

Distributed computing infrastructure for the SPD experiment

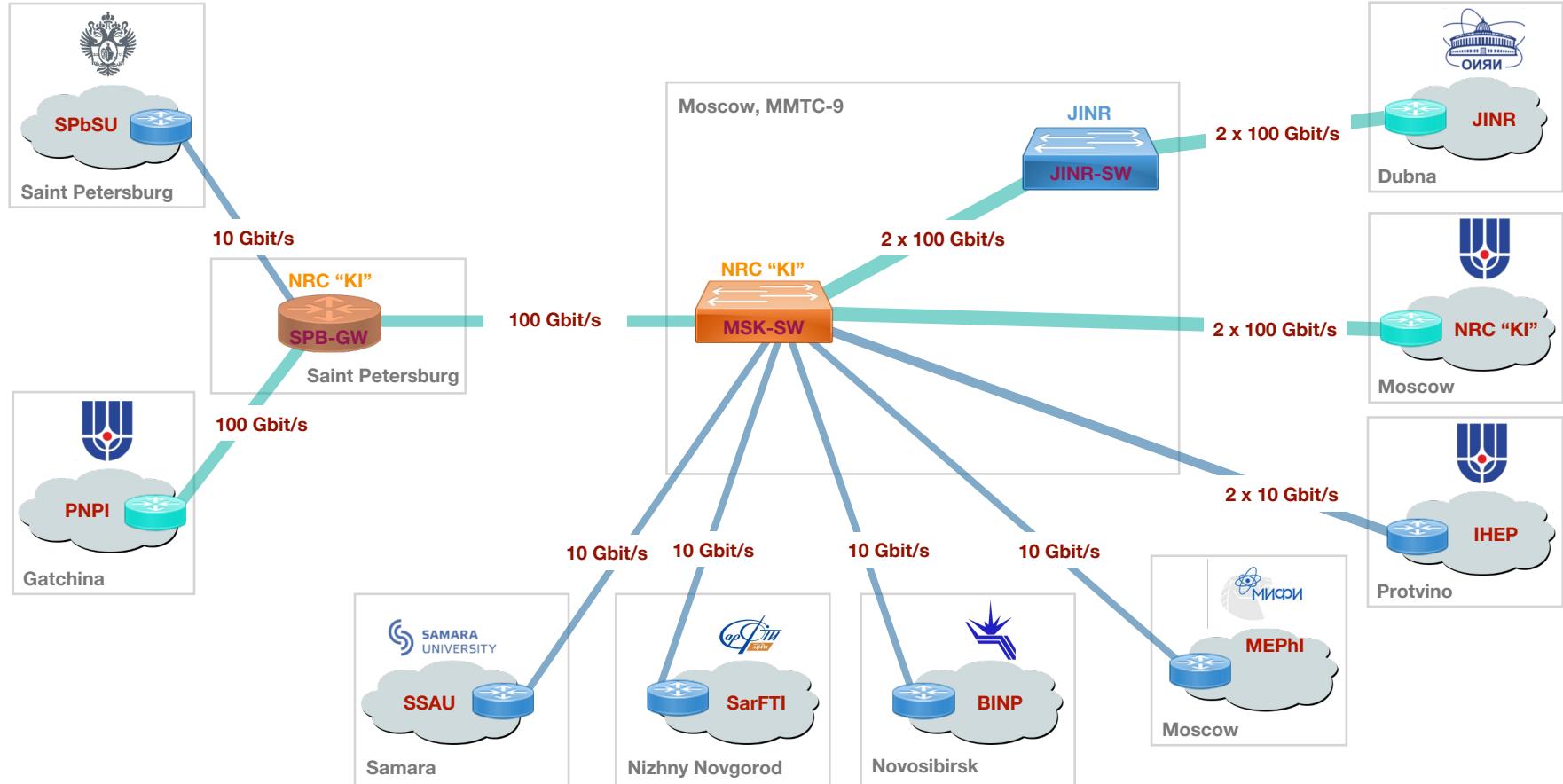
Andrey Kiryanov, NRC KI – PNPI

GRID'2025, 7-11 July 2025

Introduction

- SPD relies heavily on a distributed offline computing, which is currently in active development
- Collaboration participants can provide computing and storage resources with standard interfaces
- SPD provides central facilities for security, job and data management, software distribution, monitoring
- Russian Scientific Backbone provides broadband network infrastructure for the most major scientific organizations in Russia
 - Peering with Russian and international networks

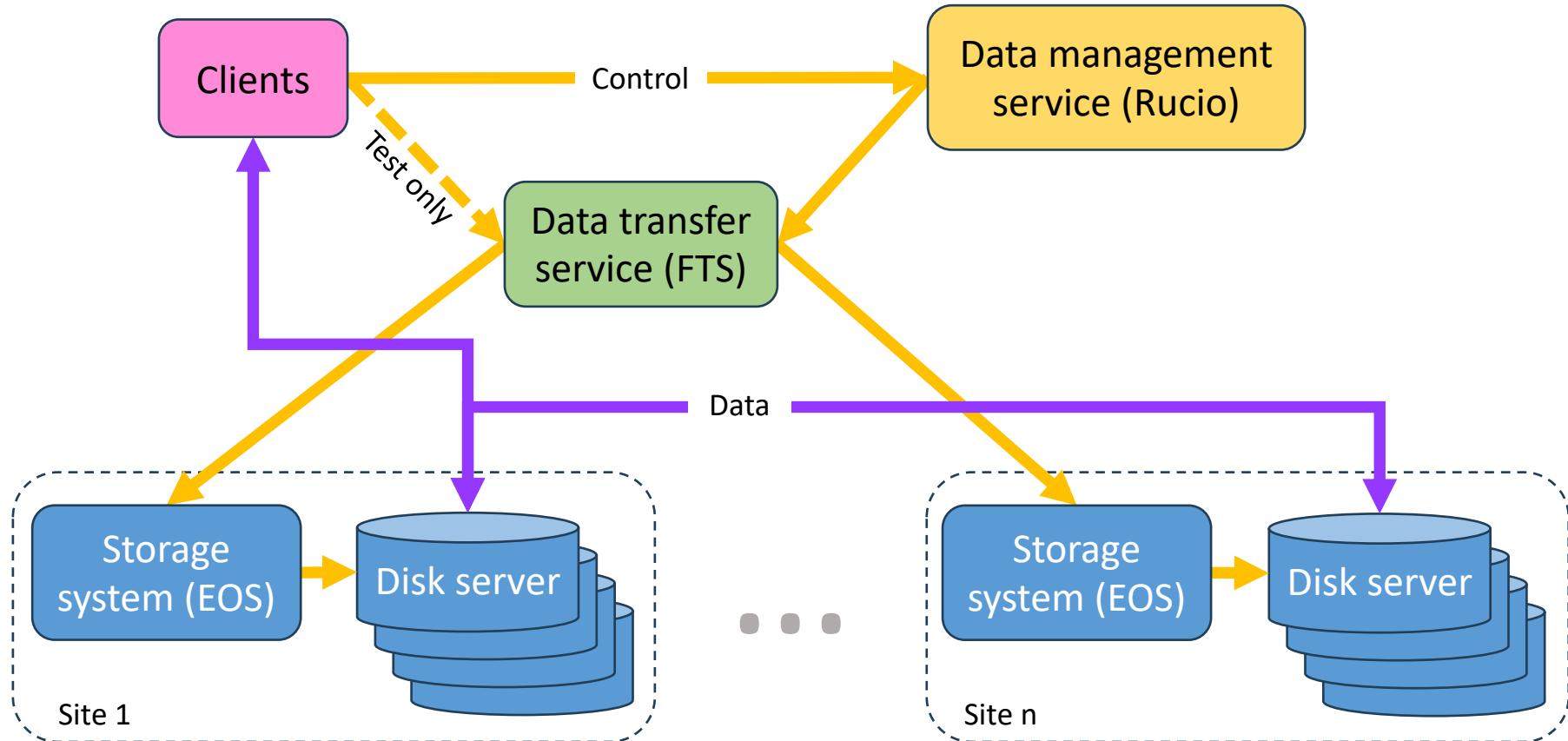
Russian Scientific Backbone



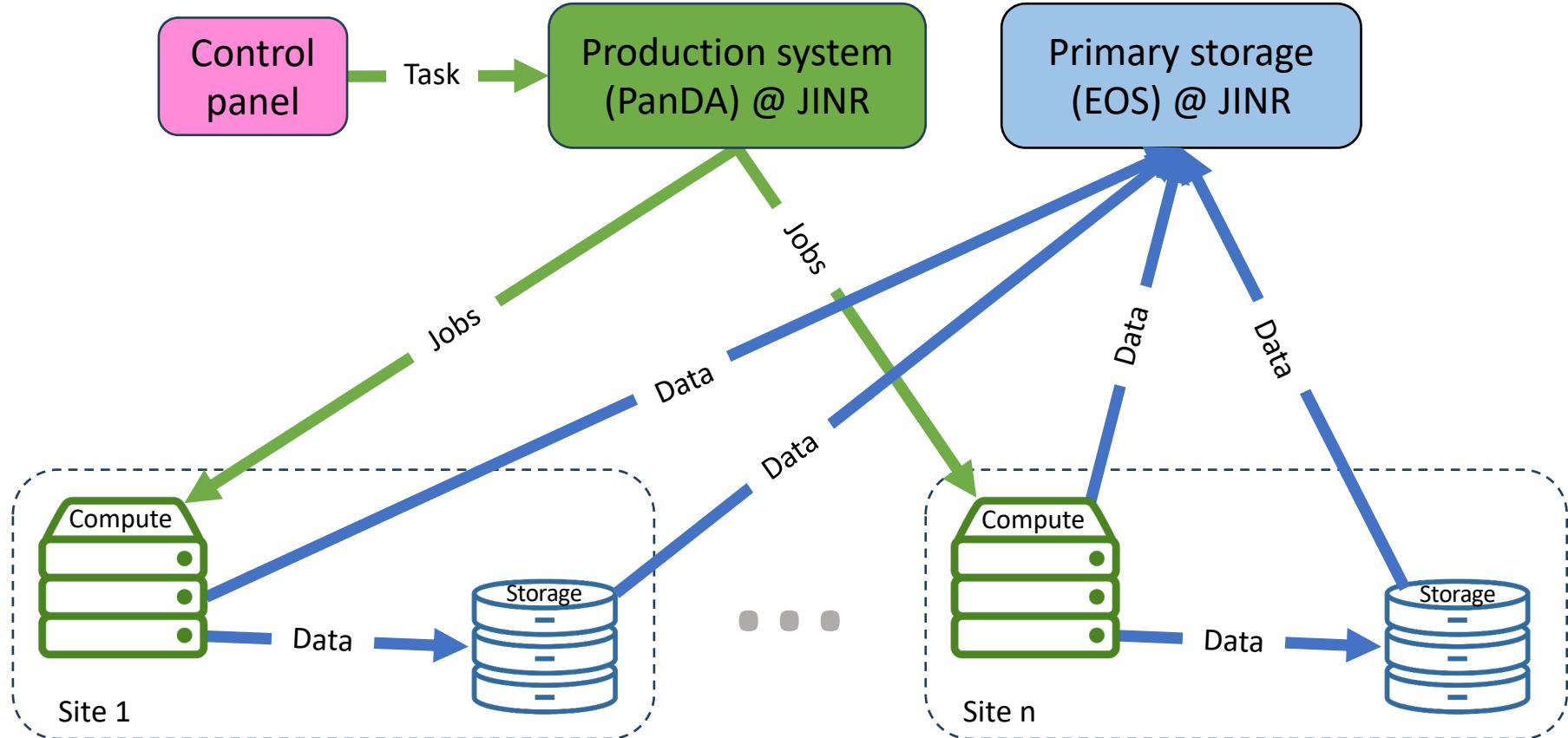
Computing building blocks

- Core of the production system deployed at JINR
 - IAM – the root of trust
 - CRIC – resource registry
 - CVMFS Stratum 0 – software repository
 - PanDA/Harvester – job management
 - Rucio/FTS – data management
 - Monitoring for all of the above
- Sites are expected to deploy a limited set of "extra" software
 - ARC CE (or HTCondor if you really need to) – job submission interface
 - Slurm (or Condor) – local batch system
 - PBS, LSF, SGE and clones are NOT recommended
 - NFS (or Lustre, CephFS, etc.) – local shared filesystem
 - CVMFS – software distribution
 - Local monitoring (Zabbix, etc.)

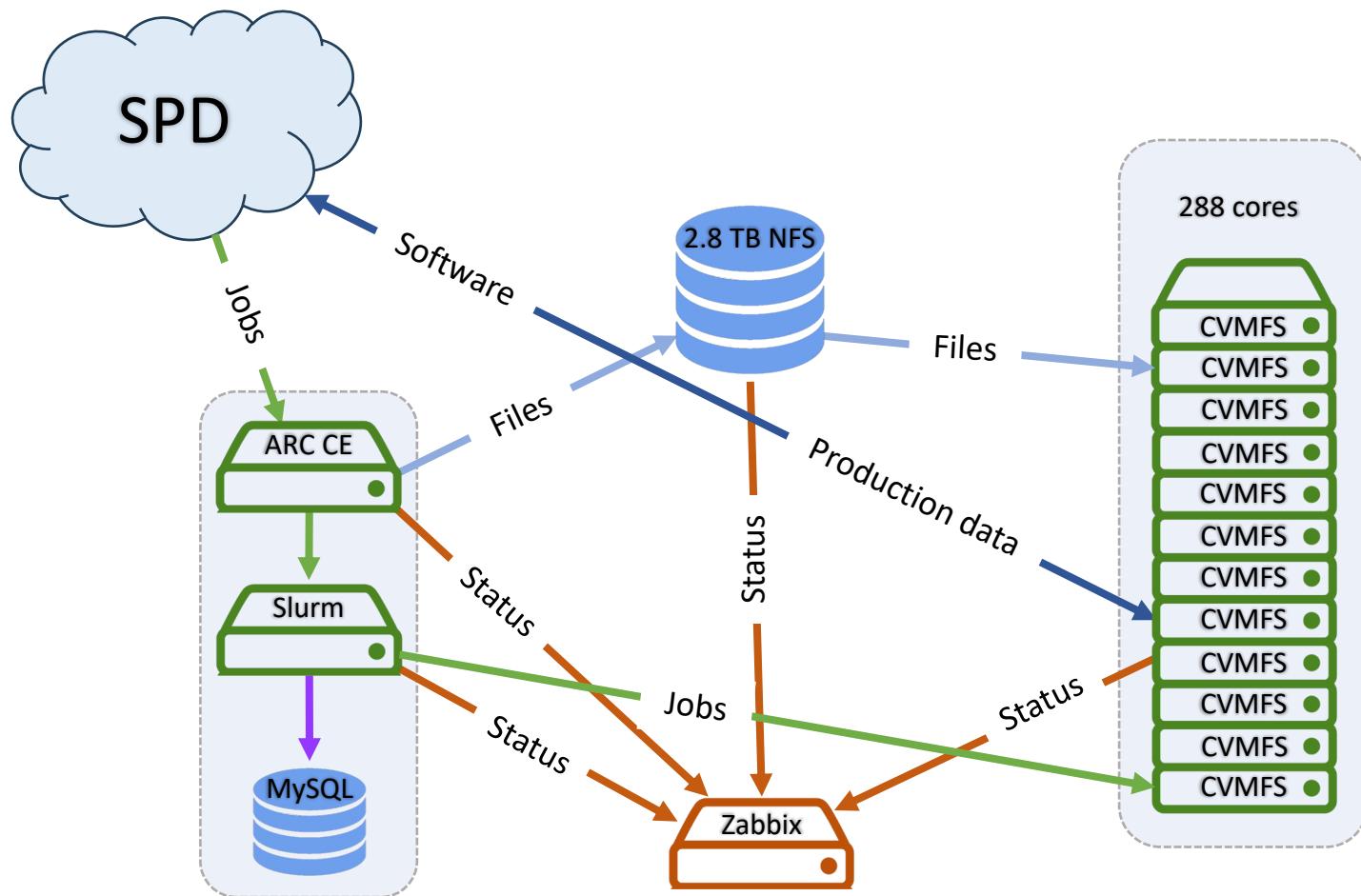
Data management in SPD



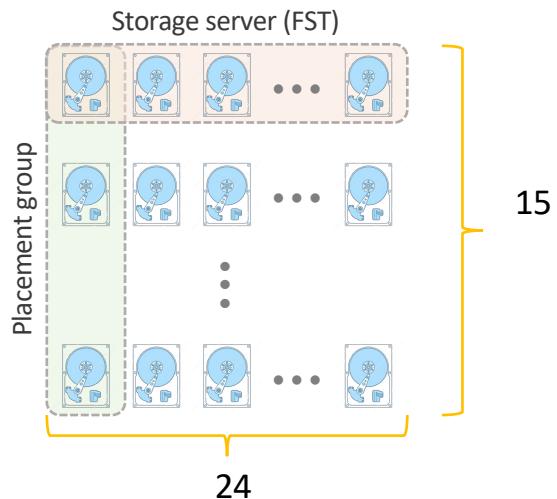
Distributed computing in SPD



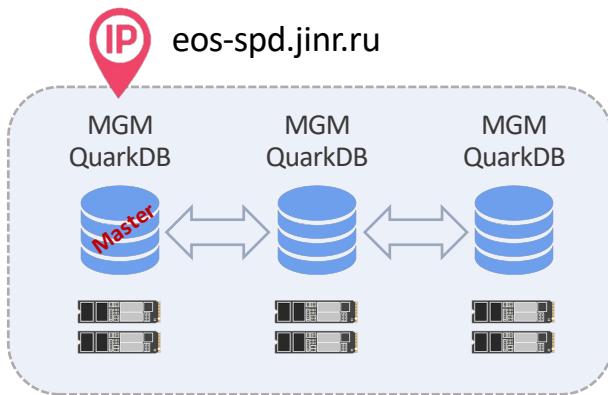
Computing deployment at PNPI



EOS deployment at JINR



- 7.2 PB of raw disk storage
- 24 placement groups
- 15 stripes per group
- 11+4 QRAIN layout (27% overhead)
- 5.3 PB of usable space



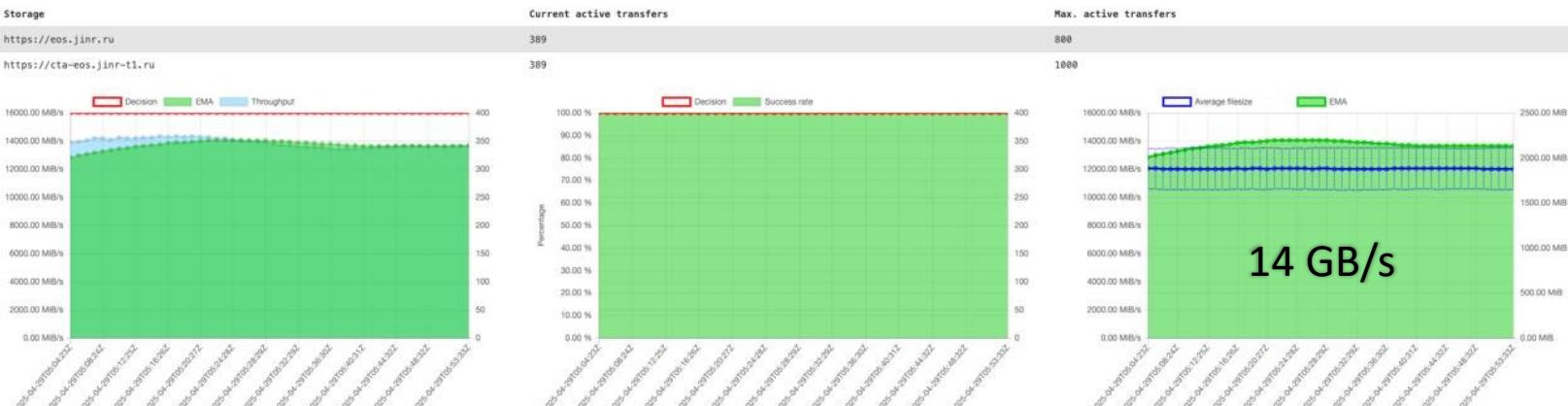
- HA MGM/QuarkDB on 3 nodes
- 1.5 TB of namespace
- Floating IP alias

Data transfer rates

Details for <https://juno-se-dr01.jinr.ru> → <https://eos-spd.jinr.ru> 



Details for <https://eos.jinr.ru> → <https://cta-eos.jinr-t1.ru> 



Zabbix monitoring at JINR

Global view

All dashboards / Global view

From: 2025-04-24 15:21:43 To: 2025-04-24 16:21:43 Apply

Zoom out (2025-04-24 15:21:43 – 2025-04-24 16:21:43)

Last 2 days Yesterday Today Last 5 minutes
 Last 7 days Day before yesterday Today so far Last 15 minutes
 Last 30 days This day last week This week Last 30 minutes
 Last 6 months Previous month This month so far Last 1 hour
 Last 1 year Previous year This month Last 3 hours
 Last 2 years This year so far Last 6 hours
 This year Last 12 hours
 This year so far Last 1 day

Top hosts by CPU utilization

Host name	Utilization	1m avg	5m avg	15m avg	Processes
FTS	39.31 %	6.07	4.33	3.56	253
Rucio Production	15.71 %	0.77	0.59	0.45	247
SPD PostgreSQL Server	10.58 %	0.42	0.35	0.23	236
Zabbix server	3.14 %	2.59	1.31	0.63	299
ProdSys Management Panel	1.76 %	0.12	0.08	0.02	168
IAM	0.33 %	0.00	0.00	0.00	183

149.50 ↓ Zabbix server Values per second

System information

Parameter	Value	Details
Zabbix server is running	Yes	zabbix-server:10051
Zabbix server version	7.0.11	New update available
Zabbix frontend version	7.0.11	New update available
Number of hosts (enabled/disabled)	31	31 / 0
Number of templates	341	
Number of items (enabled/disabled/not supported)	10677	10553 / 0 / 124
Number of triggers (enabled/disabled [problem/ok])	4532	4532 / 0 / 360 / 41721

12:42 MOSCOW

Host availability

Available	Not available	Mixed	Unknown	Total
30	1	0	0	31

Problems by severity

Disaster	High	Average	Warning	Information	Not classified
0	0	1	359	0	0

Rucio CPU utilization



Current problems

Time	Info	Host	Problem + Severity	Duration	Update	Actions	Tags
12:25:40 PM		eos-n-f029.jinr.ru	Linux: sda: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	15m 52s	Update		component: storage disk: sda scope: performance
12:25:36 PM		eos-n-f018.jinr.ru	Linux: sde: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	15m 56s	Update		component: storage disk: sde scope: performance
12:25:36 PM		eos-n-f021.jinr.ru	Linux: sdv: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	15m 56s	Update		component: storage disk: sdv scope: performance
12:25:29 PM		eos-n-f019.jinr.ru	Linux: sdk: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	16m 3s	Update		component: storage disk: sdk scope: performance
12:25:28 PM		eos-n-f019.jinr.ru	Linux: sdt: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	16m 4s	Update		component: storage disk: sdt scope: performance
12:25:28 PM		eos-n-f029.jinr.ru	Linux: sdi: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	16m 4s	Update		component: storage disk: sdi scope: performance
12:25:26 PM		eos-n-f021.jinr.ru	Linux: sdq: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	16m 6s	Update		component: storage disk: sdq scope: performance
12:25:23 PM		eos-n-f018.jinr.ru	Linux: sdw: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	16m 9s	Update		component: storage disk: sdw scope: performance
12:25:22 PM		eos-n-f023.jinr.ru	Linux: sdt: Disk read/write request responses are too high (read > 20 ms for 15m or write > 20 ms for 15m)	16m 10s	Update		component: storage disk: sdt scope: performance

What is currently deployed

- JINR
 - Production system services (prod and devel instances)
 - Computing (2200 cores)
 - Storage (7.2 PB raw with 27% redundancy = 5.3 PB)
 - Monitoring
- PNPI
 - Computing (288 cores)
 - Storage (190 TB redundant)
 - Monitoring
- SSAU
 - Computing (256 cores)
 - Storage is on the way (240 TB raw with 17% redundancy = 200 TB)
- MEPhI
 - Ongoing negotiations

What is yet missing

- Monitoring coverage for core services
 - We need to monitor the health of services, not just hardware
 - Visualization (dashboards, etc.)
- Periodic infrastructure tests
 - Network monitoring
 - Job submission tests
 - Worker node health tests
 - Data transfer tests
- Full transition to tokens
 - EOS-side configuration
 - ARC CE-side configuration
 - User manual

Thank you!