	IBM Power5-575	P5@1.9	3.9	512	1.0
CSC	Cray XT4 AMD 4-core	QC@2.3	32.3	4048	4.4
	Cray XT5 AMD 8-core		54.4	6816	6.1
ECMWF	IBM P5-575+	P4+@1.9	33.0	4552	
EPCC	Cray XT4	DC@2.8	59.0	11328	33.2
	Cray X2	X2	2.9	112	0.9
	IBM Power5-575	P5@1.9	15.4	2560	5.2
FZJ	BlueGene/P	PPC450+@0.85	223.0	65536	32.0
	IBM Power6-575	P6@4.7	8.4	448	1.8
HLRS	NEC-SX8	SX-8@2.0	12.7	576	9.2
IDRIS	BlueGene/P	PPC450+@0.85	139.0	40960	20.0
	IBM Power6-575	P6@4.7	67.3	3584	10.8
LRZ	SGI-Altix Itanium2	I2 DC@1.6	62.3	9728	39.0
RZG	BlueGene/P	PPC450+@0.85	54.0	16384	4.0
	IBM Power6-575	P6@4.7	120.0	6560	18.5
SARA	IBM Power6-575	P6@4.7	60.2	3328	15.6

Status: Apr 2009

Projects and Science Communities

DECI call 2005

29 proposals accepted 12 mio core-h granted*

DECI call 2006

23 proposals accepted 12 mio core-h granted*

DECI call 2007

45 proposals accepted 30 mio core-h granted*

DECI call and Science Communities 2008

42 proposals accepted 50 mio core-h granted*
3 virtual communities 7 mio core-h granted*

DECI call and Science Communities 2009

75 proposals >200 mio core-h requested*
>5 virtual communities

*) Core-h normalized to IBM P4+@1.6GHz

DECI:

DEISA **E**xtr^em^e **C**omputing **I**nitiative
Yearly call for proposals

Communit^es:

Virtual Scientific Communities

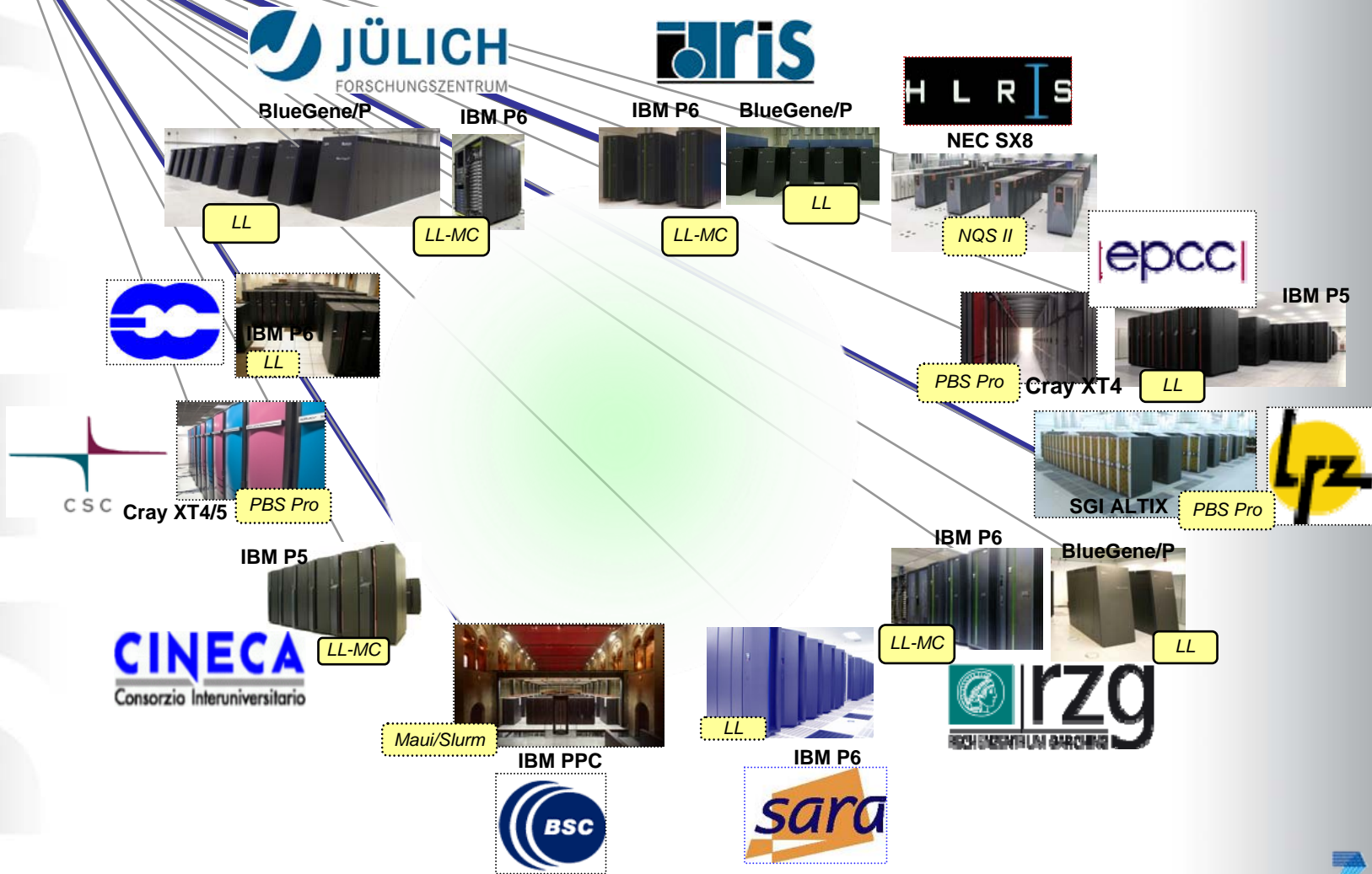


DEISA user

SSH / GSISSH client
UNICORE client
DESHL client
WS-GRAM client

Usage of DEISA resources

Distributed
European
Infrastructure for
Supercomputing
Applications



June 10, 2009, HPDC

Johannes Reetz, DEISA

7



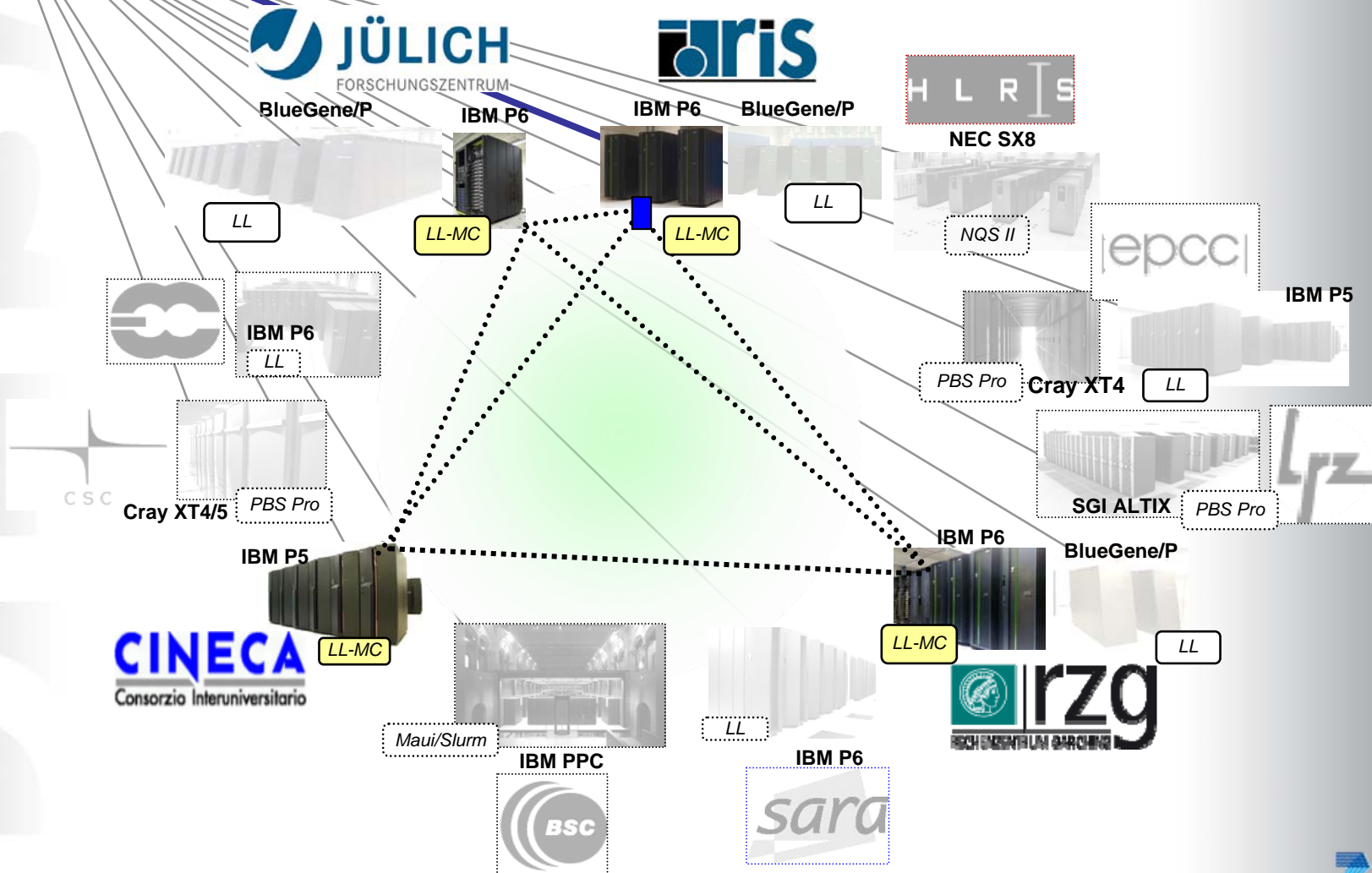
RI-222919



DEISA user

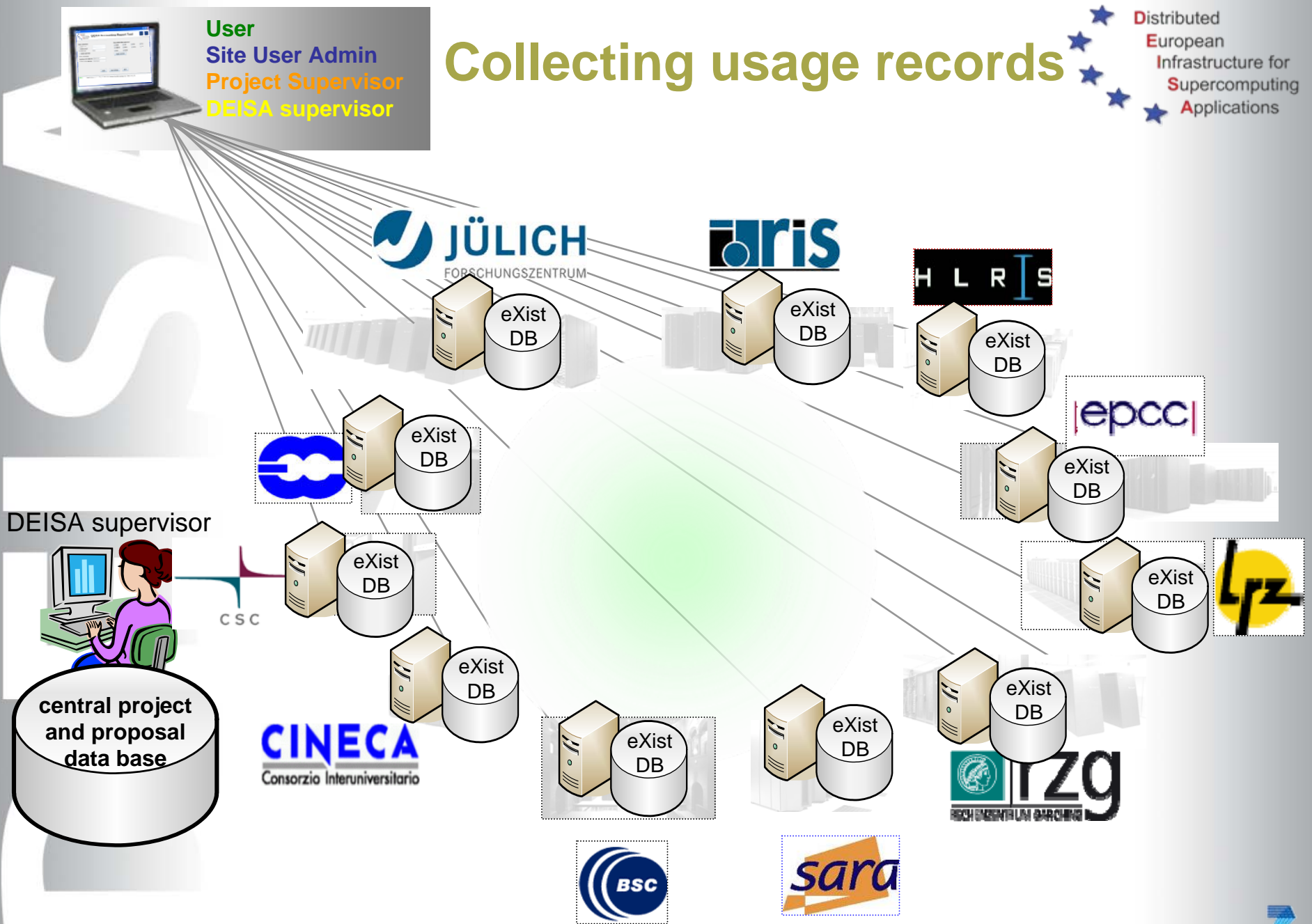
SSH / GSISSH client
UNICORE client
DESHL client
WS-GRAM client

LL remote job submission



Collecting usage records

User
Site User Admin
Project Supervisor
DEISA supervisor



Collecting URs via Web interface

DEISA Accounting Retrieval - Mozilla Firefox

Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe

https://deisa-acct.cineca.it/cgi-bin/accounting

deisa RZG Benutzerverwaltung ibm LDAP information hpc sysadm deisa-infra

DEISA Acco... DEISA Acco... DEISA Acco... DEISA Acco... DEISA Acco... DEISA Acco... DEISA ... DEISA Acco...

Get DEISA Accounting Data from CNE

Version : do, 24 jan 2008

Using /C=DE/O=GridGermany/OU=Max-Planck-Gesellschaft/OU=Rechenzentrum Garching/CN=Johannes Reetz for authentication

Select records for :

☒ Site ☐ Project ☐ User ☐ All

RZG

rzg00jkr

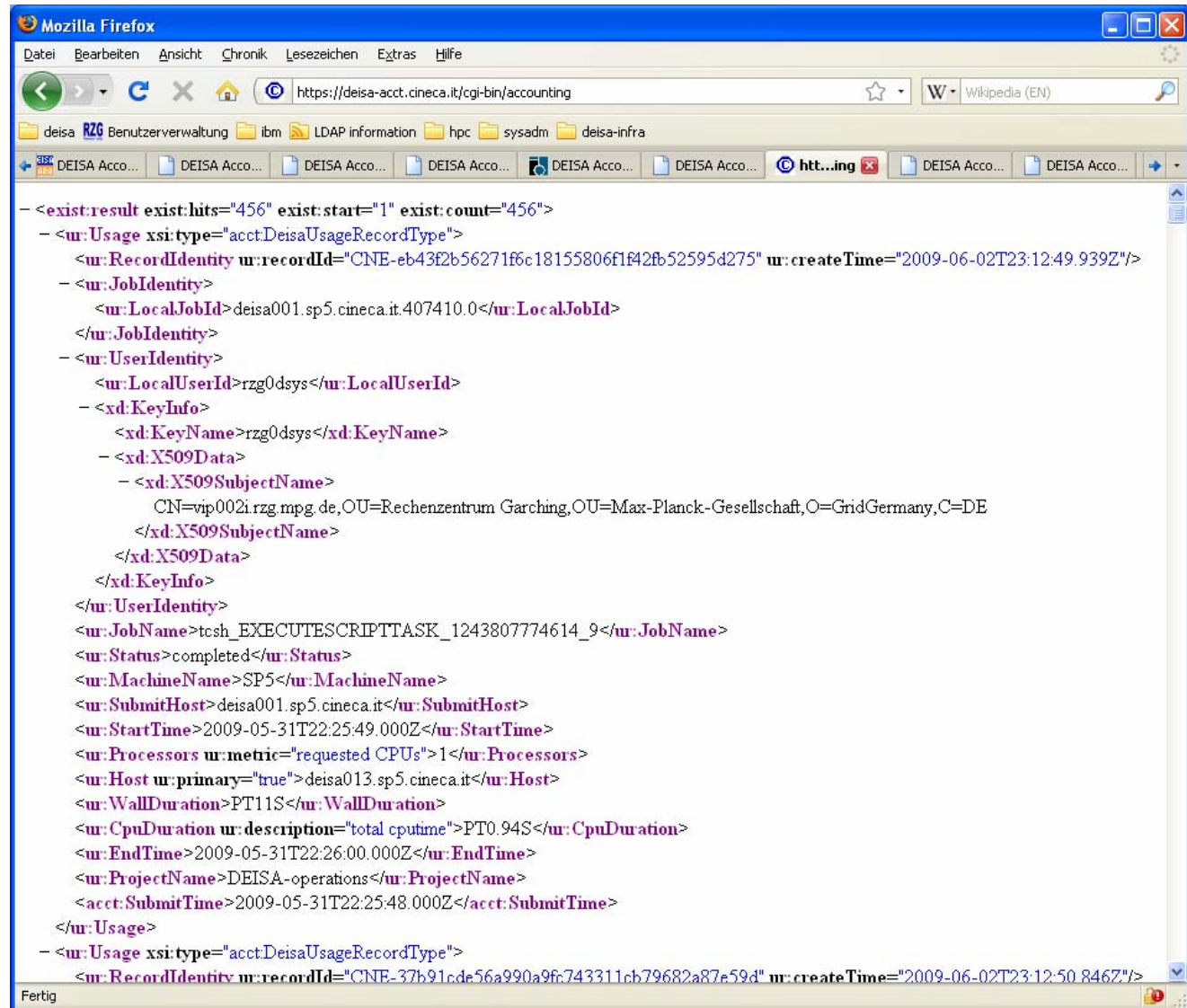
Start date (yyyy-mm-dd) 2009-05-01

End date (yyyy-mm-dd) 2009-05-31

XML Report

Fertig deisa-acct.cineca.it

Results obtained via Web interface



```
- <exist:result exist:hits="456" exist:start="1" exist:count="456">
- <ur:Usage xsi:type="acct:DeisaUsageRecordType">
  <ur:RecordIdentity ur:recordId="CNE-eb43f2b56271f6c18155806f1f42b52595d275" ur:createTime="2009-06-02T23:12:49.939Z"/>
  <ur:JobIdentity>
    <ur:LocalJobId>deisa001.sp5.cineca.it.407410.0</ur:LocalJobId>
  </ur:JobIdentity>
  <ur:UserIdentity>
    <ur:LocalUserId>rzg0dsys</ur:LocalUserId>
  </ur:UserIdentity>
  <ur:KeyInfo>
    <ur:KeyName>rzg0dsys</ur:KeyName>
  </ur:KeyInfo>
  <ur:X509Data>
    <ur:X509SubjectName>
      CN=vip002i.rzg.mpg.de,OU=Rechenzentrum Garching,OU=Max-Planck-Gesellschaft,O=GridGermany,C=DE
    </ur:X509SubjectName>
  </ur:X509Data>
  </ur:KeyInfo>
  <ur:JobName>tcsh_EXECUTESCRIPTTASK_1243807774614_9</ur:JobName>
  <ur>Status>completed</ur>Status>
  <ur:MachineName>SP5</ur:MachineName>
  <ur:SubmitHost>deisa001.sp5.cineca.it</ur:SubmitHost>
  <ur:StartTime>2009-05-31T22:25:49.000Z</ur:StartTime>
  <ur:Processors ur:metric="requested CPUs">1</ur:Processors>
  <ur:Host ur:primary="true">deisa013.sp5.cineca.it</ur:Host>
  <ur:WallDuration>PT11S</ur:WallDuration>
  <ur:CpuDuration ur:description="total cputime">PT0.94S</ur:CpuDuration>
  <ur:EndTime>2009-05-31T22:26:00.000Z</ur:EndTime>
  <ur:ProjectName>DEISA-operations</ur:ProjectName>
  <acct:SubmitTime>2009-05-31T22:25:48.000Z</acct:SubmitTime>
</ur:Usage>
- <ur:Usage xsi:type="acct:DeisaUsageRecordType">
  <ur:RecordIdentity ur:recordId="CNE-37b91cde56a990a9fc743311cb79682a87e59d" ur:createTime="2009-06-02T23:12:50.846Z"/>
```


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User and Project Administration Concept



1. Each user has an administrative DEISA **Home Site**
2. Each Project (or community) is administrated by an **Home Site**
3. A project is mapped to one more **Execution Sites**
4. The budget of compute cycles granted to a project is assigned to one or more **Execution Sites** for a given period of time.
→ the Execution Sites know about the budget of allocated core cycles
5. The consumed computing resources are collected for each project monthly to be registered into the centralized **project and proposal data base** for project controlling purposes.

Projects and Proposal Data Base

DECI Database - Mozilla Firefox
Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe
https://www.rzg.mpg.de:8443/cgi-bin/deci.pl
deisa RZG Benutzerverwaltung ibm LDAP information hpc sysadm deisa-infra

DECI Database Welcome, Johannes Reetz Database: DECI-5 (2009) access (DEISA@RZG, DART) (Gate-Script v3.2) Problems ? Contact andreas.schmidt@rzg.mpg.de

3.1 Project list views

3.1.1 Simple list of projects (without site): standardized Core hours show only PIs ☐ split int./ext. show full affiliation show

3.1.2 Complete survey sorted by projects: standardized Core hours no enabling ☐ show homesite ☐ show suitability no dates show

3.1.3 Complete/partial survey sorted by execsites: standardized Core hours no enabling ☐ show homesite ☐ show suitability no dates all sites show

3.1.4 Complete/partial survey sorted by homesites: standardized Core hours no enabling ☐ show execsites ☐ show suitability no dates all sites show

3.1.5 Complete/partial survey sorted by discipline/project: standardized Core hours no enabling ☐ show homesites ☐ show suitability no dates all disciplines show

3.1.6 Committed/assigned survey sorted by execsites: standardized Core hours no enabling ☐ show homesite ☐ show machines no dates all sites show

3.1.7 Monthly survey sorted by projects: standardized Core hours ☐ show homesite 01 / 09 until 05 / 09 show

3.1.8 Monthly survey sorted by execsites: standardized Core hours ☐ show homesite 01 / 09 until 05 / 09 all sites show

3.1.9 Monthly survey sorted by homesites: standardized Core hours ☐ show machines 01 / 09 until 05 / 09 all sites show

3.2 Additional project views

3.2.1 Complete dump for project: ACES-X show

3.2.2 Display all resources of all projects show

3.2.3 Display all used codes sorted by discipline show

3.2.4 Display affiliations sorted by country show

3.2.5 Display investigators sorted alphabetically show

3.2.6 Display all sites standard. Core hours (& committed) ☐ show machines show

3.2.7 Display all Core factors show

3.2.8 Display all machines (original Core hours) show

3.2.9 Display all aggregations show

4. Additional views/tools

4.1 Full DEISA survey sorted by execsites/projects standardized Core hours (& committed) no enabling ☐ split int./ext. - / 09 until - / 09 show

4.2 Complete survey for virtual communities sorted by communities standardized Core hours summary no enabling - / 09 until - / 09 show

4.3 Complete survey for virtual communities sorted by execsites standardized Core hours summary no enabling - / 09 until - / 09 coming soon !

4.4 Complete dump for virtual community EFDA show

4.5 Complete dump for virtual community project F-CEA-09 show

4.6 DEISA-internal projects usage standardized Core hours all projects ☐ split origin ☐ show machines - / 09 until - / 09 show

4.7 DEISA-internal projects usage by execsites standardized Core hours all sites ☐ split origin ☐ show machines - / 09 until - / 09 show

4.8 DEISA-internal projects usage by origin standardized Core hours all sites ☐ split execsites ☐ show machines - / 09 until - / 09 coming soon !

4.9 Project assignment-support standardized Core hours all sites ☐ modification-mode ☐ show suitability show

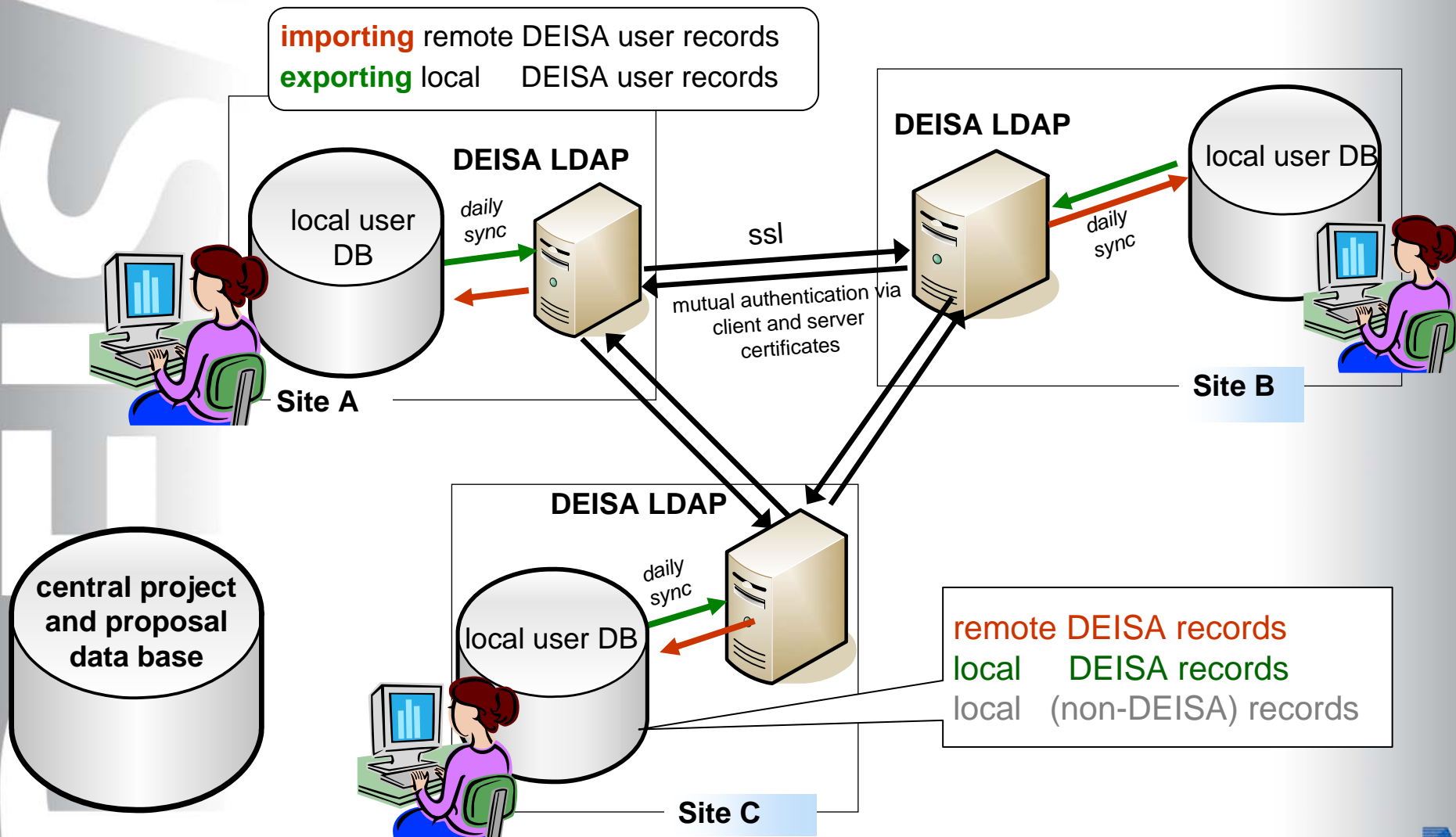
Suchen: star Abwärts Aufwärts Hervorheben Groß-/Kleinschreibung Ausdruck nicht gefunden
Fertig

Projects and Proposal Data Base (2)

Contains information about

- project acronym and unique project identifier
- project membership
- project supervisors
- project execution machines and corresponding budgets
- core cycles (job time) per project assigned to execution machine
- CPU normalization factors

DEISA User Administration System (UAS)

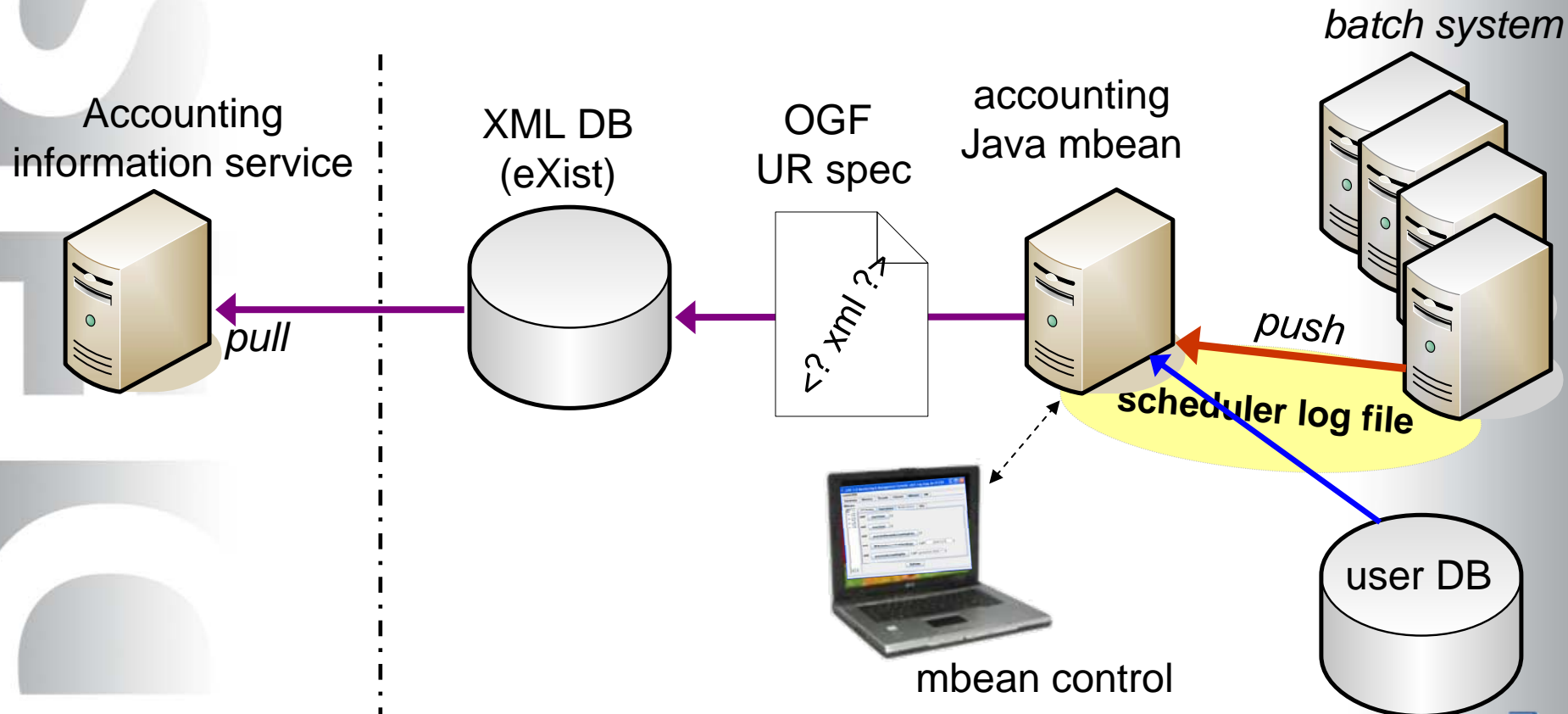


Agenda

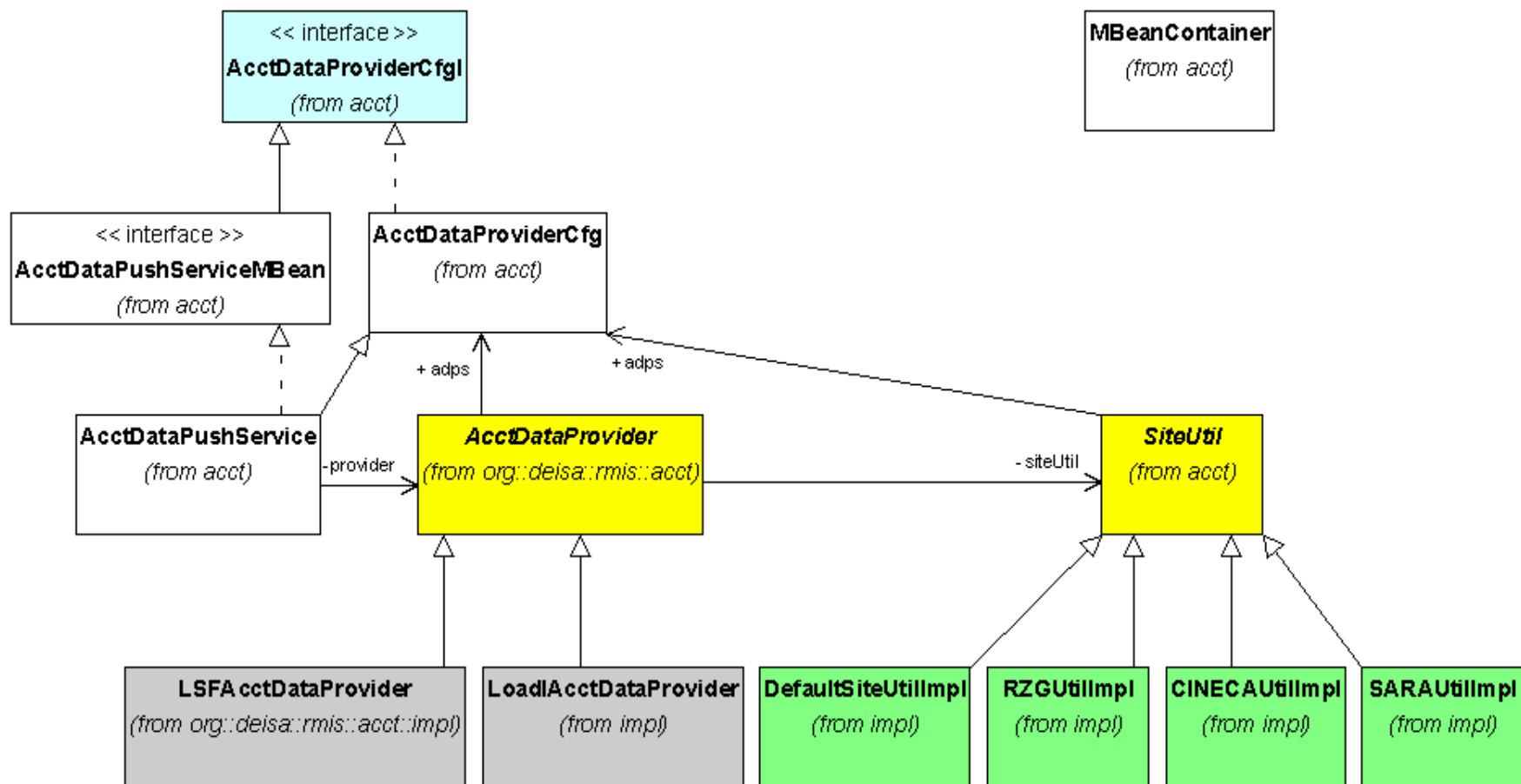
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Accounting Data Provider Tool (1)

- implemented in Java
- analyses the batch scheduler log files (e.g. LoadLeveler history file)
- adds missing information from local user DB or directly from DEISA Idap
- the result are XML records which are stored in eXist DB

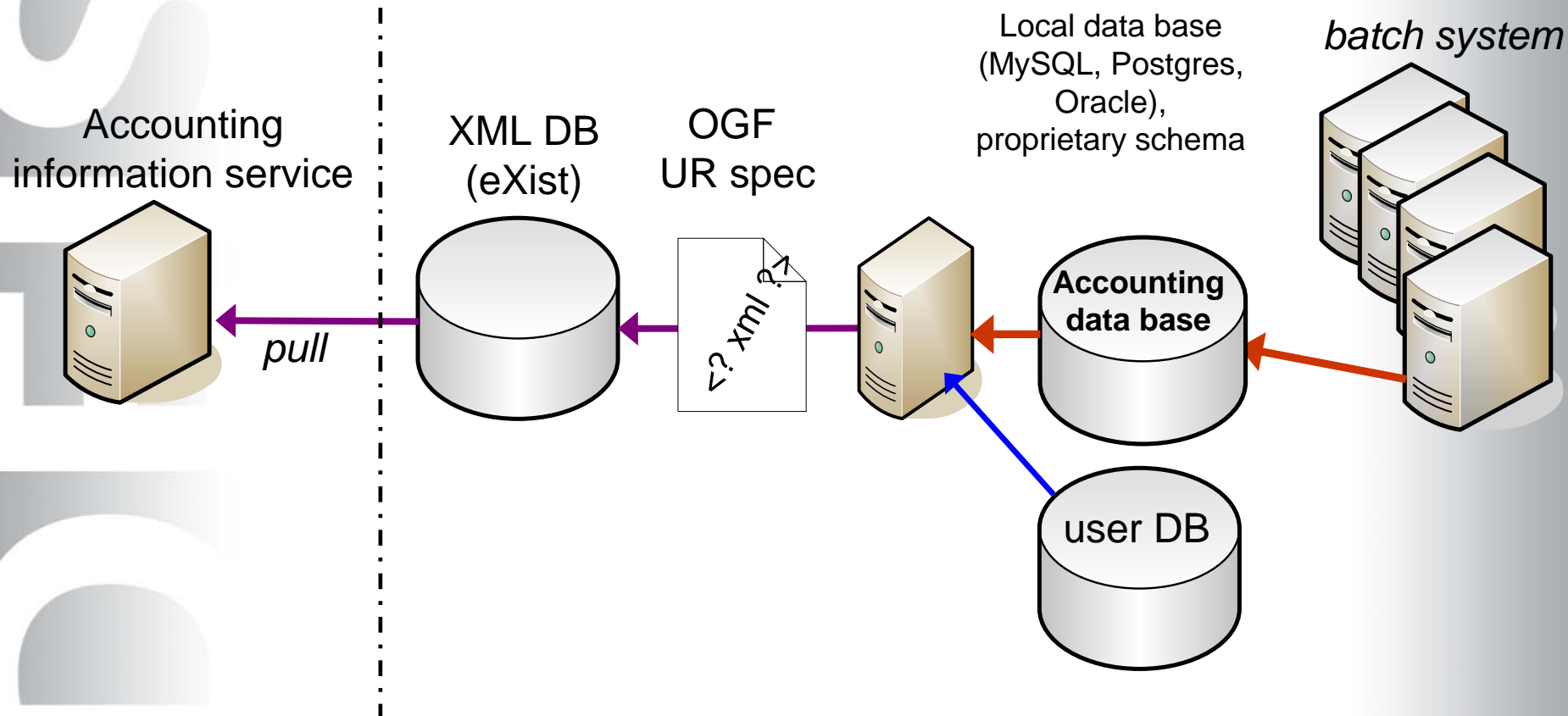


Accounting Data Provider Mbean design



Accounting Data Provider Tool (2)

- local accounting data base, stored information from batch system log file
- a second procedure (e.g. Perl script) creates XML usage records, missing information comes from user DB (or from DEISA ldap directly)
- XML records are stored in eXist DB



UR Properties used by DEISA

UR-WG Element name	Description
RecordIdentity	Identifies uniquely the usage record
JobIdentity	Contains local job identifier (LocalJobId) as assigned by the batch queue and a GlobalJobId (may be LocalJobId with a sitename prefixed)
UserIdentity	The username the job has run under (LocalUserId) and the Subject name of the X.509 cert (Keyinfo)
JobName	The global job name
Status	Completion status of job, e.g. completed, aborted.
WallDuration	Total wall clock time that elapsed while the job was running.
CpuDuration	Total CPU time used, summed over all processes of the job
MachineName	A descriptive name of the system on which the job ran
Host	The system hostname on which the job ran
SubmitHost	The system hostname from which the job was submitted
ProjectName	The name of the project that the job was run under
Processors	The number of processors used or requested (reserved)
EndTime	The time at which the usage ended
StartTime	The time at which usage started
NodeCount	The number of nodes used
SubmitTime	Not a UR-WG defined property. It gives the time the job is submitted to the system the job has run on.

UR Properties used by DEISA

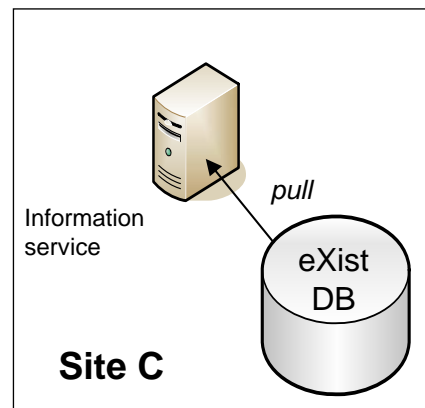
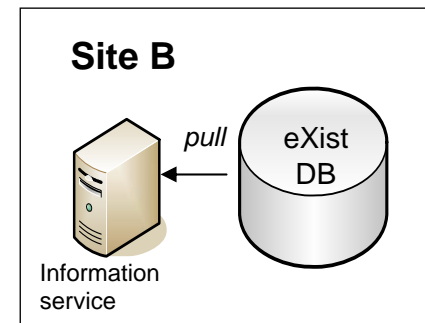
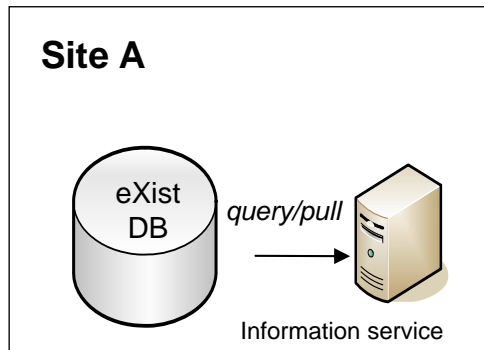
Not all attributes come from log files of the batch system

- Key info (X.509 Subject name)
- Project name
- Machine name

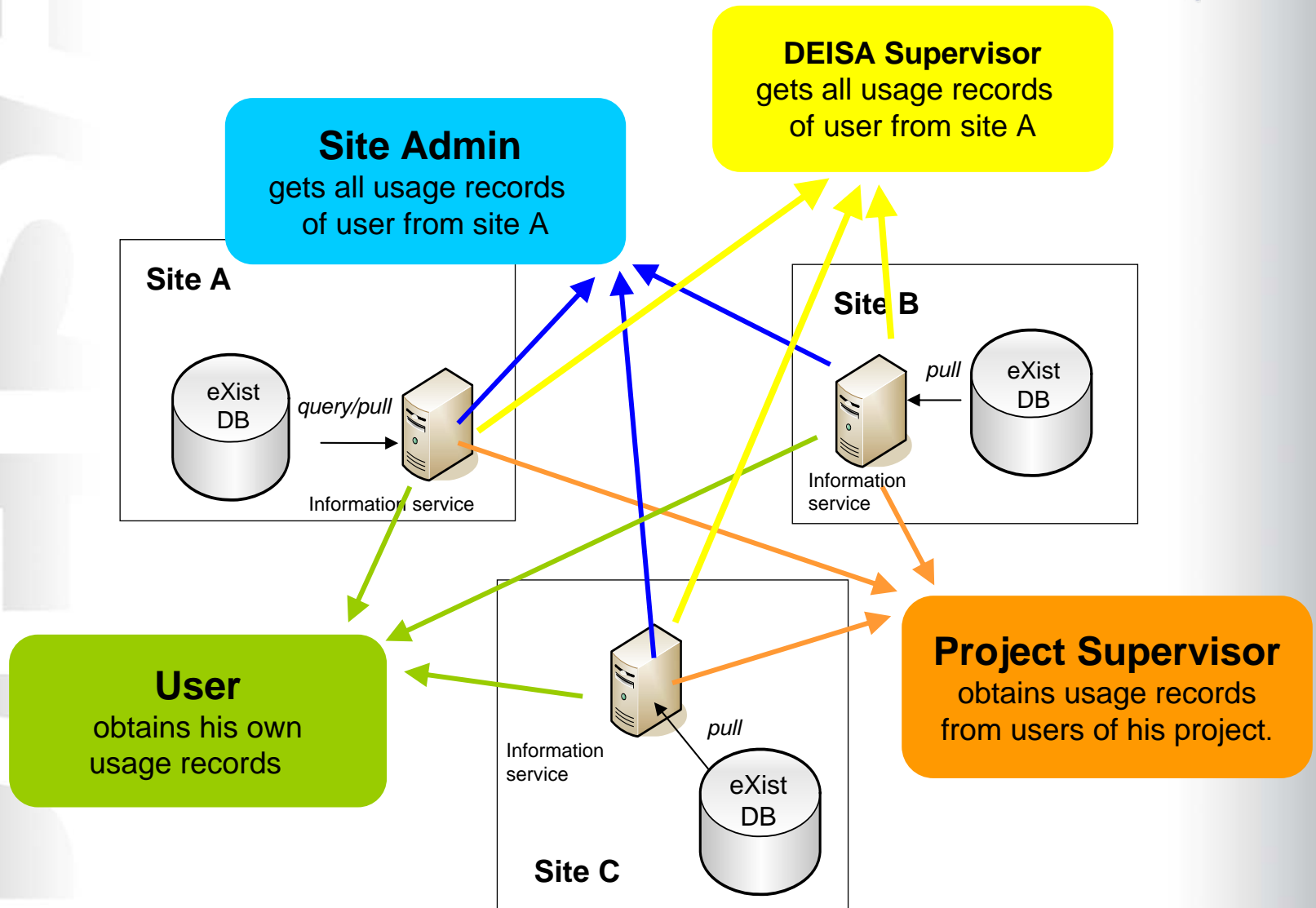
→ additional information from local user DB or DEISA LDAP

- Key info and project name can be retrieved from user DB
- Machine name from local file

Accounting Information Services



Information Requestors



Accounting Information Service



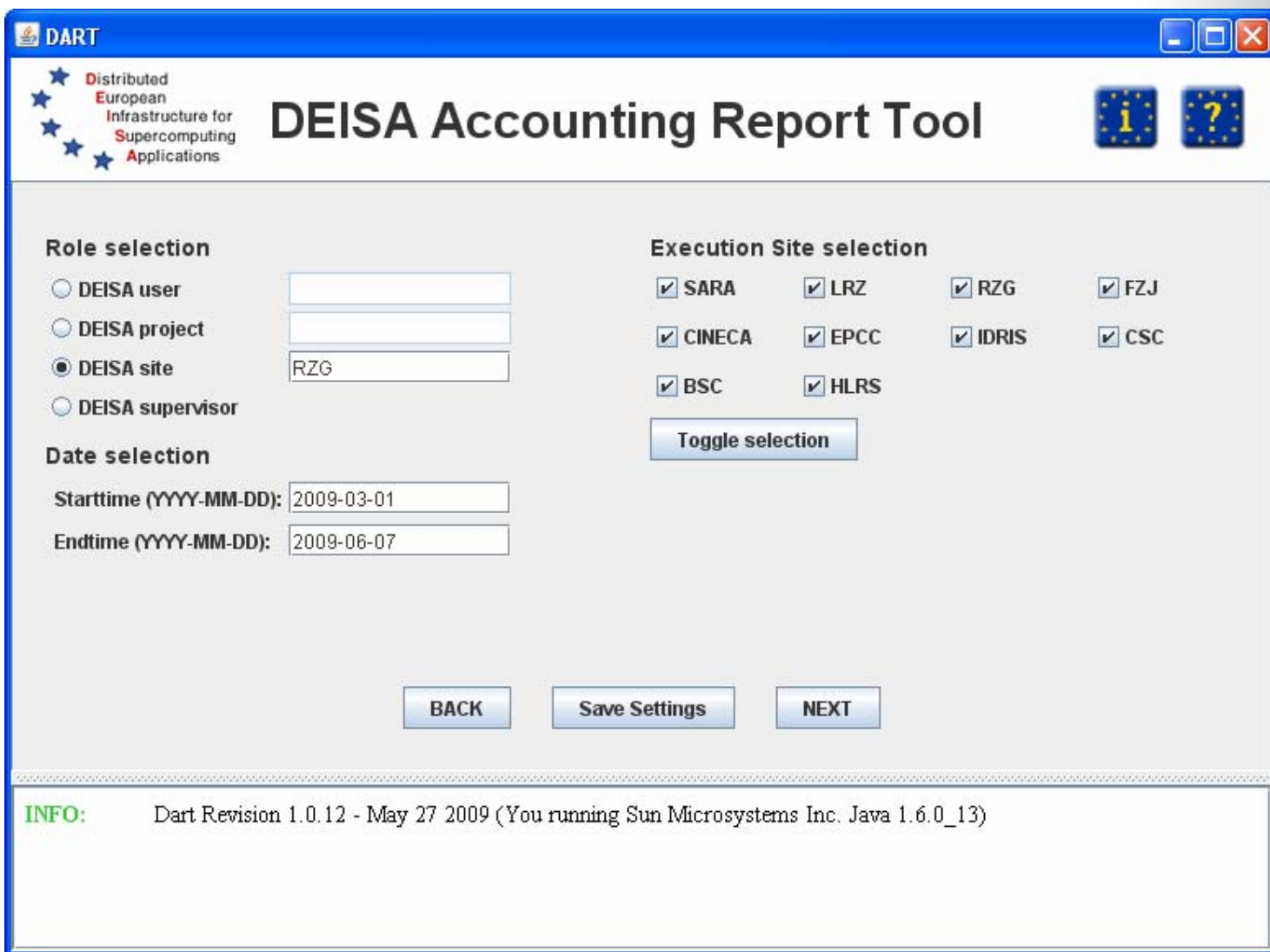
- CGI script in Apache HTTPS server (REST like interface)
- Protected with X.509 certificates
- 4 roles: User, Site administrator, Project supervisor, and DEISA supervisor
- Access control via *accounting-grid-mapfile*
- *accounting-grid-mapfile* can be automatically generated from information of DEISA UAS

```
"/O=dutchgrid/O=users/O=sara/CN=Jules Wolfrat" site-SARA  
"/O=dutchgrid/O=users/O=sara/CN=Jules Wolfrat" user-sar00005  
"/O=dutchgrid/O=users/O=sara/CN=Bart Heupers" project-xyz
```


DART Client Tool

- **DART** = DEISA Accounting Reporting Tool
- Java 1.5 program → can be used on most platforms
- Supports PKCS12 and Java Keystore for authentication
- Connects and processes accounting data from all sites simultaneously
- Java WebStart application. No local configuration needed. URLs of accounting information servers and processors normalization factors always up to date
- User friendly GUI

Obtaining Usage Reports



The screenshot shows a Java-based application window titled "DART" with a blue header bar. The header contains the DART logo, the text "Distributed European Infrastructure for Supercomputing Applications", the title "DEISA Accounting Report Tool", and two icons: a blue square with a white 'i' and a blue square with a white '?'. The main content area is divided into three sections: "Role selection", "Execution Site selection", and "Date selection". The "Role selection" section has four radio buttons: "DEISA user", "DEISA project", "DEISA site" (which is selected), and "DEISA supervisor". To the right of these radio buttons are three empty text input fields, with the third field containing the text "RZG". The "Execution Site selection" section has eight checkboxes, all of which are checked: "SARA", "LRZ", "RZG", "FZJ", "CINECA", "EPCC", "IDRIS", and "CSC". Below these checkboxes is a button labeled "Toggle selection". The "Date selection" section has two text input fields: "Starttime (YYYY-MM-DD):" with the value "2009-03-01" and "Endtime (YYYY-MM-DD):" with the value "2009-06-07". At the bottom of the main content area are three buttons: "BACK", "Save Settings", and "NEXT". A footer section at the bottom of the window contains an "INFO:" label followed by the text "Dart Revision 1.0.12 - May 27 2009 (You running Sun Microsystems Inc. Java 1.6.0_13)".

Role selection

☐ DEISA user

☐ DEISA project

☒ DEISA site

☐ DEISA supervisor

Execution Site selection

☒ SARA ☒ LRZ ☒ RZG ☒ FZJ

☒ CINECA ☒ EPCC ☒ IDRIS ☒ CSC

☒ BSC ☒ HLRS

Toggle selection

Date selection

Starttime (YYYY-MM-DD): 2009-03-01

Endtime (YYYY-MM-DD): 2009-06-07

BACK **Save Settings** **NEXT**

INFO: Dart Revision 1.0.12 - May 27 2009 (You running Sun Microsystems Inc. Java 1.6.0_13)

Usage Reporting (2)

DART									
DEISA Accounting Report Tool									
Startdate: 2009-03-01 Enddate: 2009-06-07									
<div> <div>New Report</div> <div>Export</div> </div>									
Total	March 2009	April 2009	May 2009	June 2009					
Project	User	Site / Machine	Jobs	Cpu Time (norm) [h]	Cpu Time [h]	Job Time (norm) [h]	Job Time [h]		
ALL	ALL	SUMMARY	13118	2093293,6493		2186898,1254			
ChArLES	ALL	SUMMARY	6	4732,5742		11264,8000			
	rzg0joec (CN=)	RZG / VIP	6	4732,5742	1577,5247	11264,8000	3754,9333		
DEISA-operations	ALL	SUMMARY	11434	78,0243		230,9724			
	rzg0dsys (CN=)	EPCC / HPCx	770	0,0311	0,0311	0,6069	0,6069		
		HLRS / NEC SX-8	745	0,0000	0,0000	2,3600	0,3933		
	rzg0dsys (CN=)	BSC / MareNostrum	1413	4,5838	5,7297	4,5838	5,7297		
		CNE / SP5	1432	0,2762	0,1842	13,3771	8,9181		
		CSC / Louhi_QC	377	1,5423	1,2853	1,5423	1,2853		
		EPCC / HPCx	272	0,0008	0,0008	0,1903	0,1903		
		FZJ / JUMP-P6	1012	0,8367	0,2789	20,6800	6,8933		
		LRZ / HLRB II	1095	0,2050	0,1864	4,1328	3,7571		
		RZG / VIP	1586	13,0708	4,3569	6,9075	2,3025		
		SARA / HUYGENS	1398	55,8008	18,6003	117,7317	39,2439		
	rzg0dsys (UNKNOWN)	IDR / VARGAS	1334	1,6767	0,5589	58,8600	19,6200		
E-BIT1	ALL	SUMMARY	569	84589,6036		84574,4516			
	rzg16tsk (CN=)	BSC / MareNostrum	569	84589,6036	105737,0044	84574,4516	105718,0644		
E-EMC3	ALL	SUMMARY	409	406227,2892		435404,4750			
	rzg17boe (UNKNOWN)	RZG / VIP	263	86535,7408	28845,2469	106994,5817	35664,8606		
	rzg17fre (UNKNOWN)	RZG / VIP	146	319691,5483	106563,8494	328409,8933	109469,9644		
E-GEM	ALL	SUMMARY	104	232800,9849		235907,8693			
	rzg18bds (CN=)	BSC / MareNostrum	15	692,5789	865,7236	692,4869	865,6086		
		RZG / VIP	87	232108,0933	77369,3644	235215,0767	78405,0256		
	rzg18tr (N/A)	BSC / MareNostrum	2	0,3127	0,3908	0,3058	0,3822		
F-AniDis	ALL	SUMMARY	34	90401,5360		90401,5360			
	rzg13aub (UNKNOWN)	EPCC / HECToR	34	90401,5360	75334,6133	90401,5360	75334,6133		
F-CEA-09	ALL	SUMMARY	13	300,2942		392,6933			
	rzg26dum (UNKNOWN)	RZG / VIP	13	300,2942	100,0981	392,6933	130,8978		
F-ESAHS	ALL	SUMMARY	1	13,8525		85,3333			
	rzg14huy (UNKNOWN)	RZG / VIP	1	13,8525	4,6175	85,3333	28,4444		
F-FEI	ALL	SUMMARY	52	478871,5892		494664,7508			
	rzg12bds (CN=)	EPCC / HECToR	12	0,0000	0,0000	0,0000	0,0000		
		RZG / VIP	40	478871,5892	159623,8631	494664,7508	164888,2503		
F-FZK-09	ALL	SUMMARY	44	485,7850		837,9933			
	rzg24ser	RZG / VIP	44	485,7850	161,9283	837,9933	279,3311		
F-HyBery	ALL	SUMMARY	83	143610,4633		144506,7200			
	rzg11vla (UNKNOWN)	RZG / VIP	83	143610,4633	47870,1544	144506,7200	48168,9067		
F-LATVIA-09	ALL	SUMMARY	7	12,1642		15,7867			
	rzg21zhu (UNKNOWN)	RZG / VIP	7	12,1642	4,0547	15,7867	5,2622		

INFO: Dart Revision 1.0.12 - May 27 2009 (You running Sun Microsystems Inc. Java 1.6.0_13)

INFO: Retrieve data from <https://deisa-accounting.hlr.de/cgi-bin/accounting>

INFO: Retrieve data from <https://deisap.sara.nl/cgi-bin/accounting>

INFO: Retrieve data from <https://deisacc.zam.kfa-juelich.de/cgi-bin/accounting>

INFO: Retrieve data from <https://gridacct.lrz-muenchen.de/cgi-bin/accounting>

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Procedures and Policies

- LDAP server and user DB of the DEISA UAS synchronize in less than 24h
 - changes in a local DB propagate within 24h
 - this includes modifications of user roles
- Accounting information service (eXistDB) is up-to-date within 24h
 - local accounting data provider must synchronize with 24h
- eXist DB data remains persistent for at least one year at all sites

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Lessons learned

Advantages:

- Standardized protocols and XML schema
- No central database: distributed XML databases, information services
- X.509 based authentication, authorized access
- Simple system architecture, easy to used by users, supervisors, ...
- Open Source
(Apache HTTP Server, eXist DB, Java, PERL)

Problems, open topics:

- All the requested usage records must be transferred from the eXistDB to the client for report generation
(1UR ~ 1,5 kB \Rightarrow 10.000 URs ~ 14,7 MB \Rightarrow 1.000.000 URs ~ 1,4 GB)
large numbers of records \rightarrow high performance load of the eXistDB
- Risk of incomplete reports, if a site is not reachable
(1 site: 99% availability \Rightarrow 11 sites: 89,5% availability)
- Risk of incomplete reports if eXist data is complete due to failures of the local accounting data provider.

Further Improvements

- Allow Supervisors to see only summaries over a longer period
 - less details
 - more user data privacy
- Aggregation of UR Properties
- Introduce Budgeting
 - using the LDAP infrastructure to propagate execution site specific project budgets
- Report generation, e.g. summation over URs on the server side
 - Summarized values (e.g., jobtime within a given time frame) sufficient for client
 - transfer of less amount of data
- Improve availability of service (Data Replication? Central Repository?)
 - Possible strategies:
 - save remote accounting data into databases at the homesite of the user and let users obtain their data from their homesite only
 - central database for aggregated accounting information

Summary

- Accounting data is gathered
 - directly from **batch system logs** (Loadleveler, PBS, NQS, Slurm)
 - or from an **accounting database** (e.g. mysql, postgres,...) that was previously fed by information from the batch systems.Proper project assignment requires information from the UAS.
- Accounting data is stored in **eXist XML** database using **OGF UR-WG** format
- **Distributed eXist DBs and information services** provide accounting information. Information server realized as HTTPS server with CGI script. Each site controls who gets access to which usage records
- Authorized access based on X.509 certificates, using secure communication (https), **different roles**: user, site admin, supervisors
- **DART Client tool** collects all data simultaneously and creates reports (e.g. taking processor performance factors into account).
- **Jobtimes** (#cores * elapsed time) are **normalized** before summing up across different computer platforms
- Accounting information from all sites is regularly collected by the **DEISA supervisor** and fed back into the **projects and proposal database** for project progress controlling purpose.