



INP site: grid and cloud

V. Mossolov Dz. Yermak

Research Institute for Nuclear Problems of Belarusian State University

Minsk, Belarus

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JINR Dubna

General Information

- ▶ INP grid site (BY-NCPHEP):

run by scientists and engineers of Laboratory of Fundamental Interactions, Institute for Nuclear Problems of Belarussian State University (INP BSU);

we are involved in:

CMS T3 grid site support

JINR cloud integration

NGI_BY regional staff activity

WLCG computing shifts (ADC)



Milestones

- ▶ 2008

- Site was registered in GocDB as BY-NCPHEP

- ▶ 2011

- Site was registered in CMS SiteDB as T3 BY-NCPHEP

- ▶ 2018

- Integration to JINR cloud



Resources

- ▶ servers

Dell PowerEdge R610/710/620/630 and Supermicro

- ▶ physical cores in computing cluster

200 (most of them X5650 and E5-2620)

- ▶ RAM in computing cluster

680 Gb



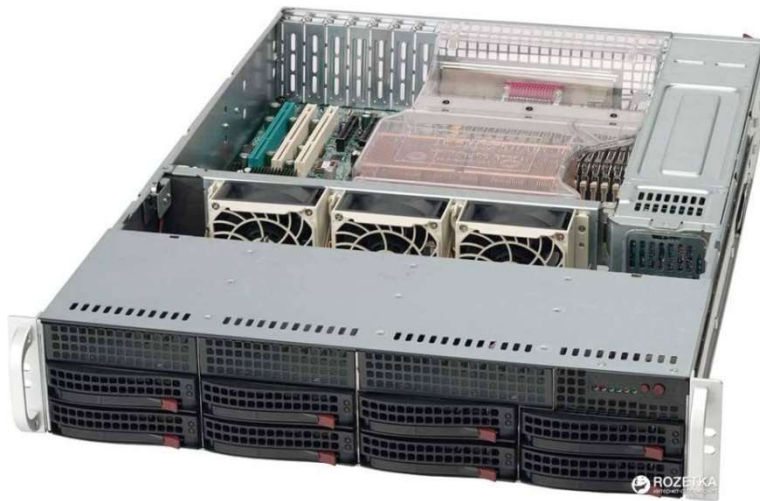
Resources

- ▶ Storage 128 Tb:

 - 2 x 24 slots and 1 x 8 slots chassis;

 - Lustre (2 MegaRAID RAID6 nodes and 1 ZFS node)

 - DRBD

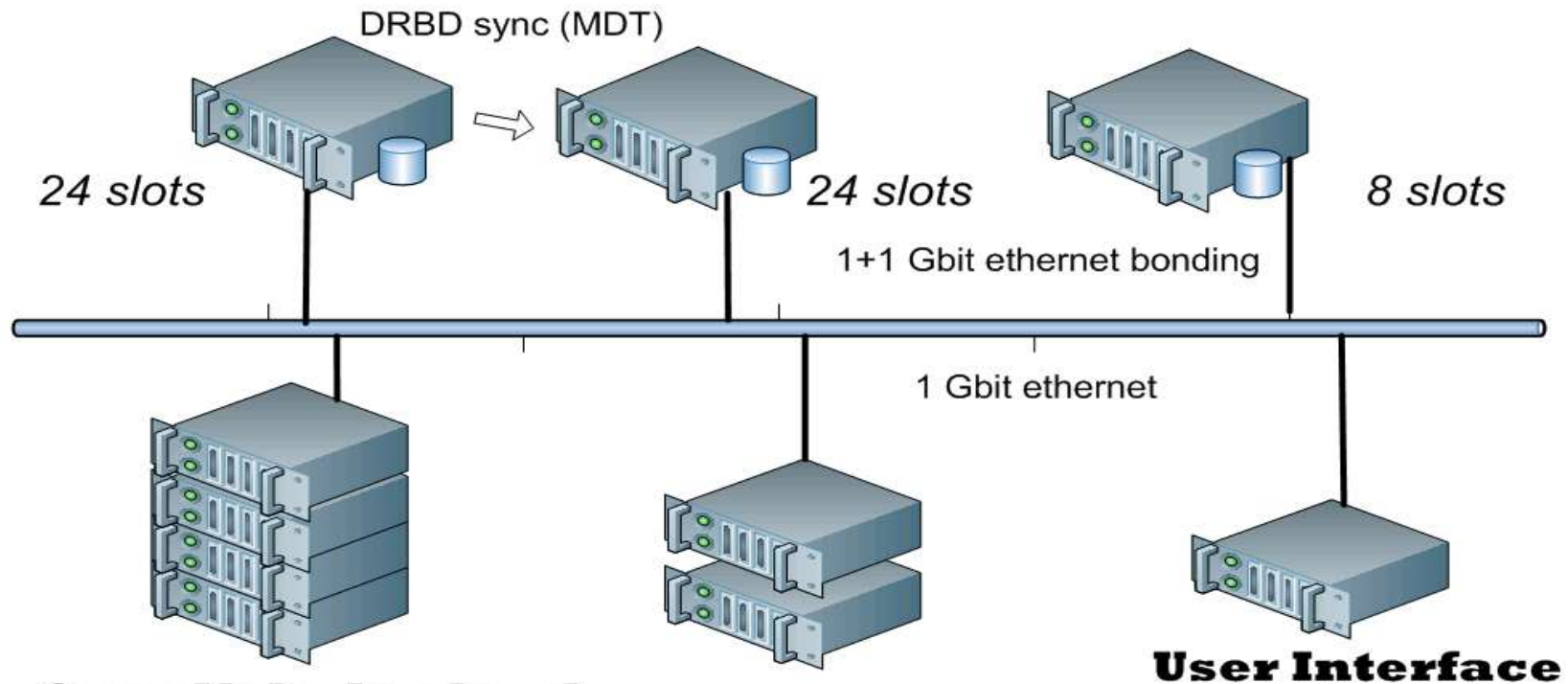


Network

Lustre Cluster (3 nodes)

MDT (RAID1+DRBD primary/secondary), 2 OST (RAID6)

OST (ZFS pool)



OpenNebula cloud

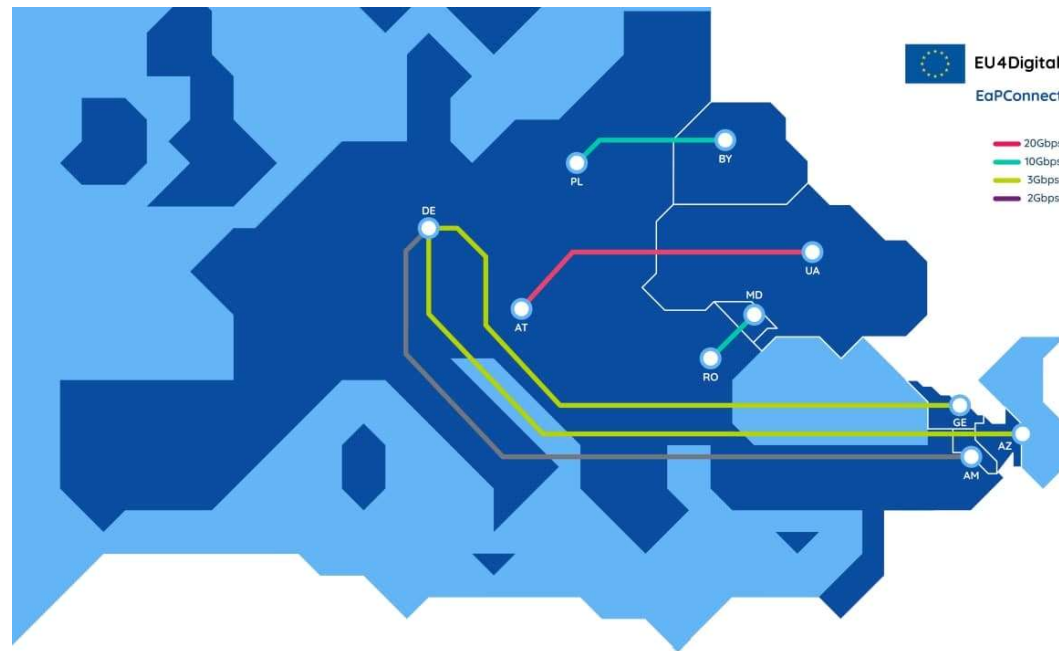
(work nodes – VMs)

Proxmox Cluster (2 nodes)

(GRID services, LDAP server, DNS server, etc. – VMs)

Network

- ▶ 1Gb LAN with
 - 2Gb bonded interface for storage boxes
 - 2x10 Gb SFP+ Intel X520-DA2 for cluster MPI jobs
- ▶ 100Mbit WAN (62 public IPv4 addresses)



GRID services

- ▶ The only belarussian certified and production WLCG site at the moment

The Grid WLCG view shows the accounting data from all Grid Sites in the database in Belarus. Accounting information is only gathered from Sites that are certified in GOCDB. The metric shown is Total number of jobs, grouped by Site and Year, all VOs are shown.

Belarus — Total number of jobs by Site and Year (All VOs)

Site	2023	Total	Percent
BY-NCPHEP	5,614	5,614	100%
Total	5,614	5,614	
Percent	100.00%		
1 - 1 of 1 results		< 1 > Number of rows per page 30 ▾	

GRID services

- ▶ ARC CE (Torque/Maui)
- ▶ Squid Frontier and CVMFS
- ▶ StoRM SE
- ▶ SBDII
- ▶ APEL
- ▶ UI



Cloud

- Infrastructure is based on Opennebula and Proxmox VE
- Proxmox 5.4 (grid services VMs)
- Opennebula 6.2(work nodes VMs, JINR cloud VMs)

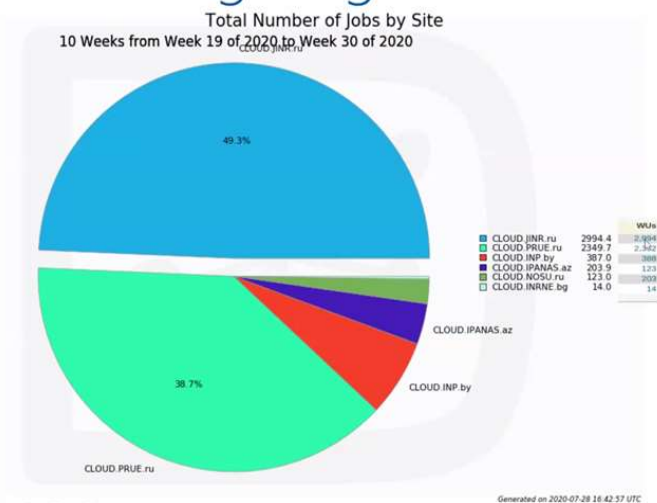
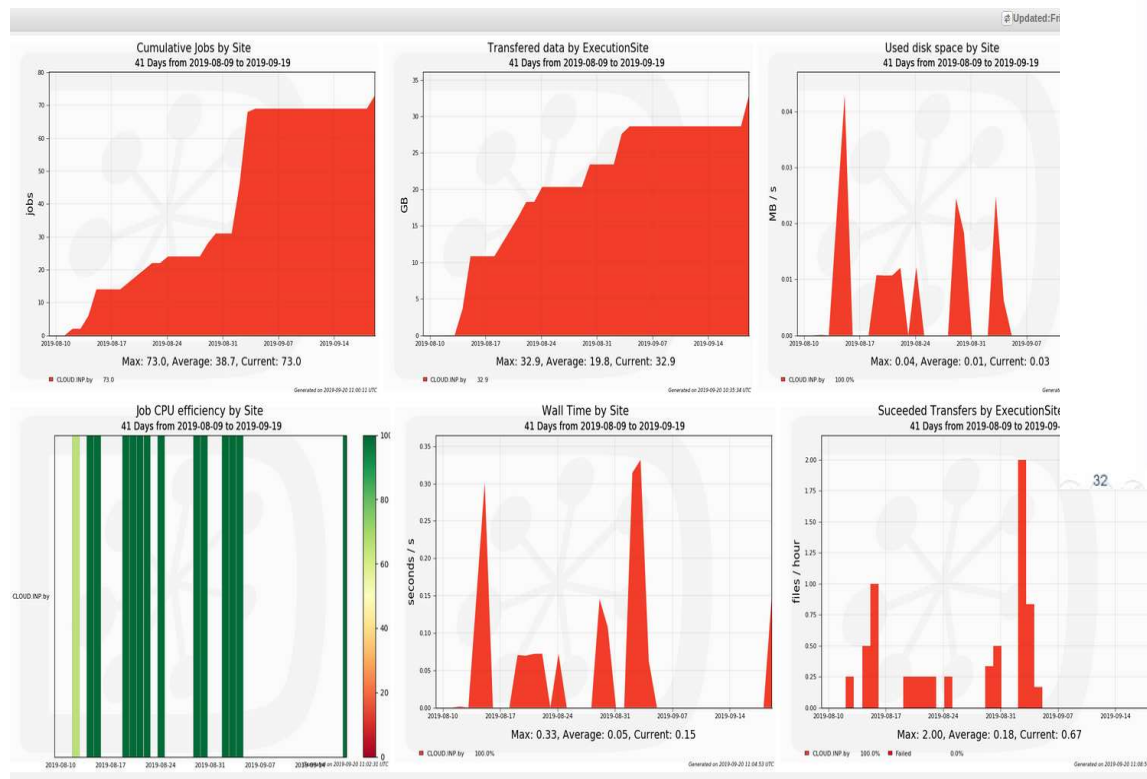
The screenshot displays two web interfaces side-by-side. The left interface is the Proxmox VE Virtual Environment 5.4-6, showing a 'Server View' of a datacenter with nodes 'gridhome1' and 'gridhome3'. It includes a 'CPU usage' graph and a 'Cluster log' table. The right interface is the OpenNebula Sunstone Cloud Operator, showing a 'VMs' list with columns for ID, Name, Owner, Group, Status, Host, and IPs. The VMs are managed by 'gridadmin' and 'oneadmin'.

ID	Name	Owner	Group	Status	Host	IPs
238	node010.hep.by	gridadmin	oneadmin	SHUTDOWN	wn003.hep.by	80.94.170.220 10.50.28.220
3986	ARC6	gridadmin	oneadmin	RUNNING	gridhome5.hep.by	80.94.170.234 10.50.28.234
3963	WN_Setup	gridadmin	oneadmin	RUNNING	gridhome9.hep.by	80.94.170.225 10.50.28.219
569	Labs	gridadmin	oneadmin	RUNNING	gridhome4.hep.by	80.94.170.222
538	node008.hep.by	gridadmin	oneadmin	RUNNING	gridhome6.hep.by	80.94.170.218 10.50.28.218
536	node006.hep.by	gridadmin	oneadmin	RUNNING	gridhome4.hep.by	80.94.170.216 10.50.28.216

Cloud

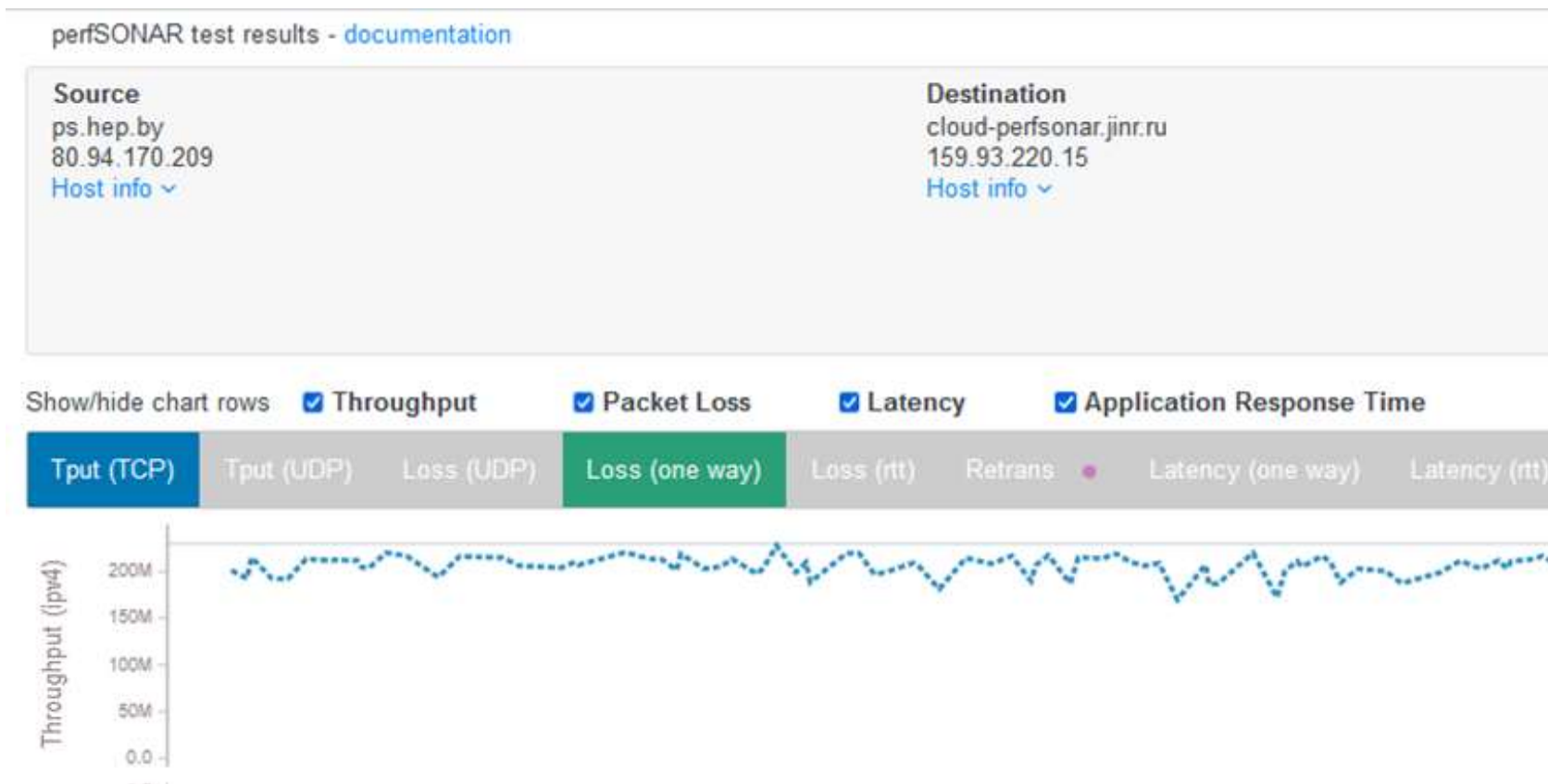
- Cloud is integrated in JINR cloud and participate in joint activity, like COVID-19 folding@home or NICA test data generation

Clouds Fighting COVID-19



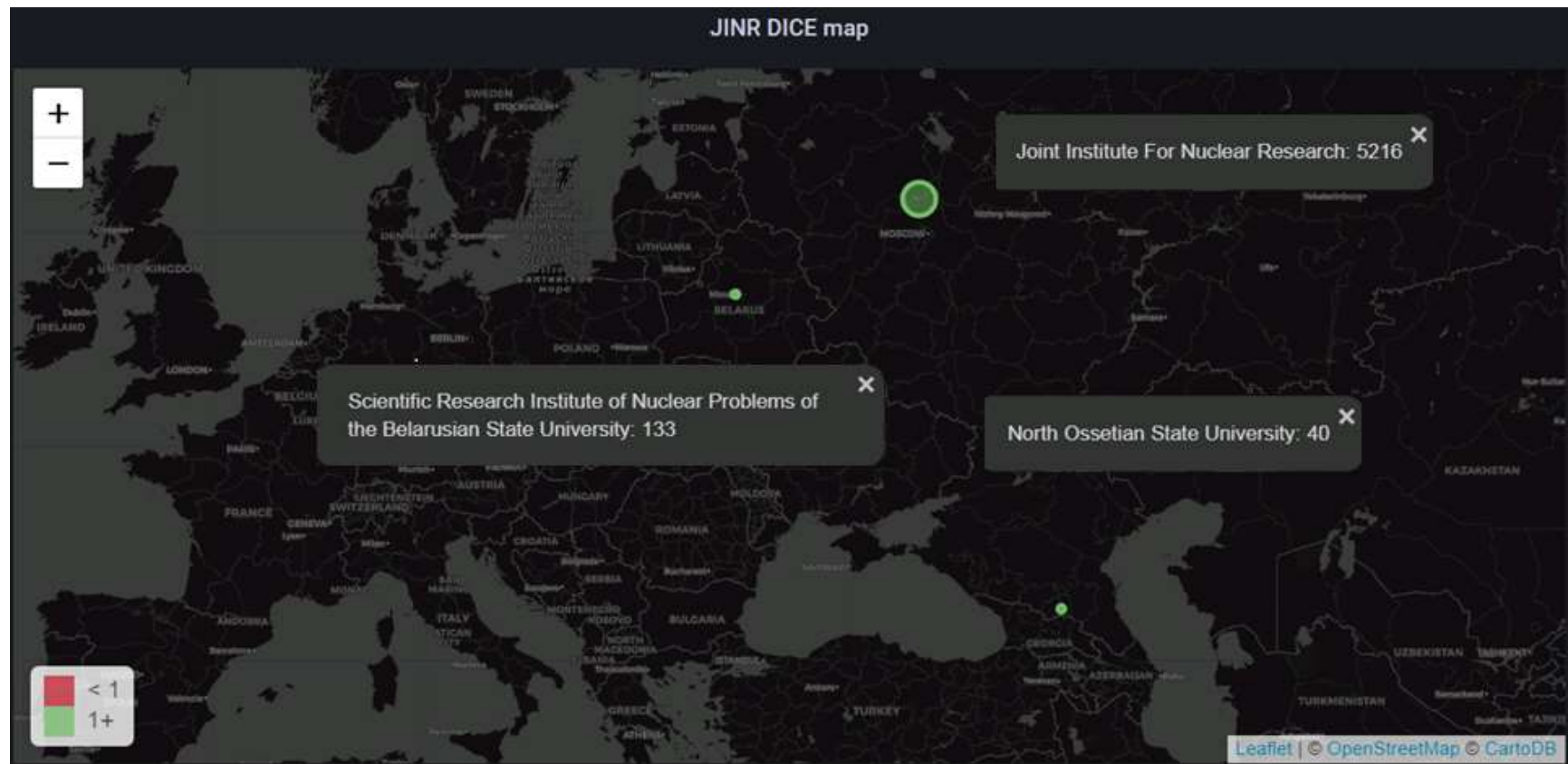
Cloud

- ▶ To monitor our network connectivity in JINR cloud, the perfSONAR toolkit is used



Cloud

- ▶ JINR cloud monitoring service was deployed recently (prometheus + thanos docker containers)



Software supported

- ▶ WLCG and CMS VO software (CVMFS distribution model)
- ▶ ORCA, Quantum ESPRESSO (MPICH, OpenMPI, OpenMP)
- ▶ Virtual Labs (ROOT and pythia) for Belarussian State University students



Software supported: some details

- ▶ - work nodes are VMs in the cloud
- ▶ - single basic image has all preinstalled software
(and both CERN and JINR CVMFS mounts)
- ▶ - VMs performance optimized by:
 guest-to-host NUMA mapping
 (qemu-kvm replaced by qemu-kvm-ev)
- ▶ - hyperthreading on host:
 disabled for VMs running computational tasks



Software supported: NICA

- ▶ MPD/SPD VO are enabled on the CE (grid04.hep.by)

The view shows the accounting data in Site BY-NCPHEP. The metric shown is Total number of jobs, grouped by VO and Month, all VOs are shown.

Resource Centre BY-NCPHEP — Total number of jobs by VO and Month (All VOs)

VO	Jun 2023	Total	Percent
atlas	400	400	7.72%
ops	3,778	3,778	72.96%
spd.nica.jinr	1,000	1,000	19.31%
Total	5,178	5,178	
Percent	100.00%		
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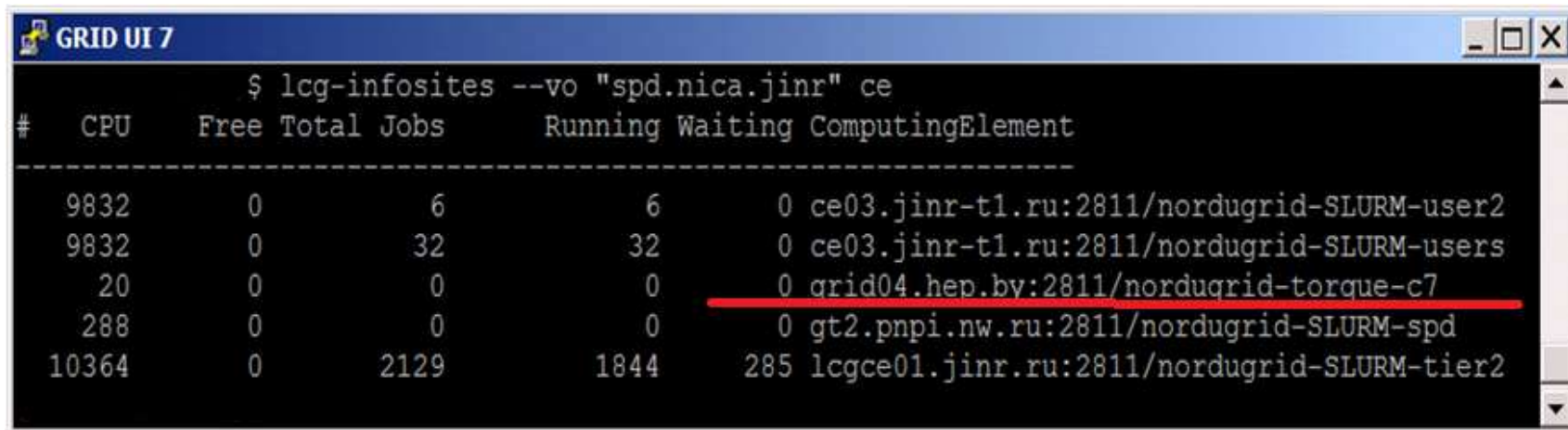
Software supported: NICA

- ▶ spdroot 4.1.5.1 is available from CVMFS like:

```
source /cvmfs/nica.jinr.ru/spd/centos7/spdroot/4.1.5.1/bin/SetEnv.sh  
spdroot.py spdroot/4.1.5.1/share/examples/SimuQslPy6.C
```

- ▶ test to check declaration for SPD support:

```
lcg-infosites --vo "spd.nica.jinr" ce
```



#	CPU	Free	Total	Jobs	Running	Waiting	Computing	Element
9832	0		6		6	0		ce03.jinr-t1.ru:2811/nordugrid-SLURM-user2
9832	0		32		32	0		ce03.jinr-t1.ru:2811/nordugrid-SLURM-users
20	0		0		0	0		<u>grid04.hep.by:2811/nordugrid-torque-c7</u>
288	0		0		0	0		gt2.pnpi.nw.ru:2811/nordugrid-SLURM-spd
10364	0		2129		1844	285		lcgce01.jinr.ru:2811/nordugrid-SLURM-tier2

Software supported: NICA

- ▶ Available ways to access data:
 - our StoRM SE is configured to support MPD/SPD
 - data located at eos.jinr.ru are available by EOS client for VO members (eosfusebind x509)



Monitoring tools

- ▶ Ganglia (cluster health)
- ▶ UptimeRobot (servers uptime)
- ▶ Cacti (router traffic)
- ▶ PerfSonar (channel bandwidth)
- ▶ WLCG/EGL monitoring (grid services)
- ▶ custom scripts (SMART, temperature, etc.)



Plans

- ▶ further JINR Cloud integration
- ▶ expand support for MPD/SPD computing
- ▶ resources extension (cores, disks, LAN/WAN)
- ▶ try
 - ipv6
 - tokens

