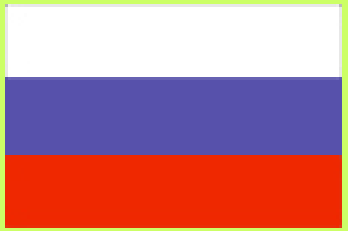
HEP Computing Coordination in Russia



V.A. Ilyin

Moscow State University

ICFA Workshop on Grid and Digital Divide, Daegu, 26 May 2005

Today we can say about coordination of HEP computing in Russia indeed. In 90s and before one can see the coordination within an experiment only.

Why:

- LHC dominating role in Russian HEP, and progress of the LCG project;

- poor budgets, thus serious need in effective use of resources: computing and human.

Grid is a technological basis for this coordination at national and inter-experiment level, with expansion on other sciences.

Three regions are indicated on the map, where HEP centers are located: Moscow, St-Petersburg and Novosibirsk

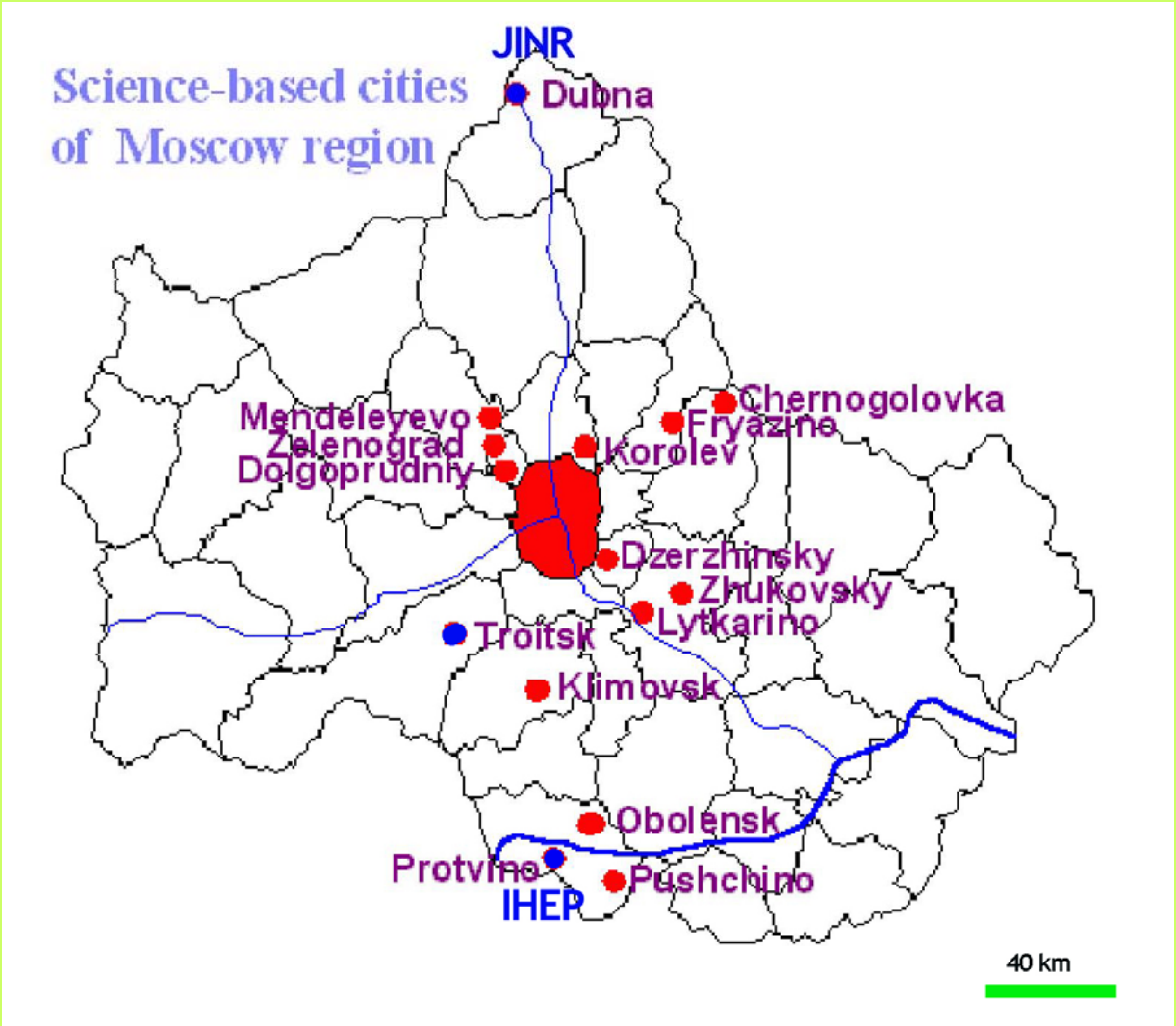
HENP institutes:

St-Petersburg region: PNPI (Gatchina), St-P St. Univ.

Novosibirsk: BINP

Moscow: ITEP, Kurchatov Institute, Moscow St. Univ., MEPhI, Lebedev Institute

Moscow region: JINR (Dubna), IHEP (Protvino), INR RAS (Troitsk)



Site (Centre)	**Acc./Coll. HEP Fac.**	**Other Exp's**	**Participation in major HEP Int. Collab.**
BINP SB RAS *(Novosibirsk)* *http://www.inp.nsk.su*	**VEPP-2M** *(linear collider at 1.4 GeV)* **VEPP-4** *(linear collider up to 6 GeV)*	**Non-Acc. HEP Exp's. (Neutrino Phys., etc), Synchrotron Rad. F.**	***CERN:*** **ATLAS, LHC-acc, CLIC** ***FNAL:*** **Tevatron-acc** ***DESY:*** **TESLA** ***KEK:*** **BELLE** ***SLAC:*** **BaBar**
IHEP *(Protvino, Moscow Region)* *http://www.ihep.su*	**U-70** *(fix target, proton beam 70 GeV)*	**Medical Exp's**	***BNL:*** **PHENIX, STAR** ***CERN:*** **ALICE, ATLAS, CMS, LHCb** ***DESY:*** **ZEUS, HERA-B, TESLA** ***FNAL:*** **D0, E-781(Selex)**
ITEP (*Moscow)* *http://www.itep.ru*	**U-10** *(fix target, proton beam 10 GeV)*	**Non-Acc. HEP Exp's. (Neutrino Phys., etc)**	***CERN*****: ALICE, ATLAS, CMS, LHCb, AMS** ***DESY*****: H1, HERMES, HERA-B, TESLA** **FNAL***: D0, CDF, E-781(Selex)* ***KEK:*** **BELLE** ***DAFNE:*** **KLOE**
JINR *(Dubna, Moscow Region)* *http://www.jinr.ru*	**Nuclotron** *(heavy ions coll. at 6 GeV/n)*	**Low Ener. Acc., Nuclear Reactor, Synchrotron Rad.F., Non-Acc. HEP Exp's: Neutrino Phys., Medical Exp's, Heavy-ion Physics**	***BNL:*** **PHENIX, STAR** ***CERN:*** **ALICE, ATLAS, CMS, NA48, COMPASS, CLIC, DIRAC** ***DESY:*** **H1, HERA-B, HERMES, TESLA** ***FNAL*****: D0, CDF** ***KEK:*** **E391a**

Site (Centre)	HEP Acc./Coll.	Other Exp's	Participation in major HEP Int. Collab.
INR RAS *(Troitsk, Moscow region, Research Centre) http://www.inr.ac.ru*		**Low Energy Acc., Non-Acc. HEP Exp's (Neutrino Phys.)**	***CERN:*** **ALICE, CMS, LHCb** ***KEK:*** **E-246** ***TRIUMF:*** **E-497**
RRC KI *(Moscow, Res. Centre) http://www.kiae.ru*		**Low Energy Acc., Nuclear Reactors, Synchrotron Rad. F.**	***BNL:*** **PHENIX** ***CERN:*** **ALICE, AMS**
MEPhI *(Moscow, University) http://www.mephi.ru*		**Low Energy Acc., Nuclear Reactor**	***BNL:*** **STAR** ***CERN:*** **ATLAS** ***DESY:*** **ZEUS, HERA-B, TESLA**
PNPI RAS *(Gatchina, St-Petersburg region, Research Centre) http://www.pnpi.spb.ru*		**Mid/Low Energy Acc., Nulcear Reactor**	***BNL:*** **PHENIX** ***CERN:*** **ALICE, ATLAS, CMS, LHCb** ***DESY*****: HERMES** ***FNAL:*** **D0, E-781(Selex)**
SINP MSU (*Moscow, University) http://www.sinp.msu.ru*		**Low Energy Acc., Non-Acc. HEP Exp. (EAS-1000)**	***CERN*****: ATLAS, CMS, AMS, CLIC** ***DESY*****: ZEUS, TESLA** **FNAL***: D0, E-781(Selex)*

Russian LCG Tier2-Cluster

Conception:

Cluster of institutional computing centers with Tier2 functionality and summary resources between canonical Tier2 and Tier1 for each experiment (ALICE, ATLAS, CMS, LHCb)

Basic functions: **analysis; simulations; users data support**

Host Tier1 in LCG infrastructure: **CERN**

Plus: **calibration/alignment/reconstructon** (algorithms/DB/production)

Thus:

Real AOD – full sets for four experiments (all passes) ⇒ RU-TIER2
plus local sets of AOD
Real (RAW)/ESD ~10% ⇒ RU-TIER2

Sim RAW/ESD/AOD for channels analyzed in Russia ⇒ RU-TIER2
Tier1 ⇐

RuTier2 computing model (to MoU on LCG).

In July 2005 the computing model will be finalized by experiments and institutes.

Some basic statements:

- (truly) distributed facilities (CPU in share use, common disk space, two MSS centers)

- Russian GOC (CIC+ROC), also distributed model

- CA

Distributed model - because there is no any institute in force to host Tier1 or, even, single Tier2 able to serve whole HEP community in Russia.

Grid – technology adequate to our internal situation for science!

Participation in Data Challenges in all four Experiments.

Example: LHCb DCs in Russia

2002 **130K** events, **1%** contribution only one centre (ITEP)

2003 **1.3M** events, **3%** contribution (IHEP, ITEP, JINR, SINP MSU)

2004 **9.0M** events, **5%** contribution started to use LCG-2/EGEE

2005 Through LCG-2/EGEE, PNPI and INR RAS are joining…

2004 DC Phase I

√

Site	Total Jobs	CPU Time (h)	Events	O.Data (GB)	Events
USA	56	1408	32500	13	0.02%
Israel	77	2493	64600	21	0.03%
Brasil	247	4489	231355	83	0.12%
Switzerland	813	19826	726750	235	0.39%
Taiwan	595	8332	757200	216	0.41%
Canada	1148	21286	1204200	348	0.65%
Poland	1418	24058	1224500	403	0.66%
Hungary	1817	31103	1999200	592	1.08%
France	5888	135632	4997156	1967	2.69%
Netherlands	6408	131273	7811900	2246	4.21%
Russia	10059	255324	8999750	3388	4.85%
Spain	13378	304433	13687450	4189	7.38%
Germany	17101	275037	17732655	6235	9.56%
Italy	25626	618359	24836950	7763	13.39%
United Kingdom	46580	917874	47535055	14567	25.62%
CERN	52940	960470	53708405	18948	28.95%
All Sites	184151	3711397	185549626	61214	100.00%

Russian Institutes to participate in the analysis of ALICE data

N	Istitutes	Tasks
1	IHEP	Direct γ, π^0 , γ–jet & HBT correlations in pp, pA, AA
2	INR RAS	Multiplicity in forward detectors, background suppression in the vector meson production
3	ITEP	TOF particle identification, charm and beauty production
4	JINR	Direct γ, π^0 , γ–jet & HBT correlations in pp, pA, AA. Resonance production, heavy quarqonia in pA.
5	PNPI	Vector meson in the ultra peripheral nuclear collisions
6	RRC KI	Direct γ, π^0 , γ–jet & HBT correlations in pp, pA, AA. Deconfinement, disoriented chiral condensates
7	SPbSU	Collective properties of hot and dense matter in pp, pA and AA collisions (quark-gluon fusion, long range correlations, strange particles)

ATLAS in Russia:

Resources for physics analysis

- Number of active users – 50
- 5% of total Raw data and 10% of ESD are permanently kept of disks to be used for algorithm developments and analysis
- Volume of group DPD data is equal to 50% of AOD data
- Volume of user data – 1 TB per user for 2008 data only and varies proportionally to events number
- CPU power needed to analyze 2008 data only by one user – 15 kSI2k
- Total CPU power is proportional to the number of accumulated events and to the number of users:

```
float CPU = Nuser*(Nev_year[i]/Nev_year[2008])*CPU_user_2008;
```

RDMS in Physics analysis

Heavy ions

- Quarkonia and Jet suppression (SINP MSU, LPI, HEPI Tbilisi)
- Global Observables (JINR, SINP MSU, HEPI Tbilisi)
- Coherent hard diffractive scattering of nuclei (ErPhI)

Higgs

- $qq \rightarrow qqH \rightarrow qqWW$ (ITEP, SINP MSU)
- $qqH \rightarrow qqZZ$ (KIPT)
- $(H \rightarrow \gamma\gamma)$ + jets (SINP MSU)
- CP-violation at Higgs sector (SINP MSU)
- Diffractive Higgs production (IHEP, PNPI)

Standard Model

- Single top production (IHEP, SINP MSU)
- Electroweak physics (JINR, GSTU, PHEP Minsk)
- B-physics (JINR)
- QCD (JINR, LPI, PNPI)
- High multiplexity events (LPI)
- Studies of Proton Diffractive Function (ErPhI)

SUSY and beyond SM

- High p_T muon pairs (JINR)
- High p_T electrons (INR, IHEP)
- Search for SUSY particles (sleptons) (INR, IHEP)
- Search for heavy neutrino (INR)

RDMS CMS physics tasks: the estimates of requirements on computing resources *preliminary analysis*

Physics channels (10 fb^-1 luminosity)	RAW data	ESD/DST	AOD	MC RAW data	MC ESD/DST	MC AOD	storage	CPU	DBs
High multiplexity events c- and b-quarks production. QCD. **(LPI)**							5 TB	15 CPU	?
Single top quark production: pp->tqb, pp->tqq, pp->tq pp->t,W pp->t,b **(SINP & IHEP)**	10-1000*10^3 events	1-10*10^6 events	10-100*10^6 events	1*10^6 events	2.5*10^6 events	8*10^6 events	5 TB = 3 TB (Data) + 2 TB (MC)	8 MC Mevents require 100 CPU (2GHz, 500 MB RAM) for 6 months	CMS MCDB (in the future – LCG MCDB)
qq->qqW(->l,nu)W(->qq) **(ITEP & SINP)**	—	7*10^6 events 3.5 TB	7*10^6 events 0.7 TB	—	21*10^6 events 10.5 TB	21*10^6 events 2.1 TB	16.8 TB	15CPU for reconstruction 15 CPU for "private“ MC	Standard set of DBs: CondDB, SimularionDB, LuminocityDB …
Heavy ions: di-muon channels jets **(SINP & LPI & HEPI)**	1 TB	2TB	1 TB 6 TB mini-DST 6 TB mini-DST	2 TB	**2** TB	1 TB 3 TB micro-DST	24 TB disk + 10 TB temp **+2 TB (LPI)**	200 CPU for 2 months + 40 CPU permanently **+ 20 CPU (LPI)** 200 CPU for 2 months + 40 CPU permanently	Standard set of DBs
Heavy di-muons **(JINR)**	0.5 TB	0.41 TB	0.123 TB	5.6 TB		3.3 TB	1.2TB + 8.9TB = 10.1 TB	40 CPU permanently & 118 CPU – for MC	Standard set of DBs
B-phycics **(JINR)**		10 TB		?			10 TB	20 CPU	?

Russian Data Intensive Grid

http://www.egee-rdig.ru

Distributed ROC https://edms.cern.ch/file/479460/4/EGEE-SA1-ExecPlan-RU-v1.6.pdf

IHEP, plus some functions provided by ITEP (user support), JINR (operational monitoring):

- serve 10 RCs, 5 new RCs to appear in next 3 months and next 5 to the end of 2005

Distributed CIC - SINP MSU, RRC KI, KIAM RAS
http://grid.sinp.msu.ru/index.php/index.php?meid=27&newlang=eng

CA *SINP MSU -> RRC KI in June 2005,* **http://lcg20.sinp.msu.ru/CA/**

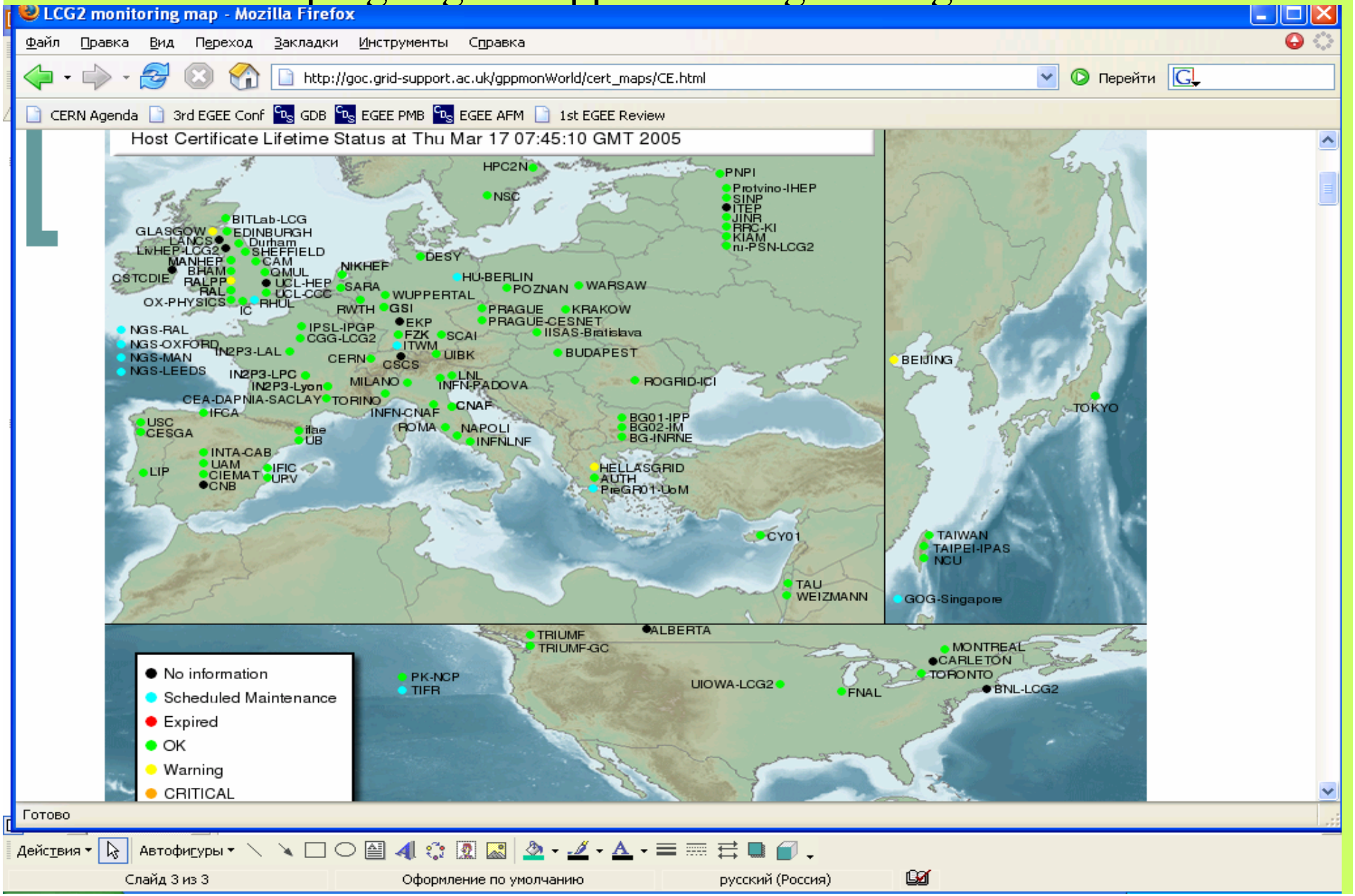
Contribution to DCs (all Expts) ~ 5 %

Russia in LCG Service Challenge: *starting session in October; 622 Mbps link to CERN will be available (Moscow-Amsterdam RBNet-GLORIAD, Amsterdam-CERN SURFNet agreed)*

RDIG today: more 100 members, (~) 10 sites, 3 (+3) applications, more 400 CPU and ~ 50 TB data

LHC Computing Grid (LCG) – start in Sept 2003

Мониторинг EGEE (March 2005)
http://goc.grid-support.ac.uk/gridsite/gocmain/



RDIG CIC

- Core grid services, used by sites in the region: Resource Broker, BDII, MyProxy.
  - 10 resource centers: IHEP, ITEP, IMPB RAS, JINR, KIAM RAS, PNPI, RRC KI, SINP MSU, GC RAS, NovSU
  - More then 400 CPUs
- VO registrar services for Russian VOs
- RLS services for the Russian VOs
- Certification Authority for all Russian sites.
  - EUGridPMA approved.
  - More then 500 certificates issued.
  - to migrate to RRC KI in June 2005.

New VOs – most important activity now!

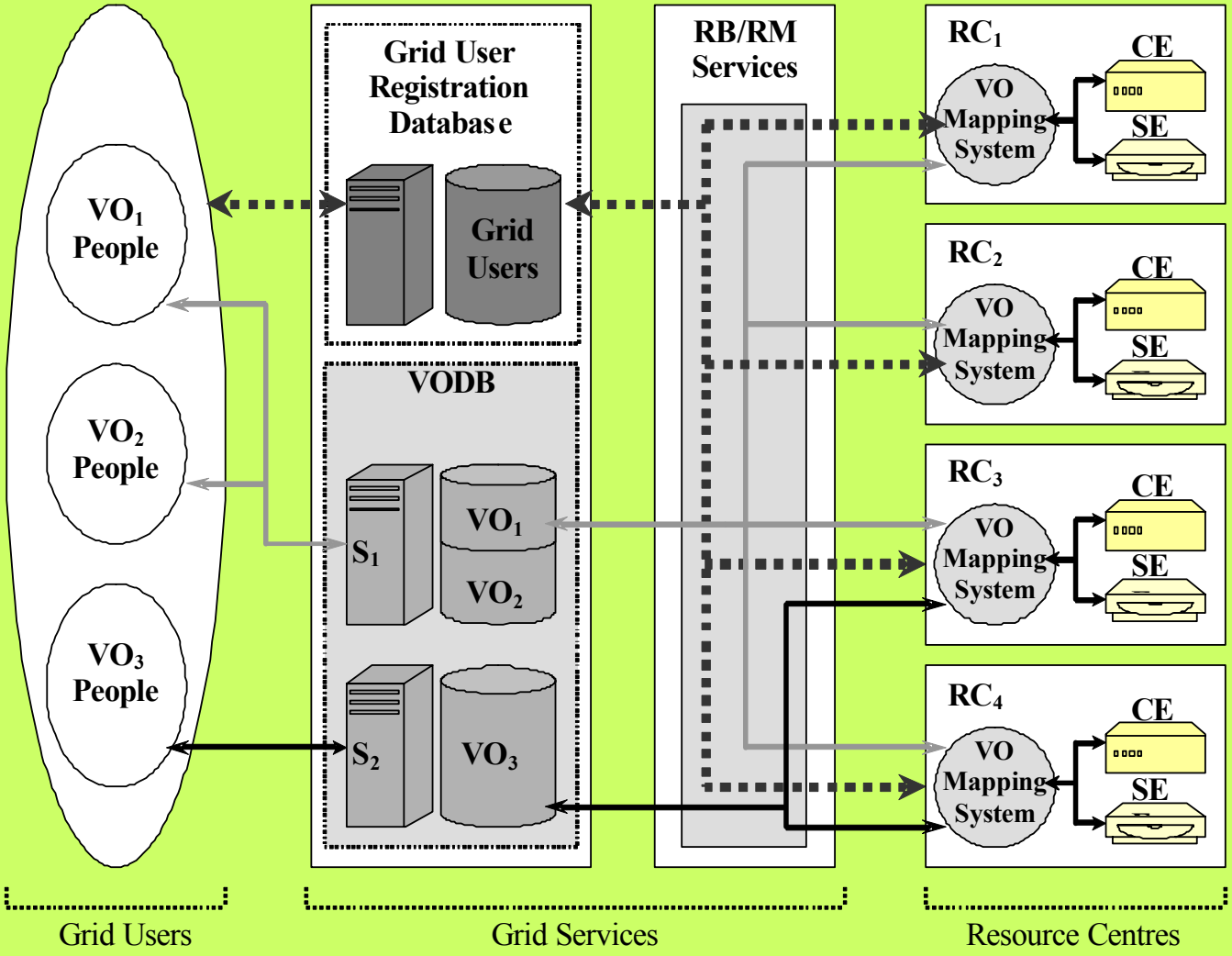
VO management in EGEE and RDIG

- **VO definition**:
  - A grouping of individuals, often not bound to a single institution or enterprise, who, by reason of their common member ship of the VO, and in sharing a common goal, are granted rights to use a set of resources on the Grid.
    - A VO can have a complex, hierarchical structure with groups and subgroups.
    - This structure is needed to clearly divide VO users according to their tasks and home institutions.

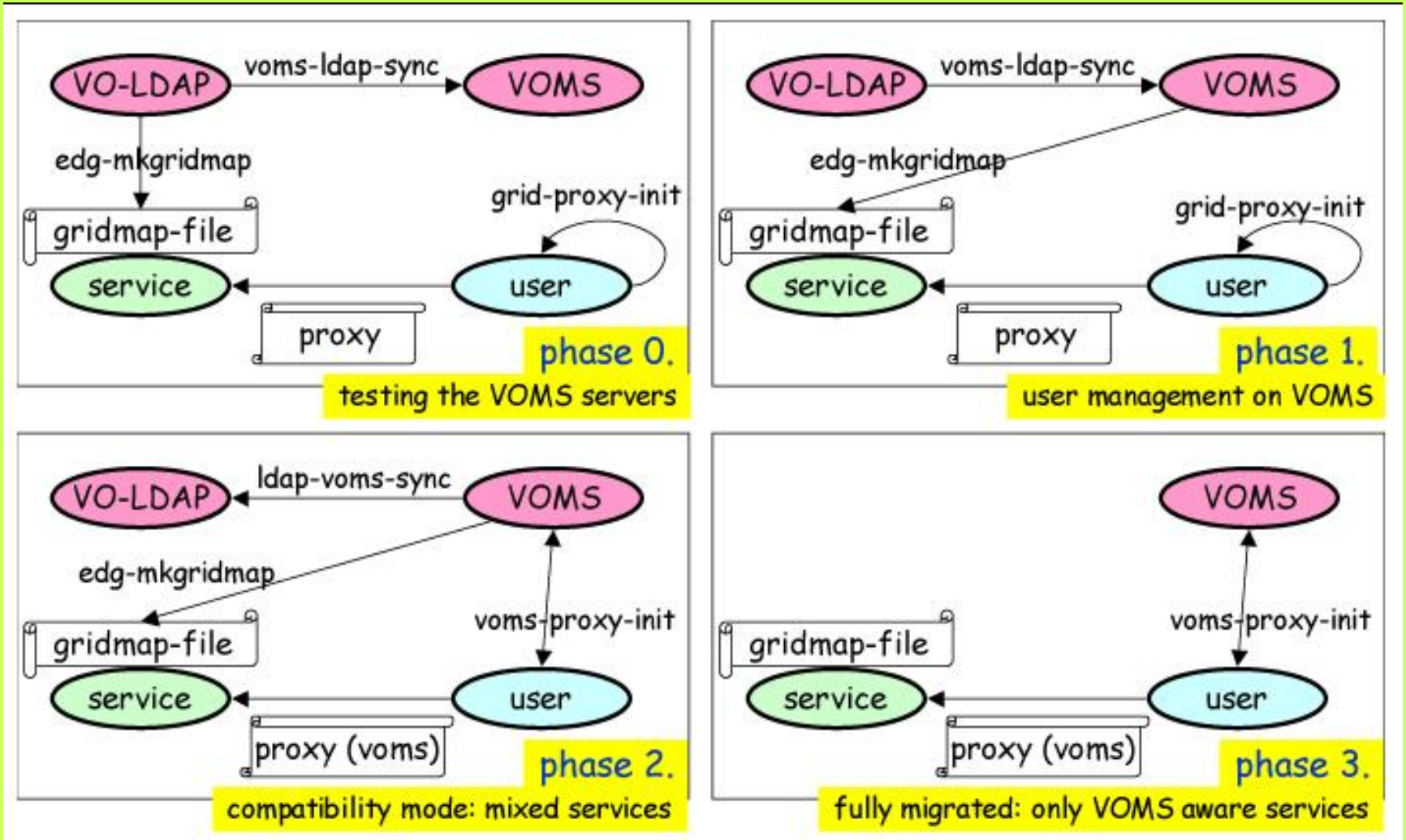
Steps to register a new VO

1. Name the VO.
2. Follow the Acceptance procedure, i.e. register with the designated EGEE bodies.
3. Set-up
4. Populate
5. Integrate
   - ***There are options for some of these steps:***
     - ***technology (LDAP or VOMS);***
     - ***location where the VO database (VODB) resides;***
     - ***...***

Integrating a VO



LDAP →VOMS Migration in EGEE



VO supported in EGEE

- LHC Affiliated VO with
  - 4 LHC experiments and Accelerators/Beam Physics:
    - ALICE, ATLAS, CMS, LHCB, SixTrack
  - technical VO
    - DTEAM
- non-LHC Affiliated VO
  - VOs for experiments in HEP:
    - BaBar, D0, H1, Zeus
  - Biomed (Biomedical activity);
  - ESR (Earth Science Research)
  - EGEODE (Expanding GEOsciences on DEmand)
  - … *many others on the way…*

Example: eEarth VO in RDIG

RDIG Russian Data Intensive Grid

- eEarth: for geophysics and cosmic research tasks;
- participating institutes:
  - Scmidt Institute of Physics of the Earth of Russian Academy of Sciences (IPE RAS)
  - Centre of Geophysical Data Studies and Telematics Applications (CGDS)
- eEarth VO will provide:
    - an access to world-wide distributed data;
    - distributed computations, e.g for interactive cartography and data vizualisation.;
    - monitoring of common computing resources loading to optimize the resources usage.
- Data Resources:
    - SPIDR Mirror site in Moscow (Spase Physics Interactive Data Resource, http://spidr.ngdc.noaa.gov);
    - Integrated Distributed Environmental Archive System (IDEAS);
    - Satellite Archive Browse and Retrieval (http://sabr.ngdc.noaa.gov);
    - Rapid Earthquake Determination Service;
    - Geophysical Survey RAS, Obninsk

RDIG supported VOs

In addition to centrally supported EGEE VOs (ALICE, ATLAS, CMS, LHCB, DTEAM) RDIG has a politics to support regional VOs (visible for EGEE)

- to support the national scientific projects and to test new application areas before including them into the global EGEE infrastructure

- Currently RDIG support the following VOs (*http://rdig-registrar.sinp.msu.ru*):
  - eEarth (eEarth Project, *http://www.e-earth.ru*)
  - PHOTON (projects PHOTON/SELEX *http://egee.itep.ru/PHOTON, http://www-selex.fnal.gov*)
  - AMS (AMS project, *http://ams.cern.ch*)
  - a couple VOs for testing the Grid (RGStest and RDTEAM)
    - Here some HEP experiments are living too, e.g. SVD U-70

- Closest plans – to create and support VOs in the areas of:
  - nuclear fusion;
  - chemical physics;
  - bio-engineering
  - Moscow St. Univ. campus Grid
  - …