



# MPD 14<sup>th</sup> collaboration meeting



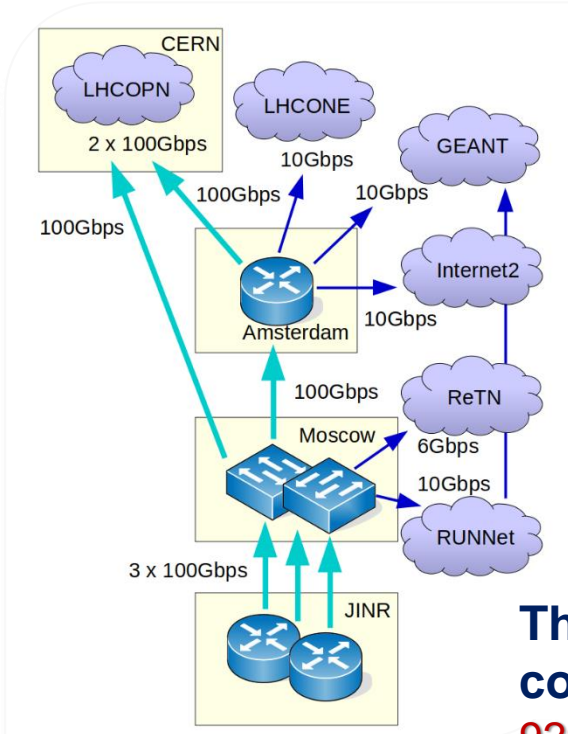
## MLIT resources and services for the MPD experiment



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Mescheryakov Laboratory of  
Information Technologies

# Network in JINR



- JINR-Moscow **3x100 Gbit/s**
- JINR-CERN - **100 Gbit/s** and JINR-Amsterdam **100 Gbit/s** for LHCOPN, LHCONE, GEANT networks
- Direct channels up to 100 Gbit/s for communication using RU-VRF technology with the collaboration of RUHEP research centers and with Runnet, ReTN networks
- The multi-site cluster network with a bandwidth **4x100 Gbit/s** between VBLHEP and MLIT

## The JINR LAN

comprises:

**9291** network elements

**18044** IP-addresses

**6355** users registered

within the network

**4477** \*.jinr.ru service

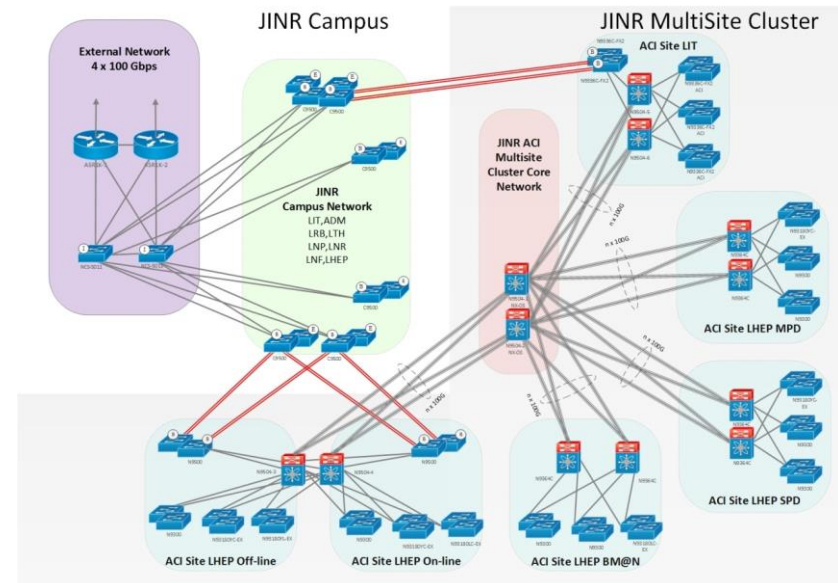
users

**1455** digital library

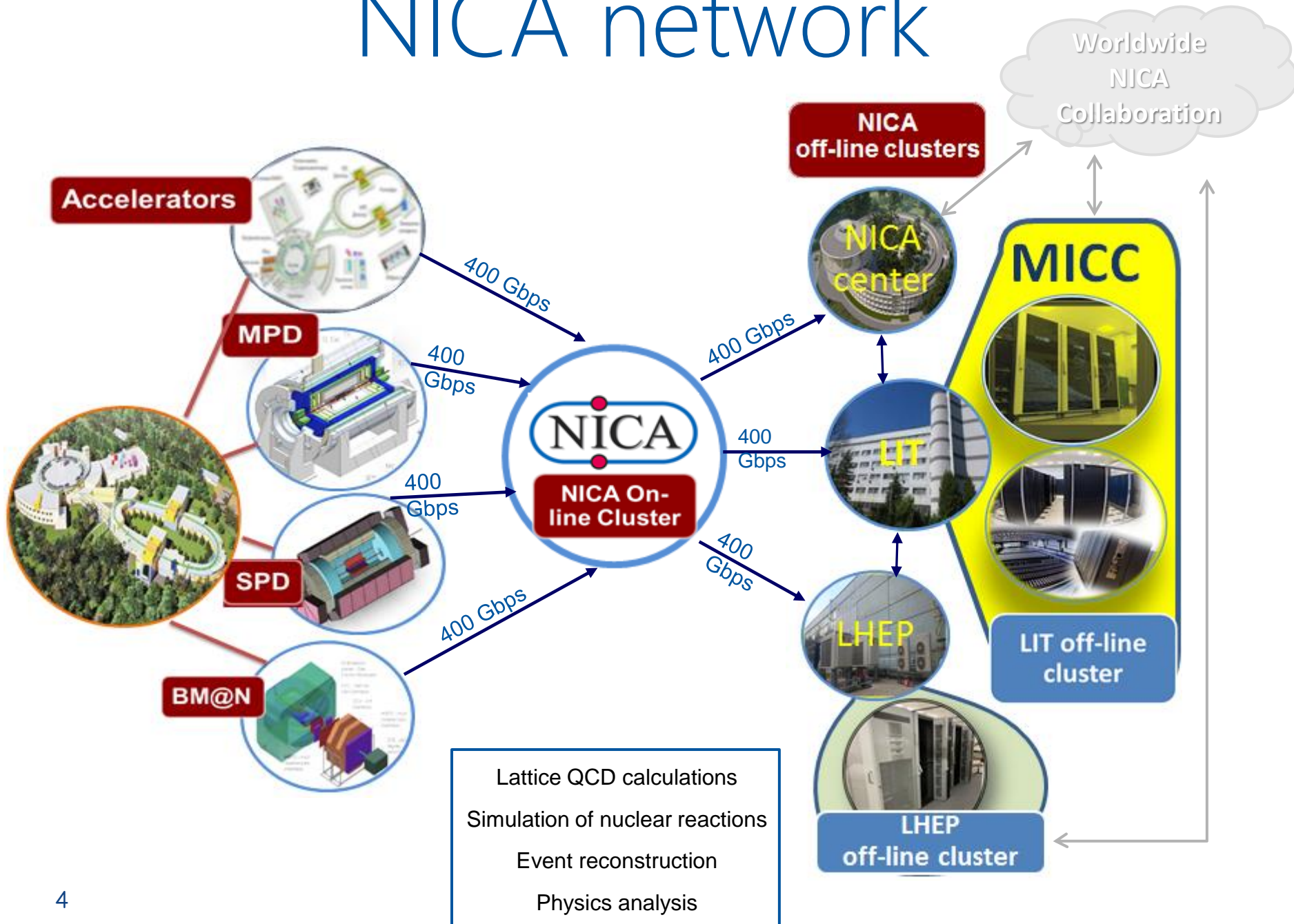
users

**837** remote VPN

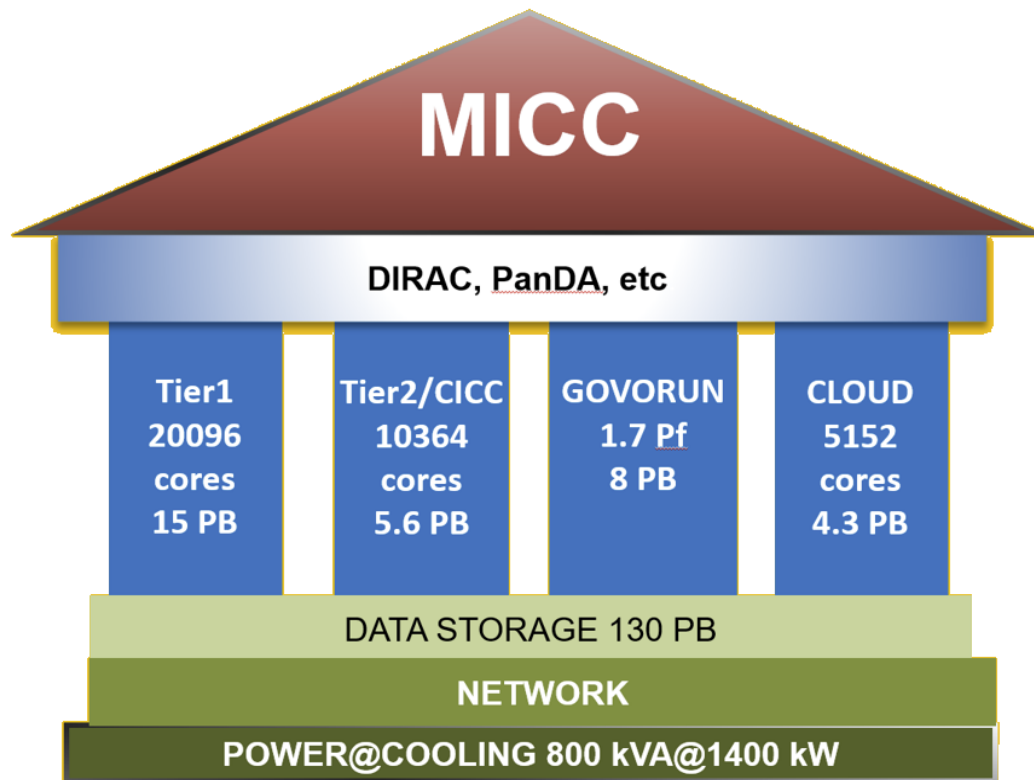
**111** EDUROAM users



# NICA network



# Multifunctional Information and Computing Complex



## 4 advanced software and hardware components:

- Tier1 grid site
- Tier2 grid site
- Govorun supercomputer
- Cloud infrastructure

## Distributed multi-layer data storage system

- Disks
- Robotized tape library

## Engineering infrastructure

- Power
- Cooling

## Network

- Wide Area Network
- Local Area Network

We ensure **multifunctionality, scalability, high performance, reliability** and **availability** in 24x7x365 mode for different user groups that carry out scientific studies within the JINR Topical Plan

# MICC storage systems

## Disks 43 PB

Disks are the main storage that allows processing of experimental and Monte-Carlo data



EOS storage is used by all experiments on NICA collider. dCache is used by CMS experiment.

MPD statistics on MLIT EOS:

**Physical space occupied – 2.04 PB**

**Physical space free – 0.36 PB**

MPD space on EOS may be expanded (to some extent) by request.

## Tapes 100 PB

Tapes are primarily used for data backups



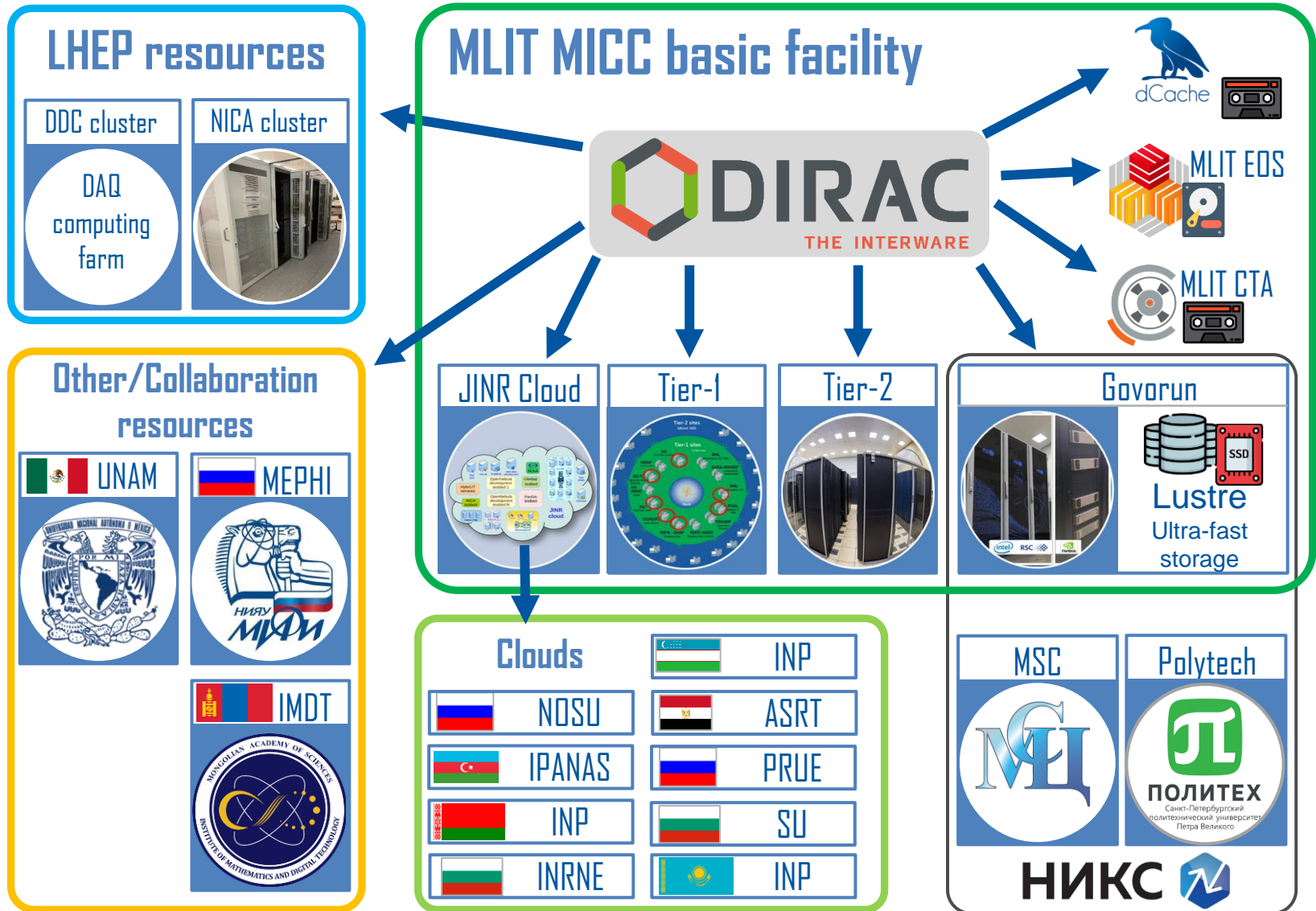
CERN  
Tape Archive



Enstore is the original system that may work with dCache to provide access to tapes. CTA is a CERN archival solution, it is rather new system which was adopted by many experiments.

CTA is proposed to be used as an archival storage for MPD. That is ongoing work by MPD members from MLIT.

# DIRAC in JINR

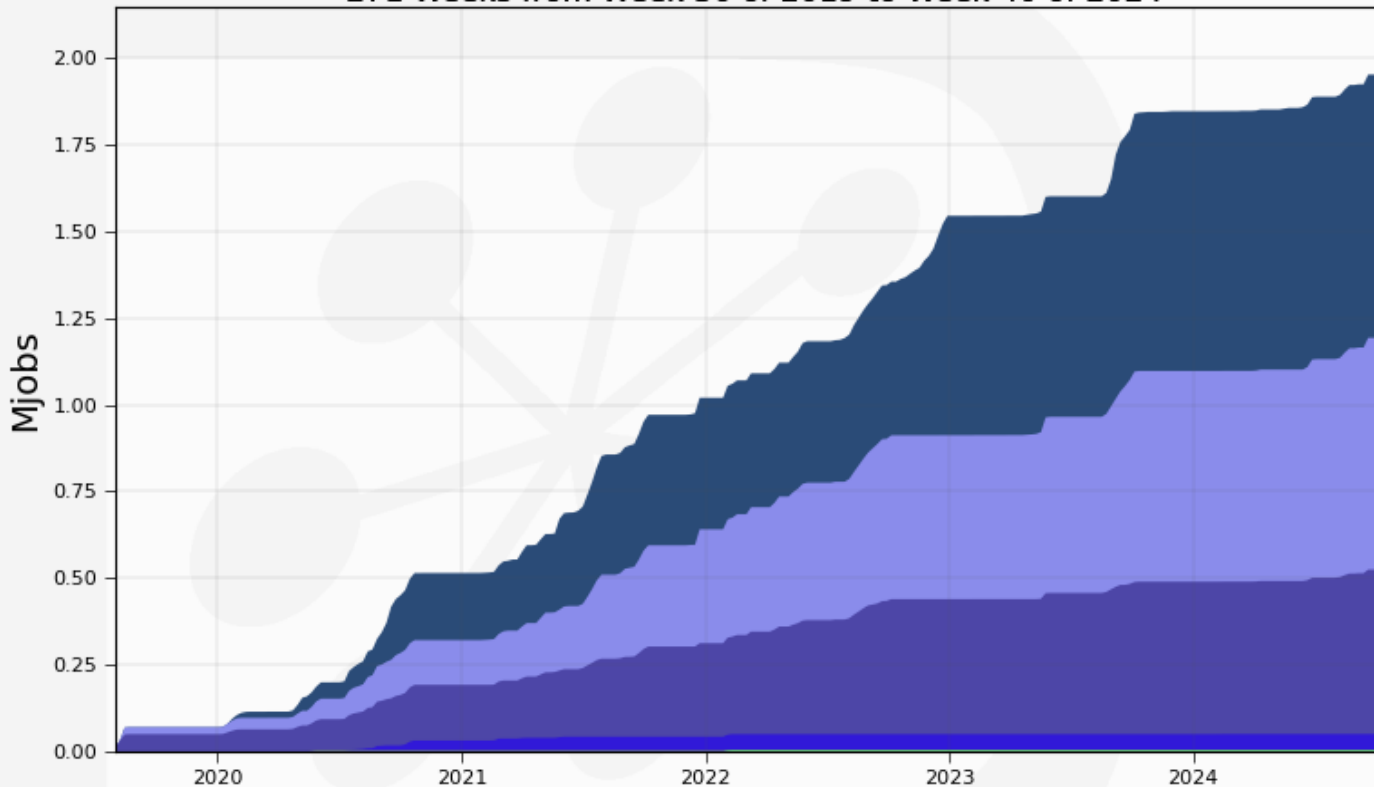


# Successful MPD Jobs executed

## Cumulative Jobs by Site

271 Weeks from Week 30 of 2019 to Week 40 of 2024

1.95 M  
jobs completed



Max: 1.95, Min: 0.01, Average: 1.03, Current: 1.95

DIRAC.GOVORUN.ru	0.8	DIRAC.JINR-LHEP.ru	0.0	CLOUD.JINR.ru	0.0	CLOUD.INP.by	0.0
DIRAC.JINR-TIER.ru	0.7	DIRAC.NIKS-JSCC.ru	0.0	CLOUD.NOSU.ru	0.0		
DIRAC.JINR-CREAM.ru	0.5	DIRAC.UNAM.mx	0.0	CLOUD.INP.kz	0.0		

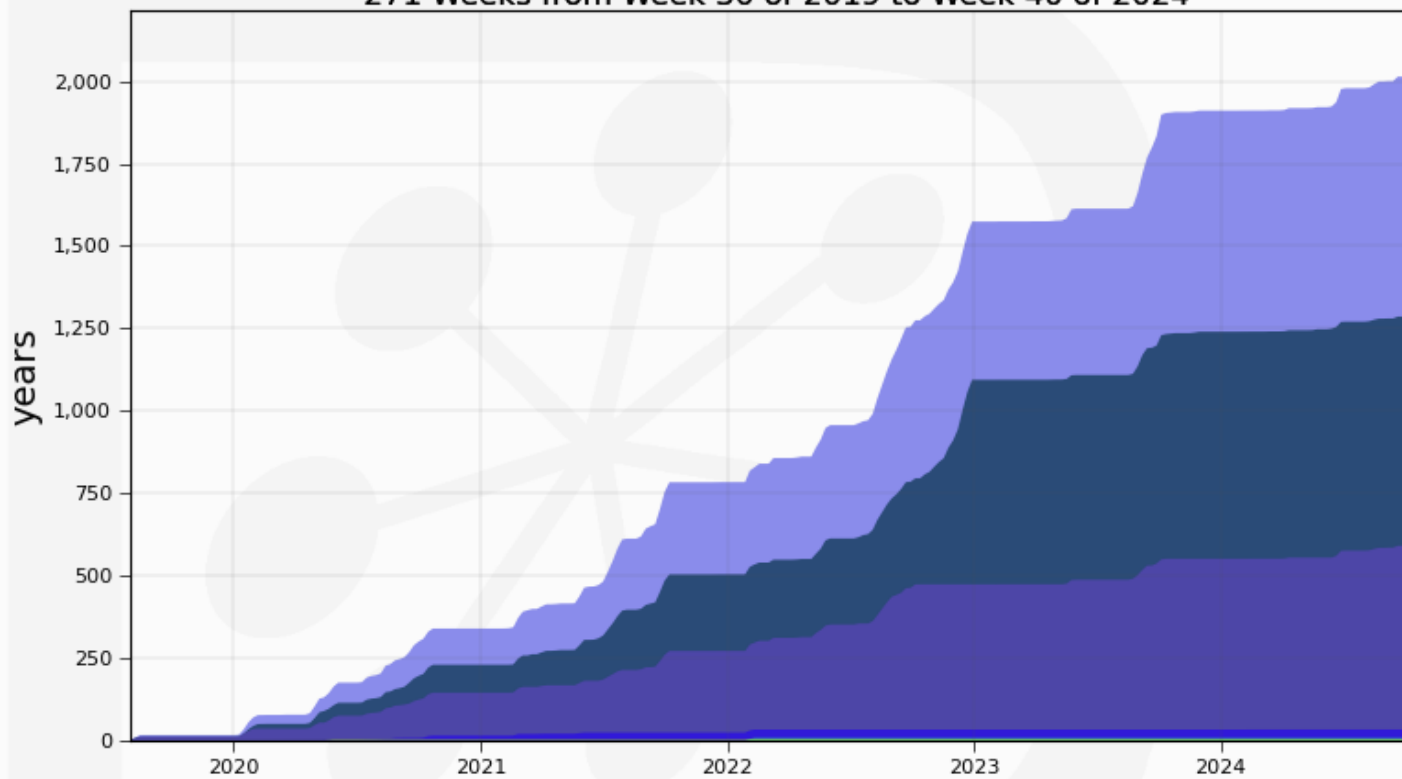
Generated on 2024-10-11 12:58:22 UTC



# Successful MPD Jobs walitime

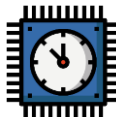
Cumulative wall time by Site

271 Weeks from Week 30 of 2019 to Week 40 of 2024



Max: 2,013, Min: 2.17, Average: 960, Current: 2,013

DIRAC.JINR-TIER.ru	727.7	DIRAC.NIKS-JSCC.ru	4.9	CLOUD.INP.kz	0.0
DIRAC.GOVORUN.ru	694.9	DIRAC.UNAM.mx	1.3	CLOUD.INP.by	0.0
DIRAC.JINR-CREAM.ru	557.3	CLOUD.JINR.ru	0.6		
DIRAC.JINR-LHEP.ru	26.5	CLOUD.NOSU.ru	0.2		



## 2013

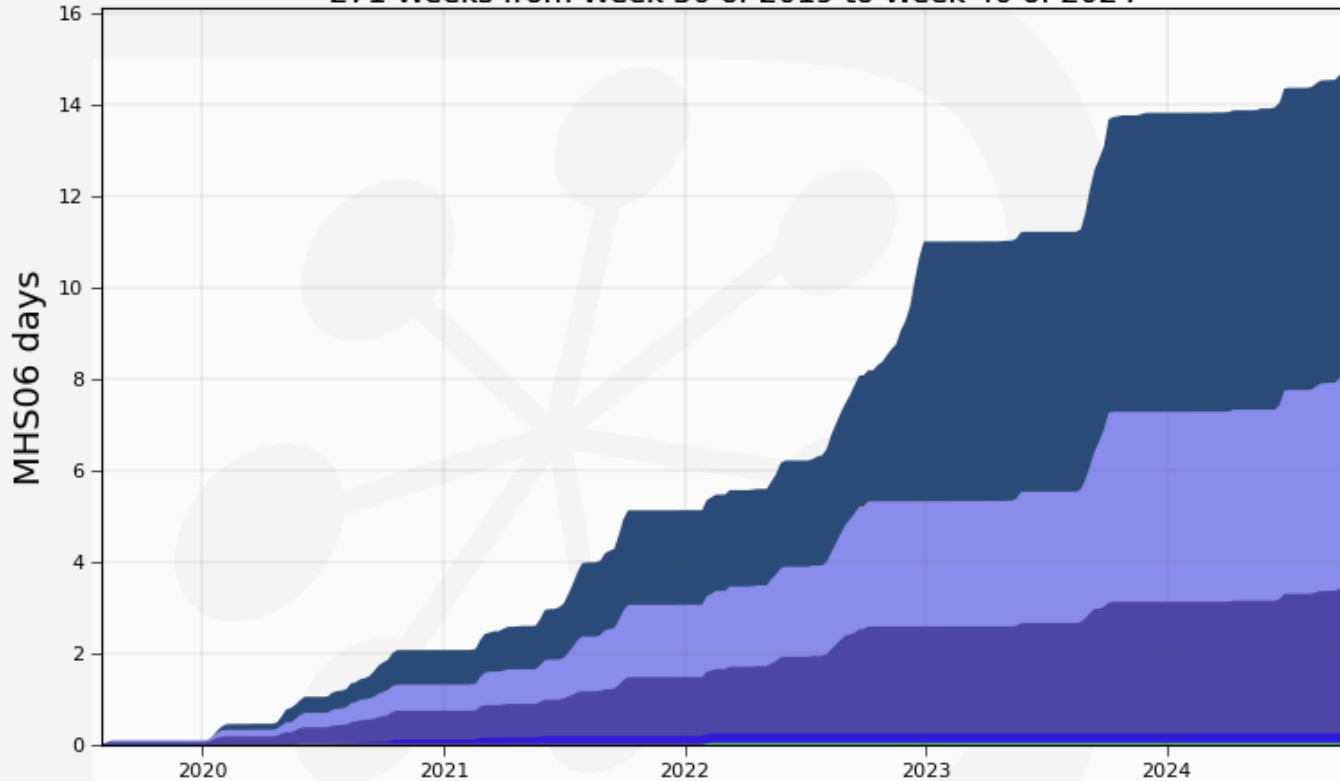
total computation time  
(years)

Generated on 2024-10-11 12:59:56 UTC

# Successful MPD Jobs normalized time

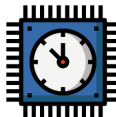
Normalized CPU used by Site

271 Weeks from Week 30 of 2019 to Week 40 of 2024



Max: 14.6, Min: 0.01, Average: 6.62, Current: 14.6

DIRAC.GOVORUN.ru	6.6	DIRAC.JINR-LHEP.ru	0.2	CLOUD.JINR.ru	0.0	CLOUD.INP.by	0.0
DIRAC.JINR-TIER.ru	4.6	DIRAC.NIKS-JSCC.ru	0.0	CLOUD.NOSU.ru	0.0		
DIRAC.JINR-CREAM.ru	3.2	DIRAC.UNAM.mx	0.0	CLOUD.INP.kz	0.0		



**40k**  
HEPSpec06 Years

Generated on 2024-10-11 13:00:11 UTC

# MPD in numbers



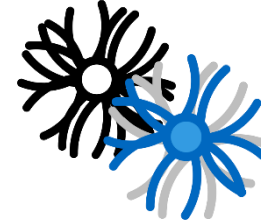
36

data generation campaigns



1.412 B

events generated



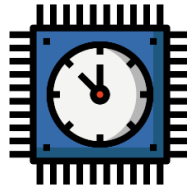
568

events reconstructed



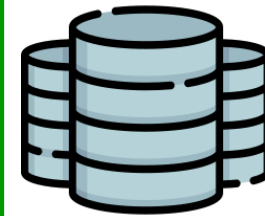
1.95 M

jobs completed



2013

total computation time(years)



1.6 PB

MPD data produced



10

data analysis campaigns



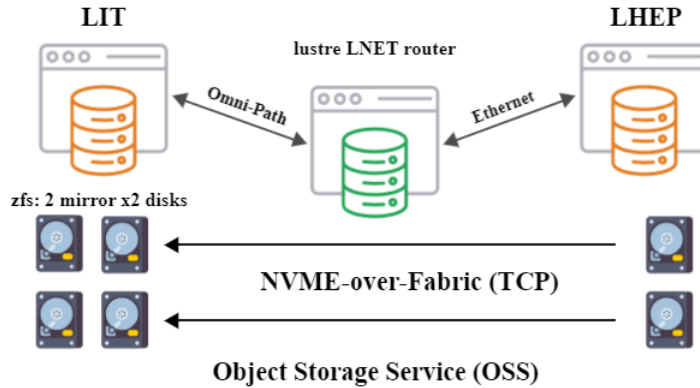
500 M

events analyzed

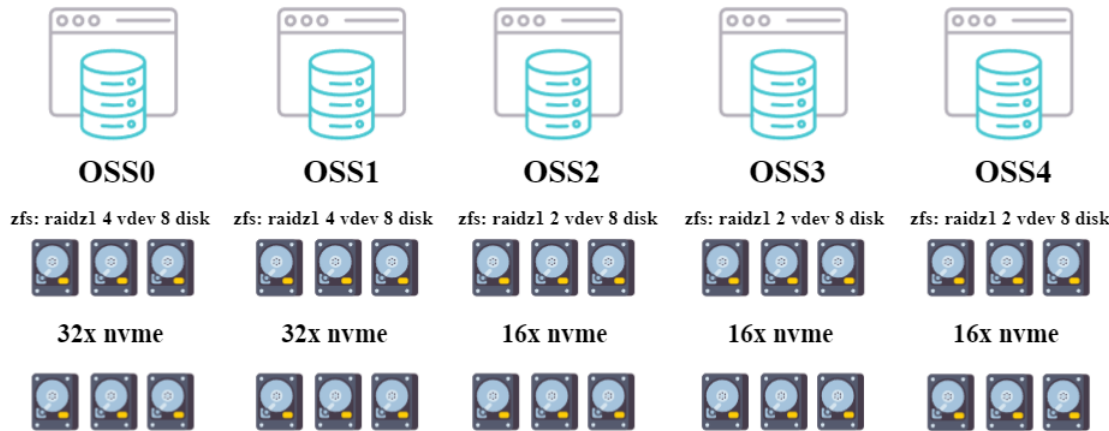
# Distributed Lustre Govorun/NCX

The task is to simplify data transfers between Govorun supercomputer and NCX cluster

Management Service (MGS)  
& Metadata Service (MDS)

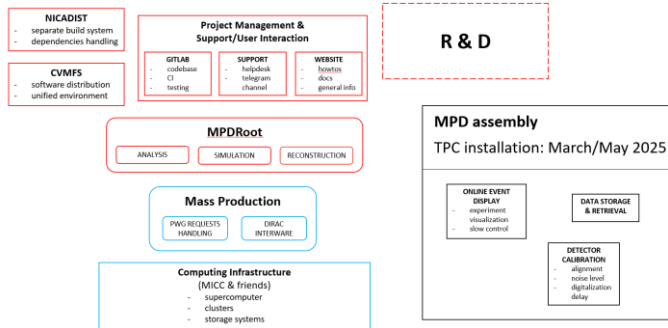


Distributed Lustre file system consists from two parts. One on NCX cluster and one on Govorun supercomputer.



Tests done with DIRAC demonstrated good performance of distributed Lustre file system which was similar to local HDD performance.

# MPDRoot Developments



MLIT is responsible for applying modern development and integration techniques for mpdroot software. New releases are published regularly. Automatic tests and deployment is done using GitLab and CVMFS.

## New features

- Analysis updates (physicists)
- LUSI detector
- Global QA histograms
- ACTS vertexing
- ACTS v36 port

## Latest dependencies

- ROOT ..... 6.32.06
- GCC ..... 13.2.0
- Boost ..... 1.83.0
- FairRoot .... 18.6.10
- GEANT4 .... 11.2.1
- Python ..... 3.12.4
- GSL ..... 2.8
- Fedora 40, Ubuntu 24.04 LTS

[git.jinr.ru/nica/mpdroot/-/releases](https://git.jinr.ru/nica/mpdroot/-/releases)

GitLab release page for v24.09.24. The page shows a progress bar at 100% complete and a milestone for v24.09.24 release. Under the Assets section, there are four download links: Source code (zip), Source code (tar.gz), Source code (tar.bz2), and Source code (tar). Below the assets, there is an 'Evidence collection' section with a link to v24.09.24-evidences-57.json and a note that it was collected 2 weeks ago. The 'Release notes' section contains a link to RELEASE NOTES v24.09.24.

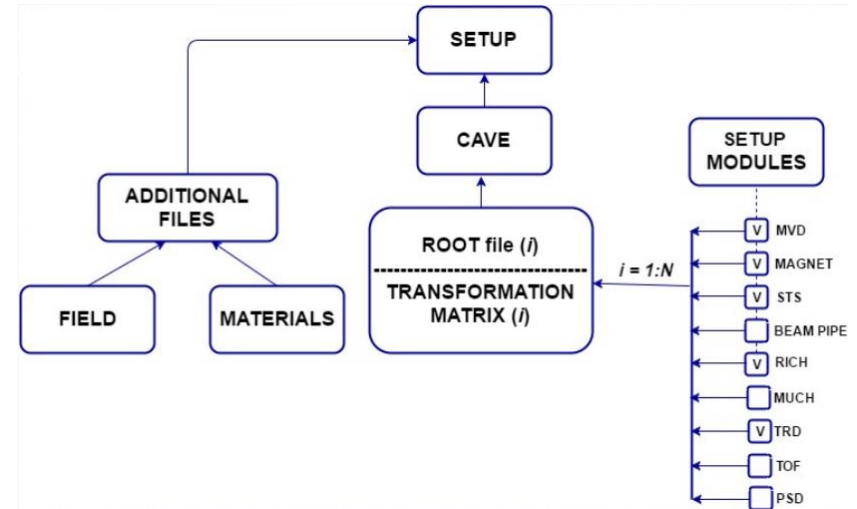
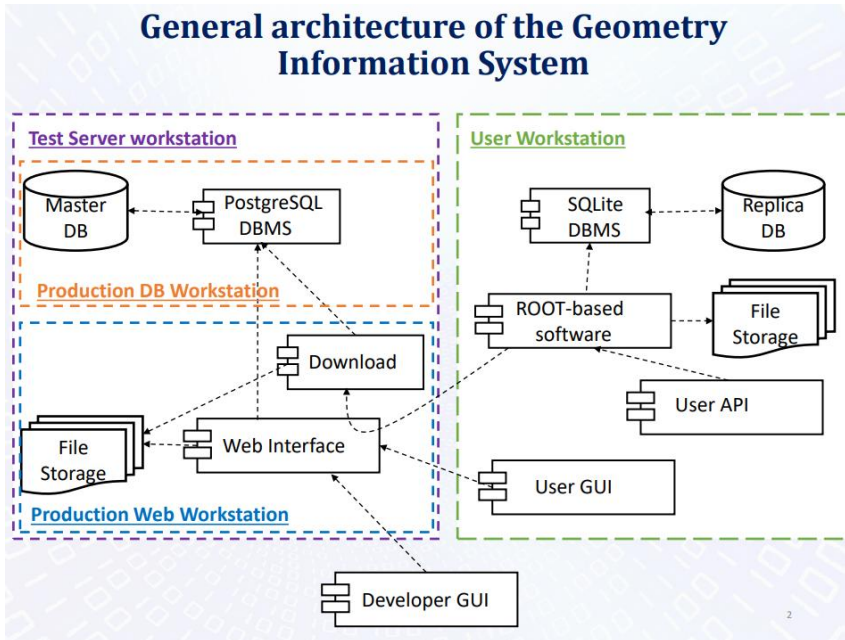
GitLab release page for v24.06.24. The page shows a progress bar at 100% complete and a milestone for v24.06.24 release. Under the Assets section, there are four download links: Source code (zip), Source code (tar.gz), Source code (tar.bz2), and Source code (tar). Below the assets, there is an 'Evidence collection' section with a link to v24.06.24-evidences-52.json and a note that it was collected 3 months ago. The 'Release notes' section contains a link to RELEASE NOTES v24.06.24.

*More detailed info will be presented today by Slavomir Hnatic:*  
<https://indico.jinr.ru/event/4806/contributions/27982/>

# MPD databases

There are two databases that are in development now and crucial for successful MPD operations: Geometry DB and Conditions DB.

Team in MLIT develops their structure and study a way to improve performance of these databases.

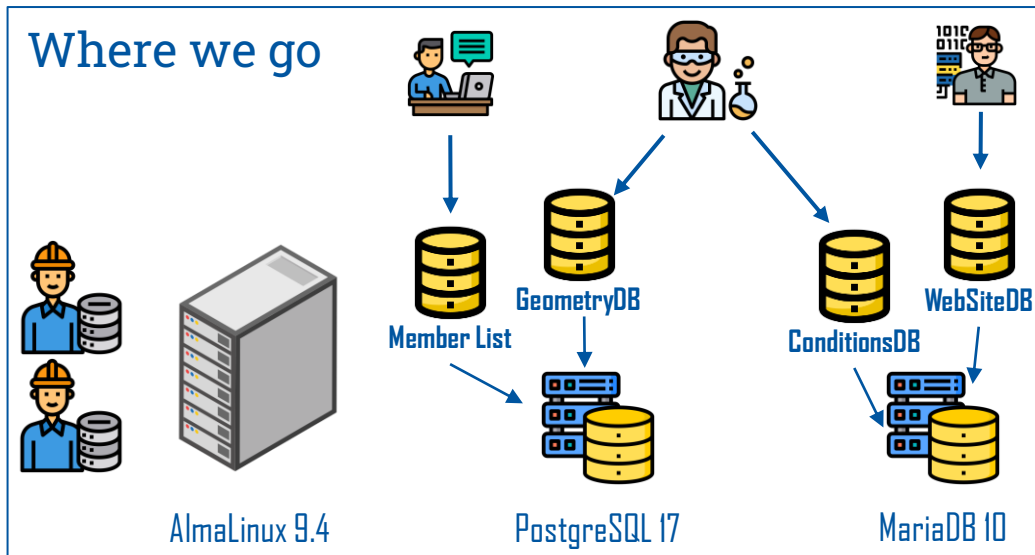
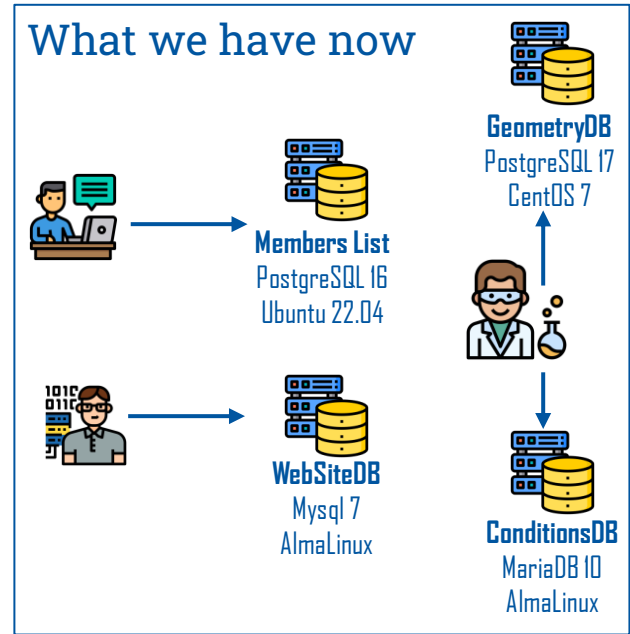


The prototype of the Condition database, at the request of users, was created in 2023. For this purpose, the state database created for BM@N was used. It was adapted for the MPD experiment. At the moment, it is being transferred from the HybriLIT to a special machine.

# Central Database Service

The need to host and support a number of databases leads to the need for some sort of Central Database Service.

An establishing meeting was organized with representatives from MPD experiment to discuss requirements and usage models of this service.



This approach should:

- Free developers from administration
- Simplify OS and DB updates
- Automate backup procedures
- Improve security
- Boost DB performance

In development

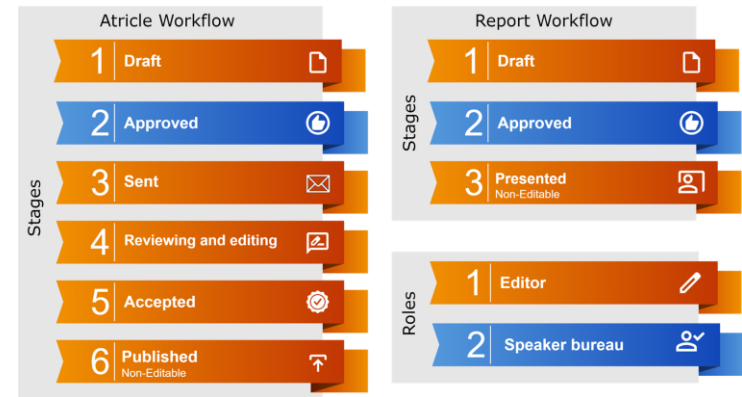
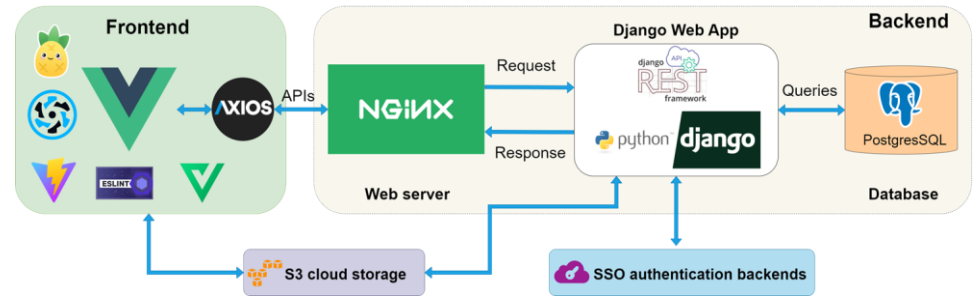
# Storage Service for Scientific Documentation

Scientific groups collaborate on various types of documents:

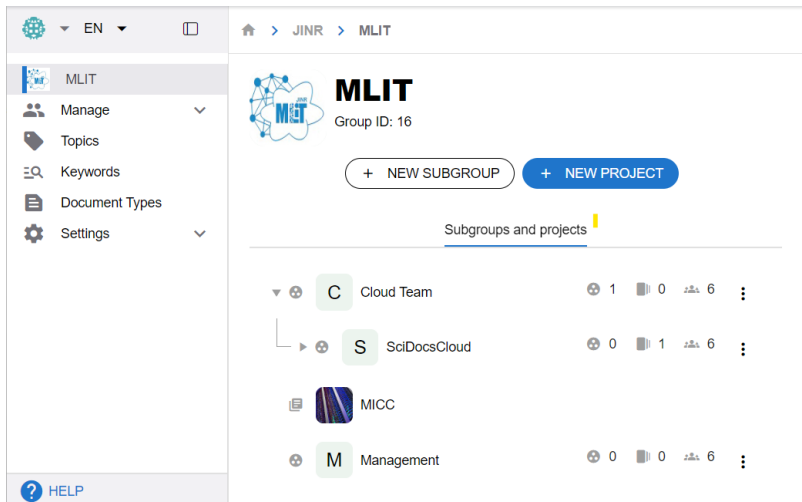
- Articles
- Abstracts
- Presentations
- Reports, etc

Common challenges of collaborative work:

- Organizing safe and structure documents storage
- Tracking changes to documents
- Restricting access to documents
- Sharing of documents



The service is available for use: <https://docs.jinr.ru>



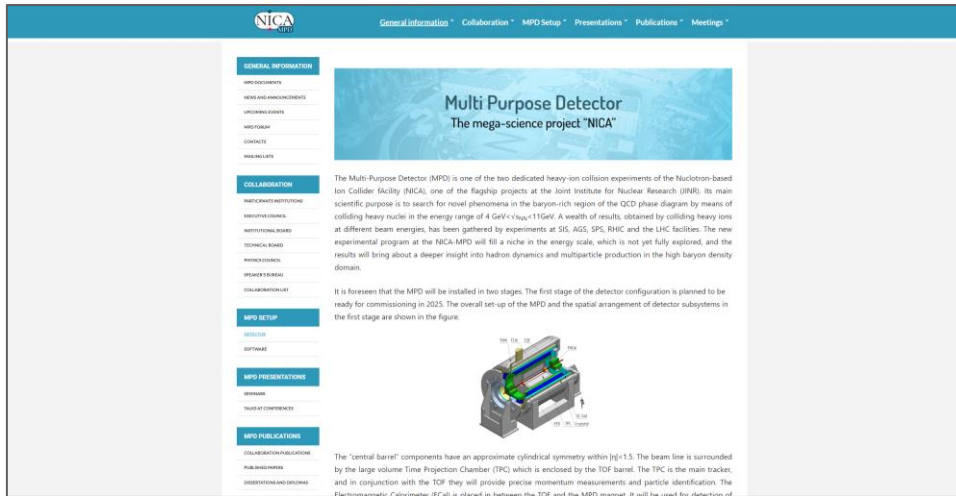
In development





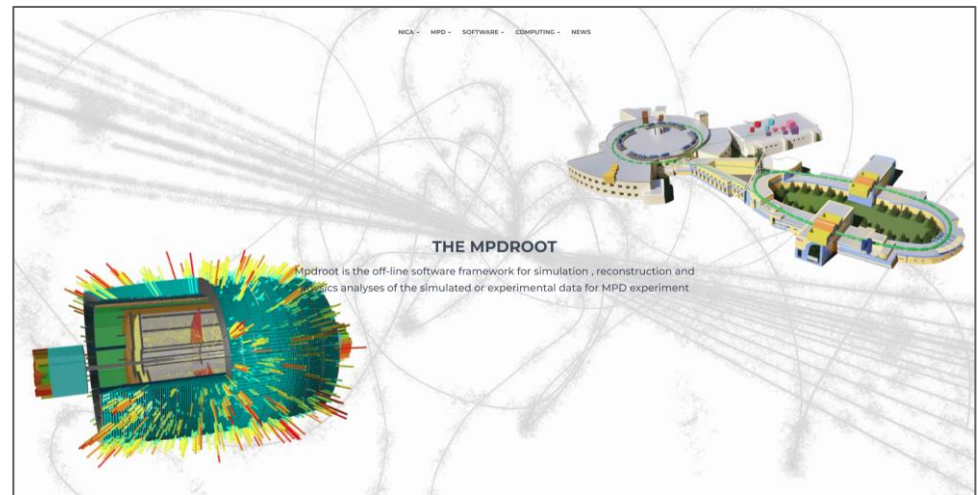
# MPD collaboration websites

MLIT is hosting some of the MPD Collaboration websites. Some participants from MLIT were taking participation in websites developments.



<https://mpd.jinr.ru/>  
MPD collaboration website

<https://mpdroot.jinr.ru/>  
MPD root website



# Works related to NCX cluster

MLIT team was working in collaboration with NCX team to perform migration from SGE to Slurm which is a modern cluster workload management system.

The NICA LHEP offline computing cluster

The first offline computing cluster created specially for the NICA

[GETTING STARTED](#) [LEARN MORE](#)

- Slurm Workload Manager**  
Slurm workload manager is useful when you have a lot of tasks to execute and want to distribute the tasks over a cluster of machines.
- EOS STORAGE**  
EOS is a disk-based, low-latency storage service. Having a highly-scalable hierarchical namespace, and with data access possible by the XROOT protocol, it was initially used for physics data storage.
- POWERFULL NETWORK**  
Data transfer rate up to 400 Gbit per second between computing nodes of the NICA complex in JINR. Between cluster nodes, the speed is 100 Gbps.



Together with Ivan Slepov a monitoring system with public access was developed and presented to users of NCX cluster.

It allows users to be aware of current load on the NCX cluster and reminds them about local storage occupation.

# MLIT in MPD IT infrastructure

## Participants from MLIT

Aleksandr **Kokorev**

Anastasia **Anikina**

Andrey **Dolbilov**

Balashov **Nikita**

Dmirty **Belyakov**

Dmitry **Podgainy**

Evgeny **Aleksandrov**

Igor **Aleksandrov**

Igor **Pelevanyuk**

Irina **Filozova**

Jan **Busha Jr.**

Maria **Lubimova**

Maxim **Zuev**

Natalia **Gromova**

Oksana **Streltsova**

Sergei **Shmatov**

Slavomir **Hnatic**

Tatyana **Strizh**

Valeriy **Mitsin**

Vladimir **Korenkov**

Vladimir **Trofimov**

Vladimir **Uzhinsky**

Mescheryakov Laboratory of Information Technologies take active participation in MPD collaboration wide range of works related to both **development** and **support** of IT services and providing **computing, storage and network resources**.



Supercomputer



# Conclusion

MLIT provides a wide range of IT different services and resources:

- GitLab, CVMFS, Slurm, DIRAC
- Govoron, Tier1, Tier2, EOS, CTA
- Network, hosting, security



MLIT also directly participates in MPD collaboration activity:

- Develop new services and setting up new systems.
- Participate in development of applied software.
- Develop new approaches to solve appearing problems.



Govoron  
Supercomputer



## Thank you for attention



