



INP site: grid and cloud

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GRID'2025

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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:

JINR cloud integration

SPD computing integration

NGI_BY regional staff activity



Milestones

- ▶ 2008

- Site was registered in GocDB as BY-NCPHEP

- ▶ 2011

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

- ▶ 2018

- Integration into JINR cloud

- ▶ 2024

- SPD MoU was signed;

- start of integration into SPD computing



Resources

- ▶ servers

 - Dell PowerEdge R610/710/620/630 and Supermicro

- ▶ physical cores in computing cluster

 - 264 (most of them X5650 and E5-2620)

- ▶ RAM in computing cluster

 - 800 Gb



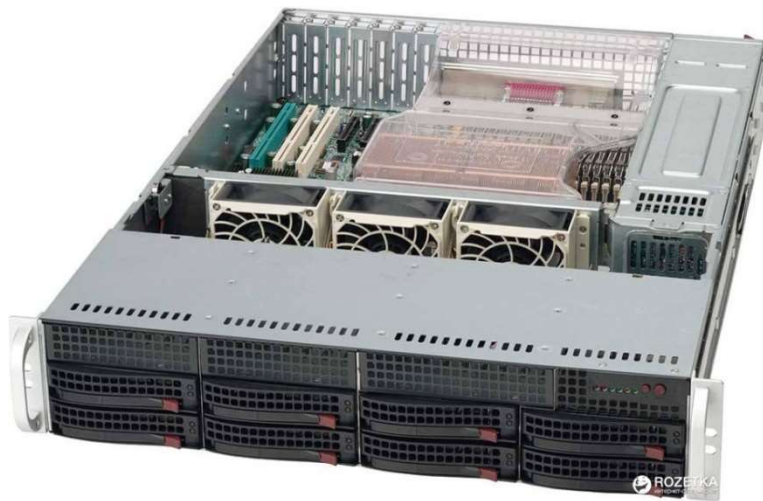
Resources: Storage

- ▶ 128 Tb (Lustre):

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

 - 2 MegaRAID RAID6 nodes and 1 ZFS node; DRBD

- ▶ 9 Tb (NFS)

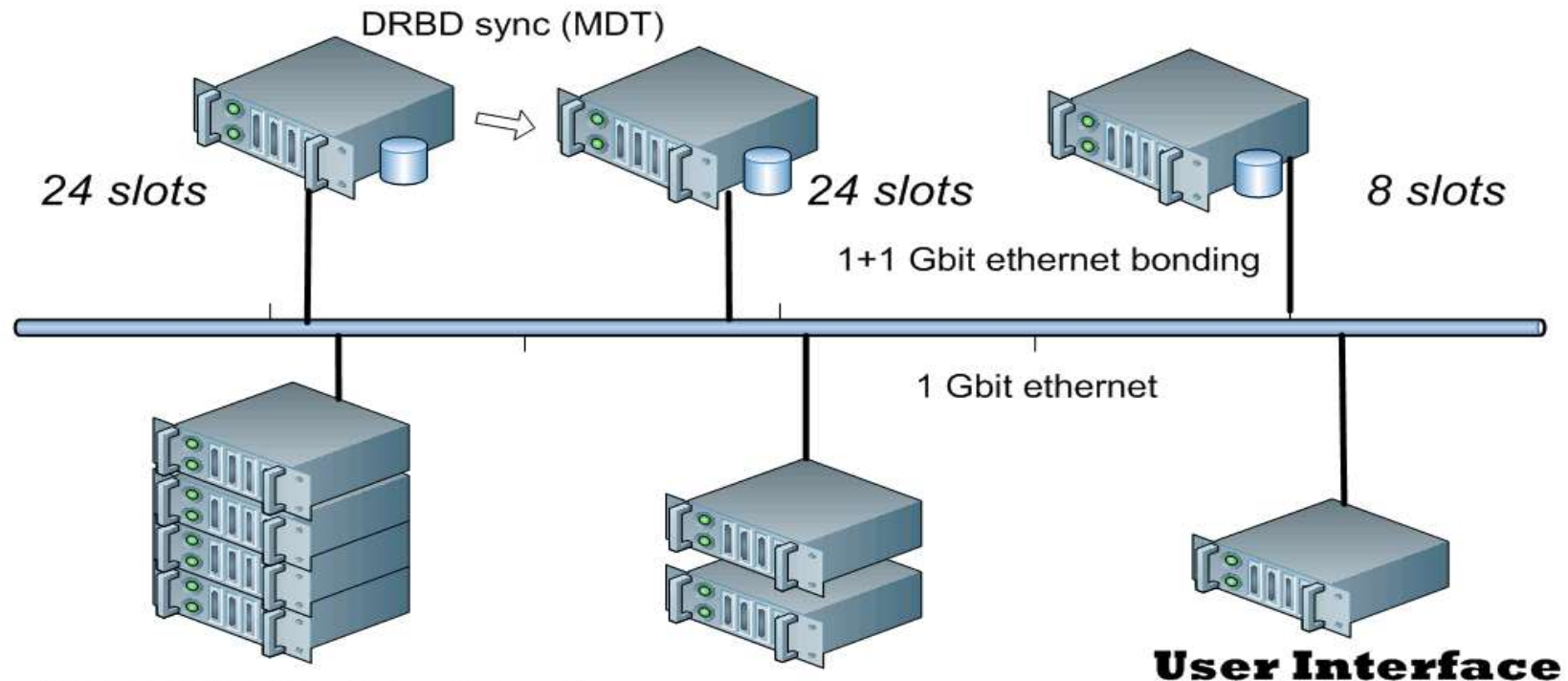


Network: LAN

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: WAN

- ▶ 100Mbit WAN (62 public IPv4 addresses)
- ▶ AS21274 (Peers IPv4):

Description		IPv6	Peer
Republican Unitary Enterprise "National Traffic Exchange Center"		X	<u>AS60280</u>
GEANT Vereniging		X	<u>AS20965</u>
Open Joint Stock Company 'Minsk Tractor Works'			<u>AS199561</u>
Belarussian National Technical University			<u>AS50934</u>
Republican Unitary Enterprise Research and Development Center of Information Resources and Communications			<u>AS57331</u>
A.V. Luikov Heat and Mass Transfer Institute of the National Academy of Sciences of Belarus			<u>AS60744</u>
Institution Central Information and Analytical Center at the Ministry of Education of Belarus			<u>AS5498</u>



GRID services

- ▶ ARC CE (Torque/Maui)
- ▶ Squid Frontier and CVMFS
- ▶ StoRM SE (upgrade to 1.11.22)
- ▶ FTS3
- ▶ SBDII
- ▶ APEL
- ▶ 2 UI (CentOS7, AlmaLinux9)



CernVM-FS



GRID services: FTS3

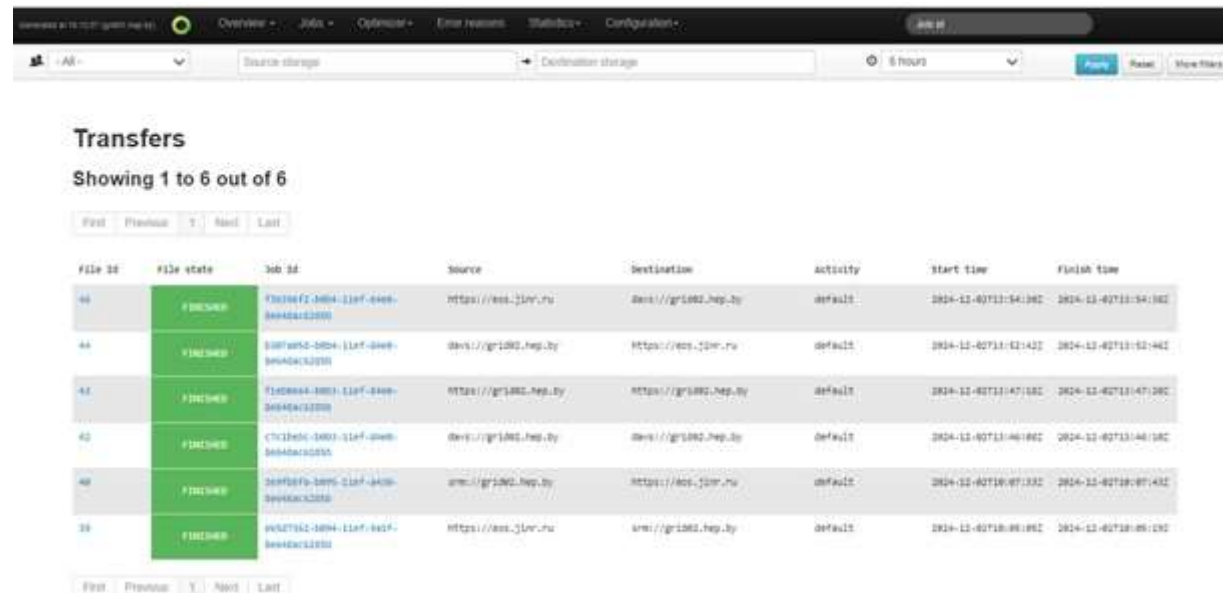
Endpoint: grid01.hep.by



two-way transfers to/from:

https://grid02.hep.by/spd.nica.jinr/path_to_files..

https://eos.jinr.ru:8443/eos/nica/path_to_files..



The screenshot shows the FTS3 Transfers interface. At the top, there is a navigation bar with tabs: Overview, Jobs, Optimizer, Error reasons, Statistics, and Configuration. Below the navigation bar, there is a search bar and a dropdown menu for 'Source storage'. The main content area is titled 'Transfers' and shows 'Showing 1 to 6 out of 6' jobs. Below this, there is a table with columns: File ID, File state, Job ID, Source, Destination, Activity, Start time, and Finish time. The table contains 6 rows of data, all with a 'Finished' state.

File ID	File state	Job ID	Source	Destination	Activity	Start time	Finish time
46	Finished	7303042-0004-11d4-b406-00406c320000	https://eos.jinr.ru	dev://grid02.hep.by	default	2024-12-02T11:54:18C	2024-12-02T11:54:18C
46	Finished	0007052-0004-11d4-b406-00406c320000	dev://grid02.hep.by	https://eos.jinr.ru	default	2024-12-02T11:52:42C	2024-12-02T11:52:42C
41	Finished	7303044-0003-11d4-b406-00406c320000	https://grid02.hep.by	https://grid02.hep.by	default	2024-12-02T11:47:18C	2024-12-02T11:47:18C
42	Finished	0703046-0003-11d4-b406-00406c320000	dev://grid02.hep.by	dev://grid02.hep.by	default	2024-12-02T11:46:18C	2024-12-02T11:46:18C
40	Finished	0007050-0005-11d4-b406-00406c320000	dev://grid02.hep.by	https://eos.jinr.ru	default	2024-12-02T10:07:33C	2024-12-02T10:07:33C
39	Finished	0007052-0004-11d4-b406-00406c320000	https://eos.jinr.ru	dev://grid02.hep.by	default	2024-12-02T10:06:18C	2024-12-02T10:06:18C

Worker Nodes

- ▶ - nodes are VMs in the cloud
- ▶ - single basic image has all preinstalled software
- ▶ - VMs performance optimized by:
 - guest-to-host NUMA mapping
(qemu-kvm is replaced by qemu-kvm-ev)
 - tuned profiles:
 - virtual-host (host)
 - hpc-compute (guest)
- ▶ - hyperthreading on host: disabled



Worker Nodes: software

- ▶ Grid (UMD repositories, etc.)
- ▶ SPD VO specific software
- ▶ ORCA, MCNP, Quantum Espresso (MPICH, OpenMPI, OpenMP)



Worker Nodes: software

- ▶ Docker images:

<code>docker.io/jemtchou/spdroot</code>	<code>4.1.6</code>
<code>git.jinr.ru:5005/spd/spd-sw/gaudi</code>	<code>develop</code>
<code>gitlab-registry.cern.ch/giordano/dbl2-cpp/dbl2</code>	<code>latest</code>

- ▶ Cvmfs + Squid frontier



Cloud

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

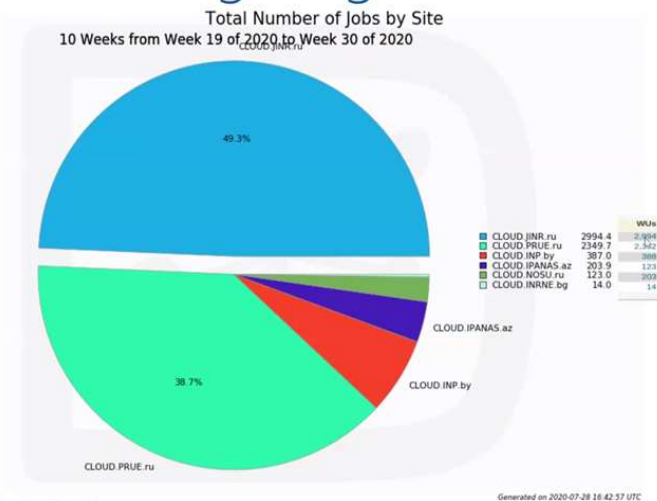
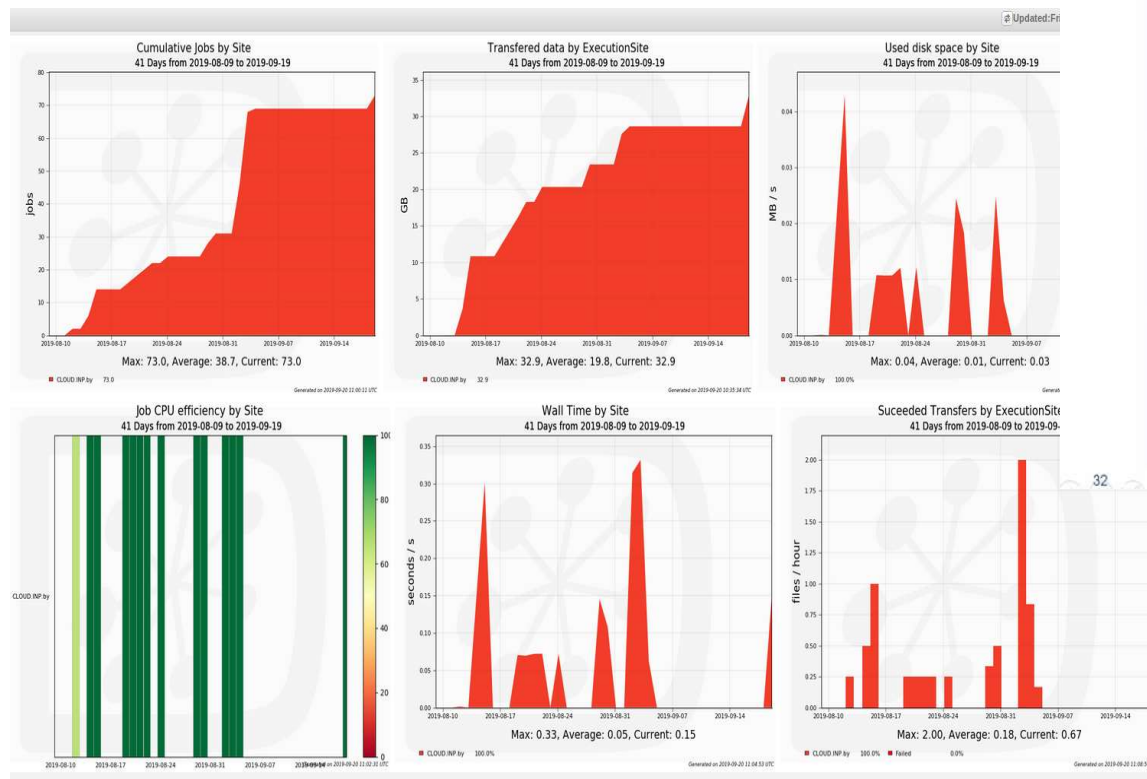
The screenshot displays two web interfaces side-by-side. The left interface is the Proxmox VE Virtual Environment 5.4-6, showing a 'Server View' of a cluster named 'Datacenter (BY-NCPHEP)'. It lists nodes 'gridhome1' and 'gridhome3'. A 'CPU usage' graph is visible, and a 'Cluster log' table at the bottom shows recent activities. The right interface is the OpenNebula Sunstone Cloud Operator, displaying a 'VMs' table. The table lists various virtual machines with their IDs, names, owners, groups, statuses, hosts, and IP addresses.

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

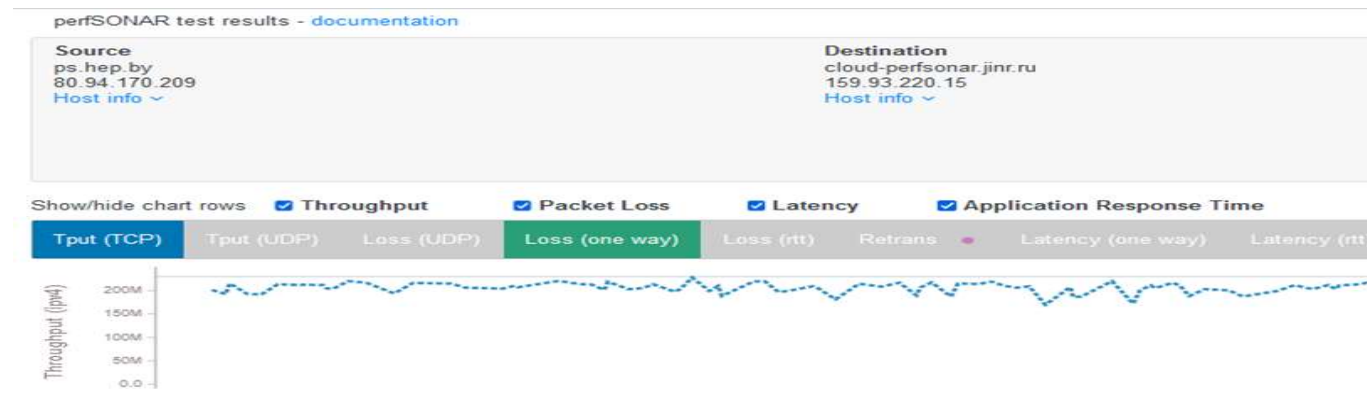
- Cloud is integrated in JINR cloud and participate in joint activity, like COVID-19 folding@home or NICA test data generation

Clouds Fighting COVID-19



Cloud: monitoring

- ▶ perfSONAR toolkit is used



- ▶ Prometheus/thanos docker service



Monitoring tools

- ▶ Ganglia (cluster health)
- ▶ UptimeRobot (servers uptime)
- ▶ Cacti (router traffic)
- ▶ PerfSonar (channel bandwidth)
- ▶ EGI monitoring (suspended)
- ▶ custom scripts (grid services, S.M.A.R.T, etc.)



Status changes: end of CERN agreement

- ▶ The only belarussian certified and production WLCG site for years

Belarus — Total number of jobs by Site and Year (All VO's)

Site	2023	Total	Percent
BY-NCPHEP	5,614	5,614	100%

- ▶ the agreement between CERN and Belarus expired 27 June 2024 and not renewed
- ▶ what was changed: ca_BYGCA package is no longer in ca-policy-egi-core



Plans

- ▶ more disks for storage
- ▶ new services for SPD VO; grid services upgrade
- ▶ further JINR cloud integration
- ▶ migration to AlmaLinux9
- ▶ infrastructure upgrade (more UPS, etc.)

