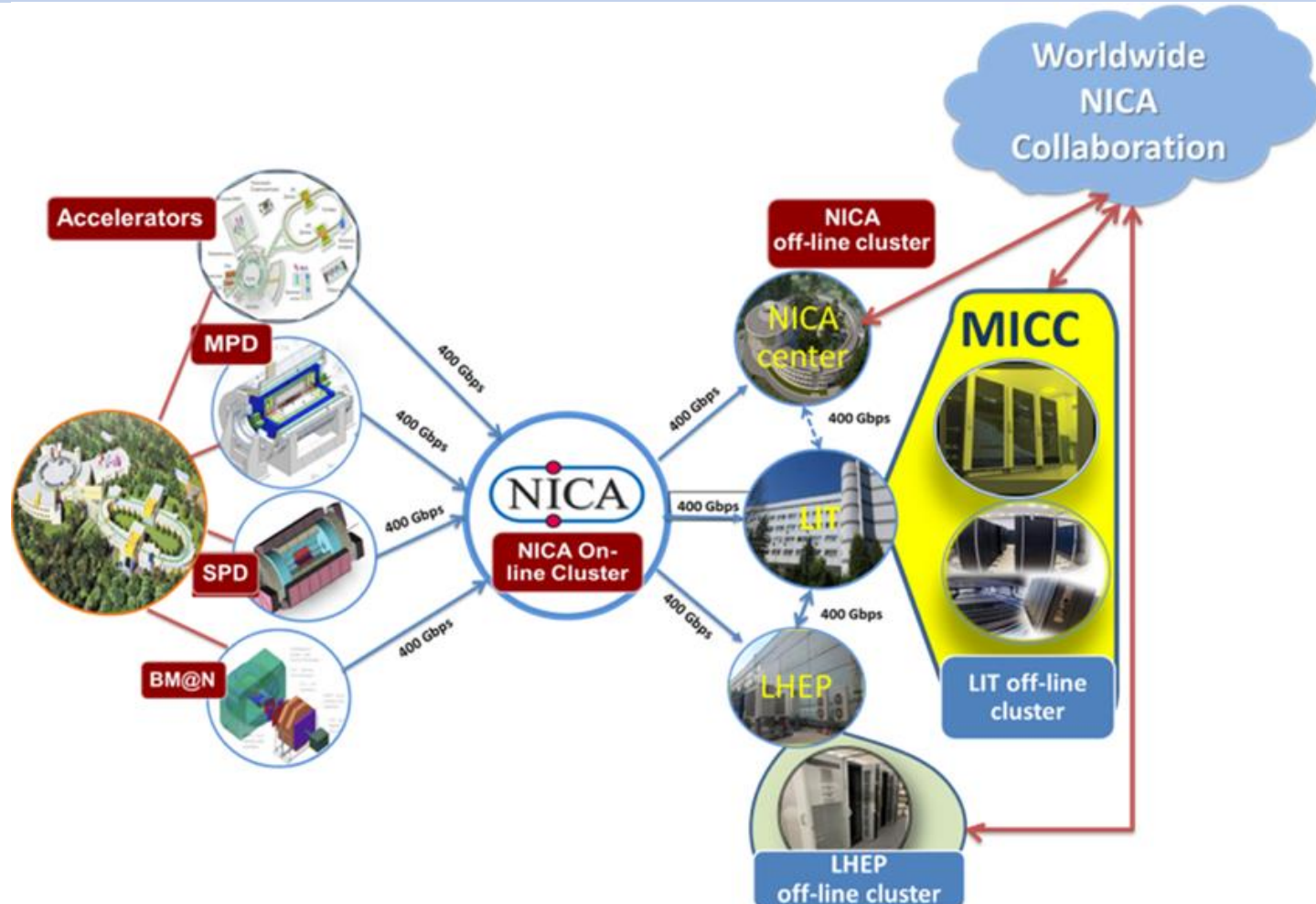


# Status of the computing for BM@N

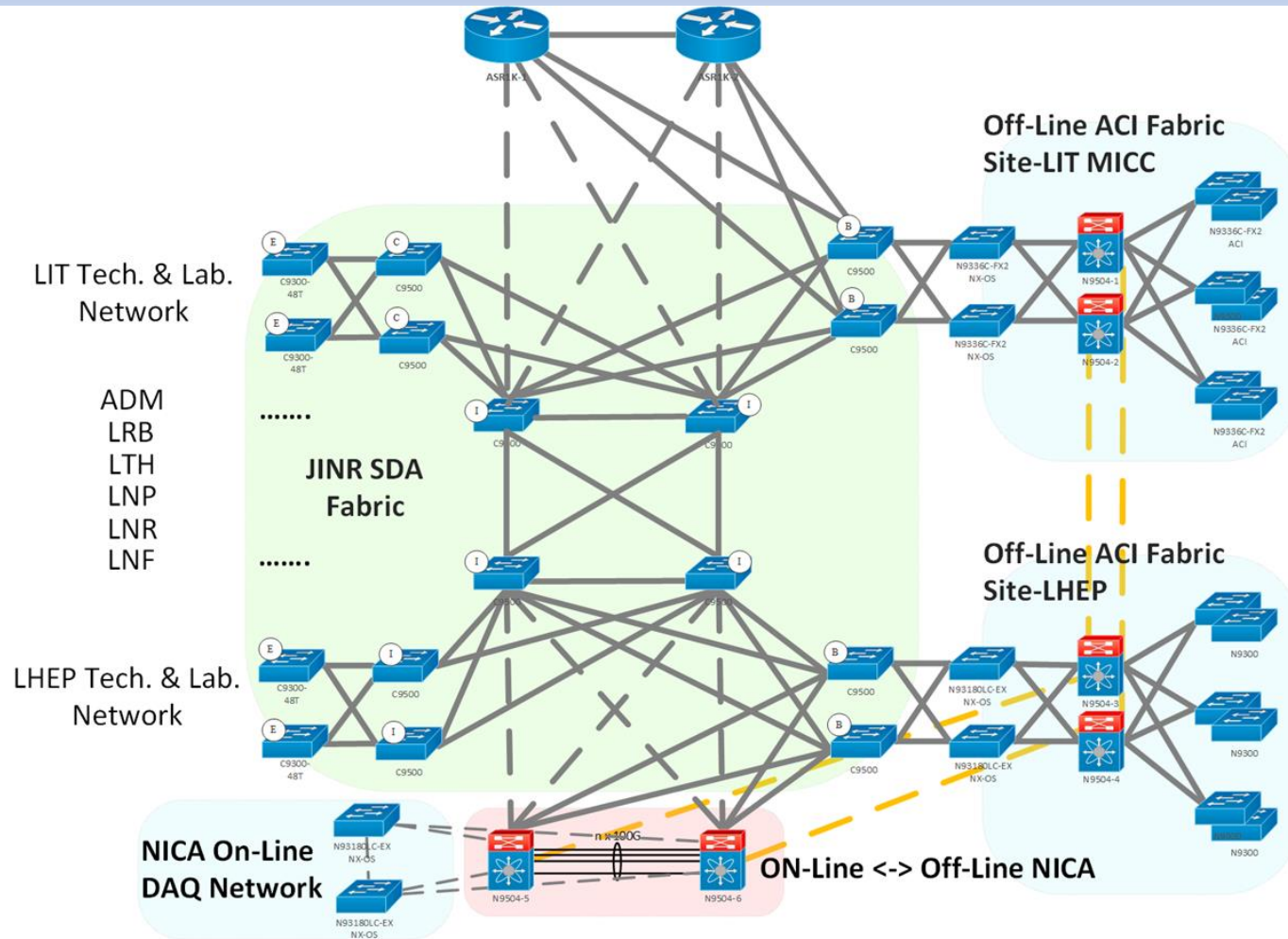
6th Collaboration Meeting of the BM@N Experiment at the NICA Facility  
Andrey Dolbilov

27-10-2020

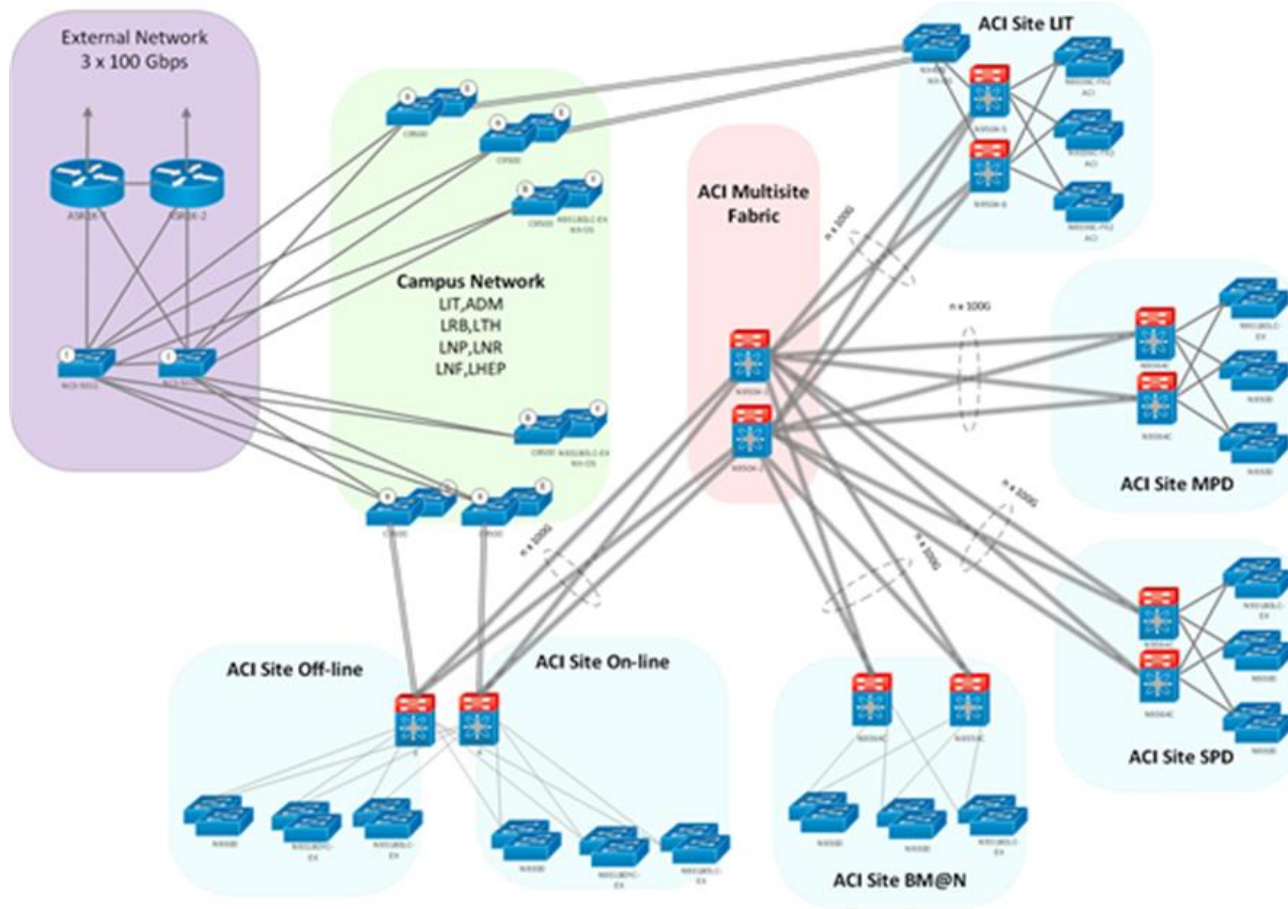
# Computing structure of NICA complex



# JINR Campus & Technical network

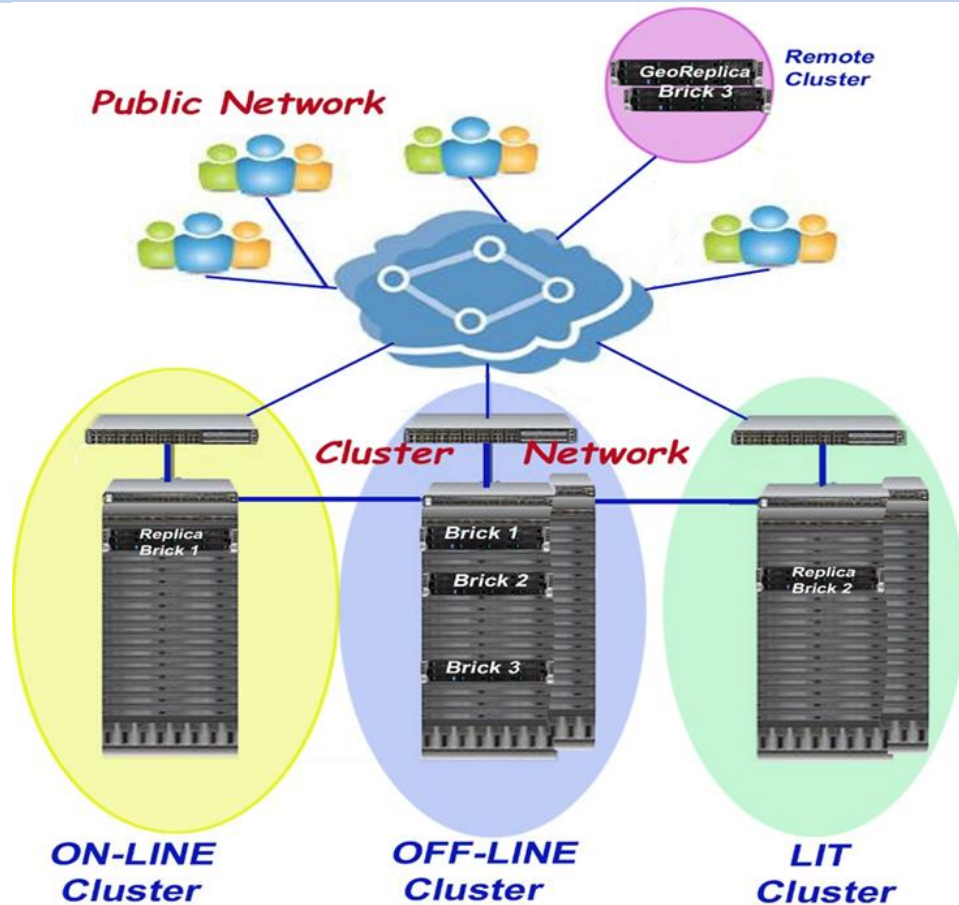


# NICA multisite ACI network fabric as part of the JINR network



- On-line ACI Site
- Off-line ACI Sites (LHEP, LIT, NICA center)
- Technological ACI sites (BM@N, MPD, SPD)

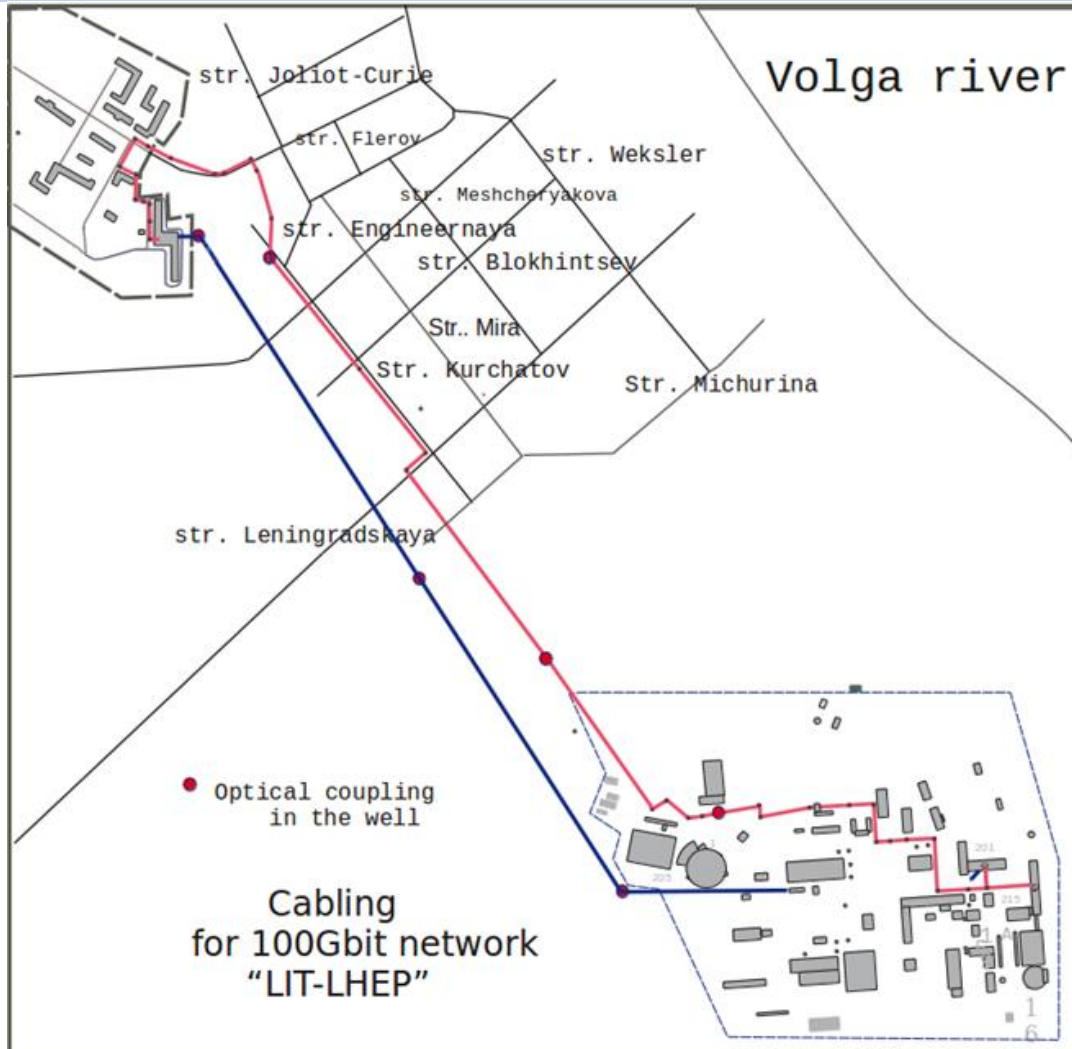
# Structure of distributed NICA Cluster



- Scheme of NICA distributed computer complex

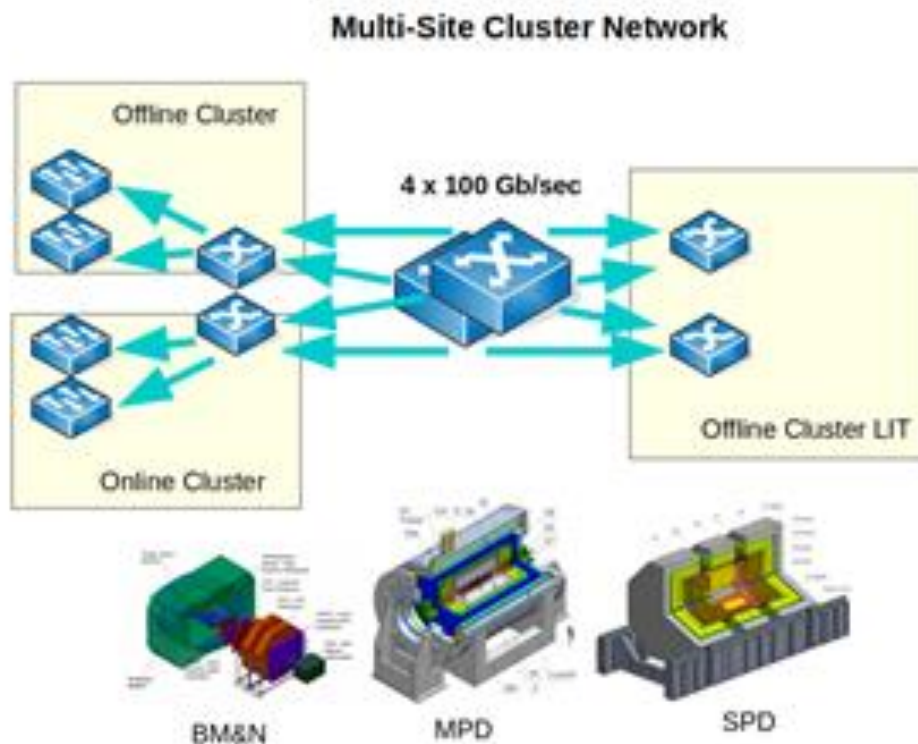


# NICA Network: Links LHEP <-> LIT



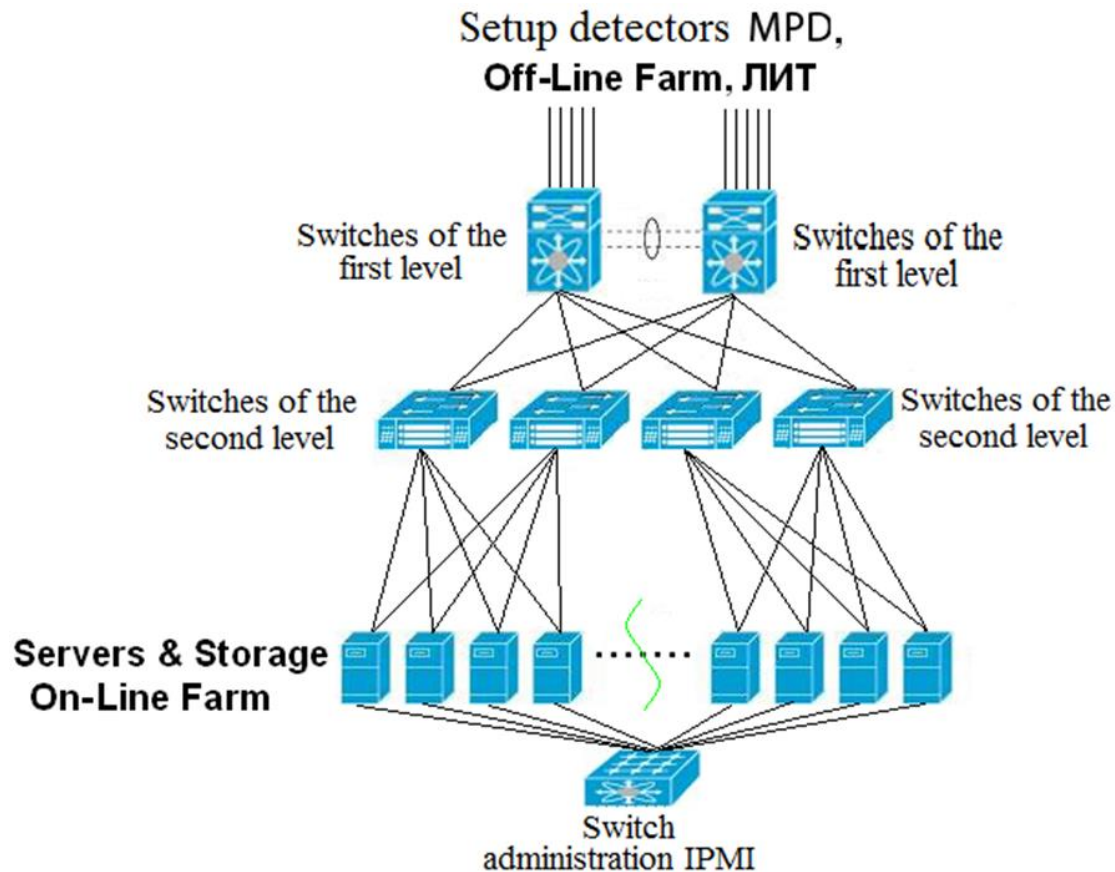
- Last edition of 2 new cable lines between LIT and LHEP sites for NICA complex. ~2.4Km

# Example communication LHEP and LIT sites of the NICA complex on two independent optical line



The core of the network system, switching will be performed on the Cisco Nexus 9504  
**4 x 100Gbps**

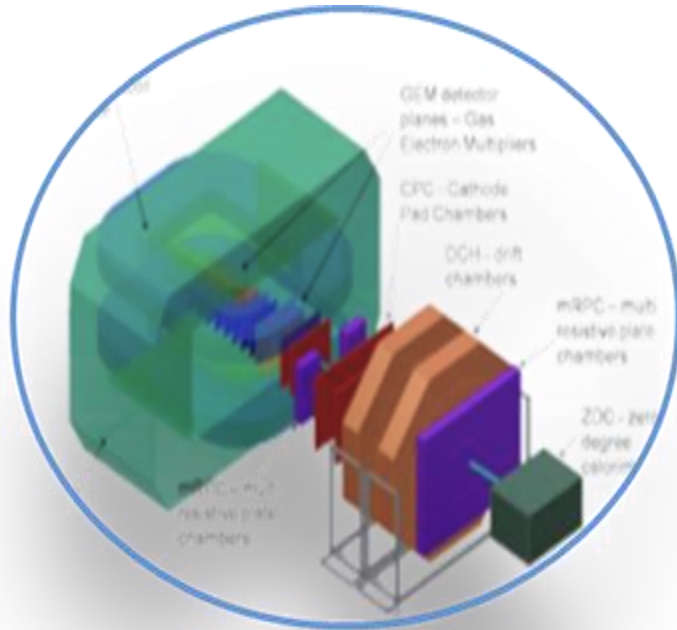
# NICA On/Off-Line cluster network technologies



Example of structural diagram of computer NICA cluster based on **Spine & Leaf** topology



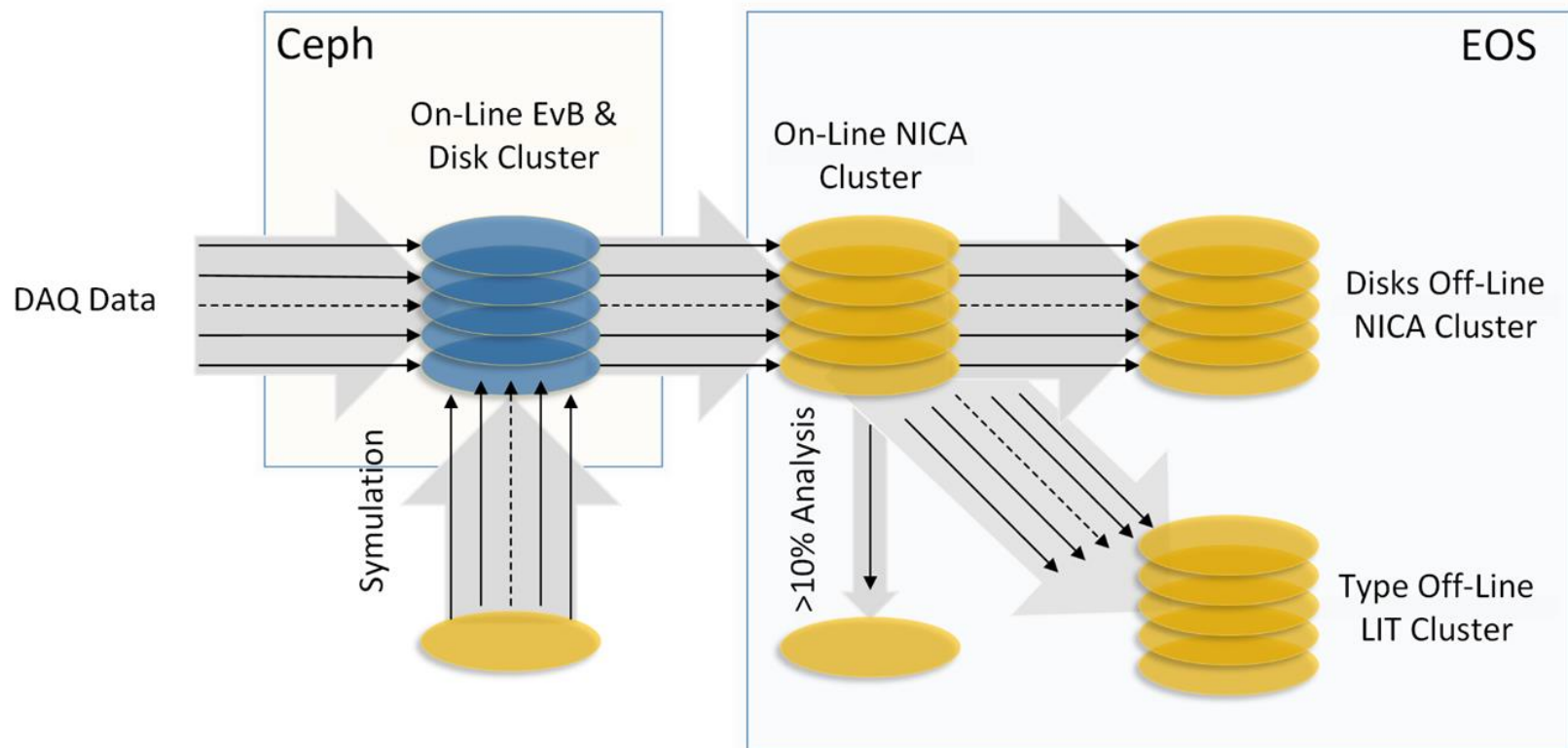
# BM&N Network links



**2** links with **10Gbps**

The “peak” speed  
from BM&N  
detectors can reach  
up to **20 Gbps**

# NICA Data flow



# NICA: on-line cluster



We are  
waiting for  
permission  
building  
modernization  
the on-line  
cluster

# NICA: off-line cluster

## LHEP 12 PB Disk 5K CPU



01 июня 2015 г. - НАЧАЛО



On March 6, 2019 the NICA offline cluster of LHEP - is started!

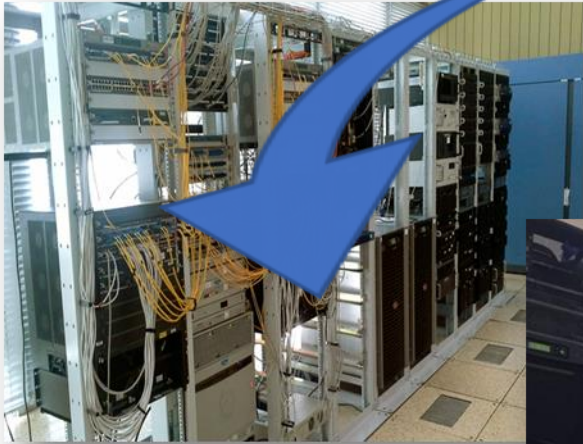


06 марта 2019г. - Система охлаждения запущена!

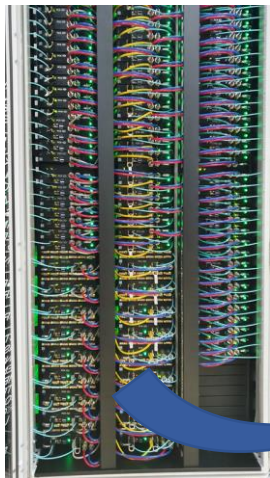


# NICA: off-line cluster LIT

LIT Network center



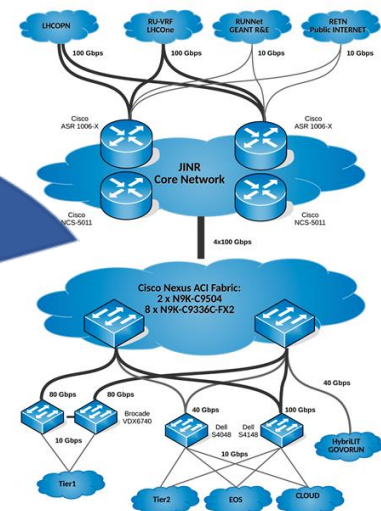
ultrafast disk memory system



LIT type robot



Supercomputer "GOVORUN"

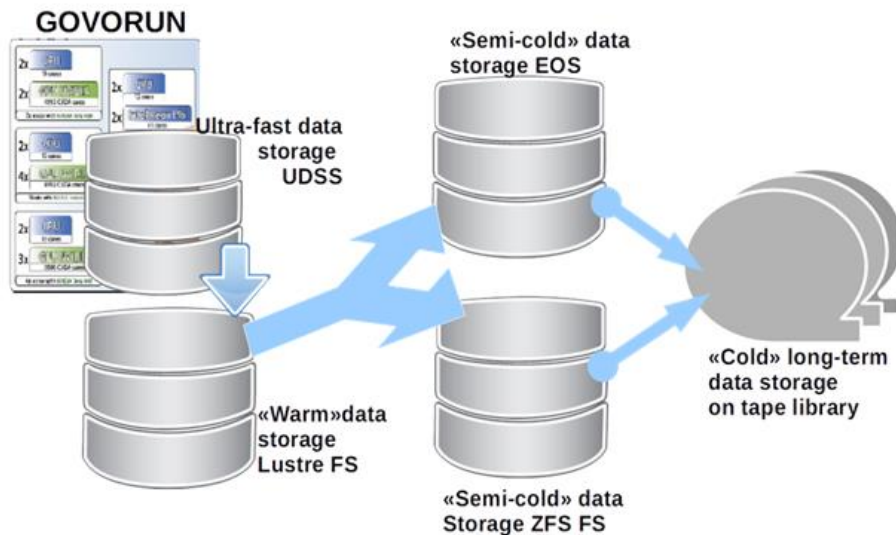




# Multifunctional Information and Computing Complex of JINR



# Off-Line: LIT “GOVORUN” supercomputer



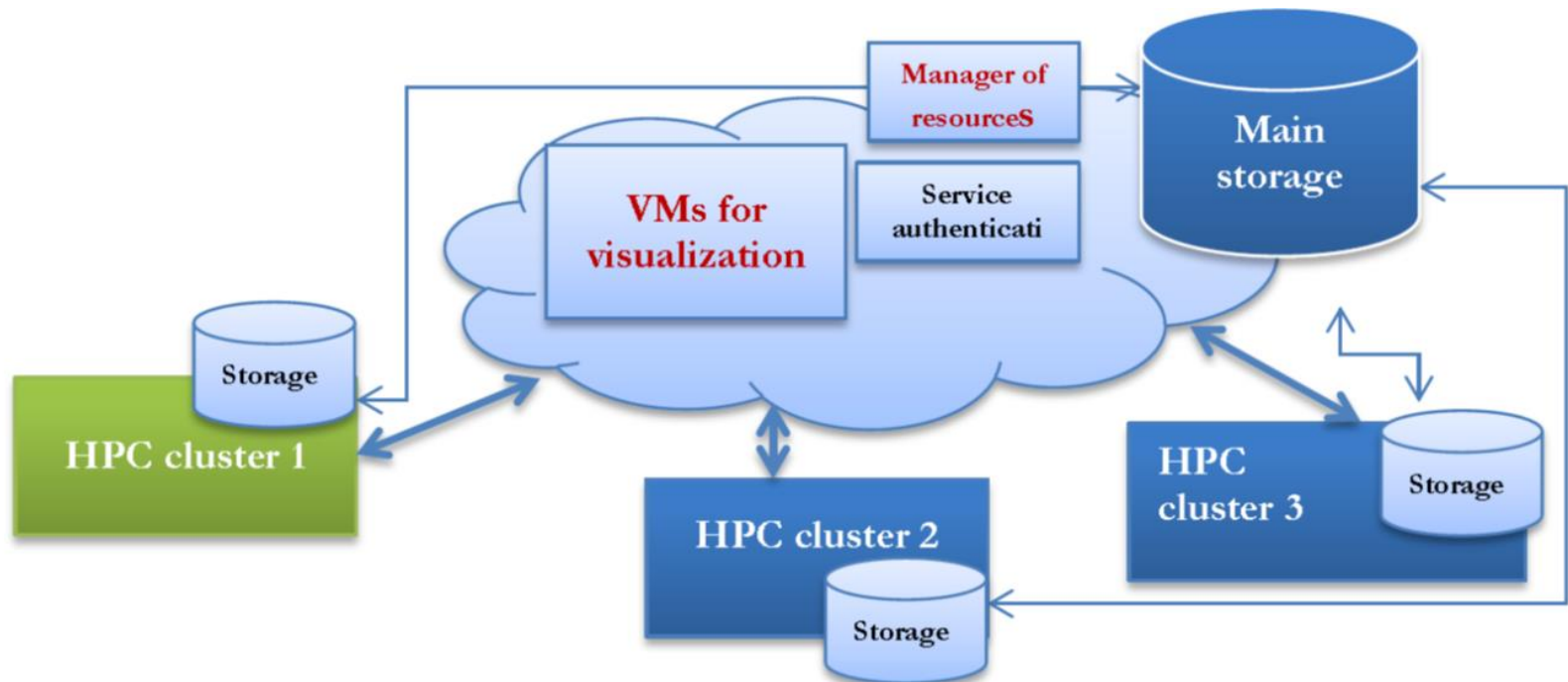
Data transfer scheme on the “GOVORUN” supercomputer to model calculations for the NICA megaproject and simulate events for the NICA experiments

**1.7** PFlops for single precision

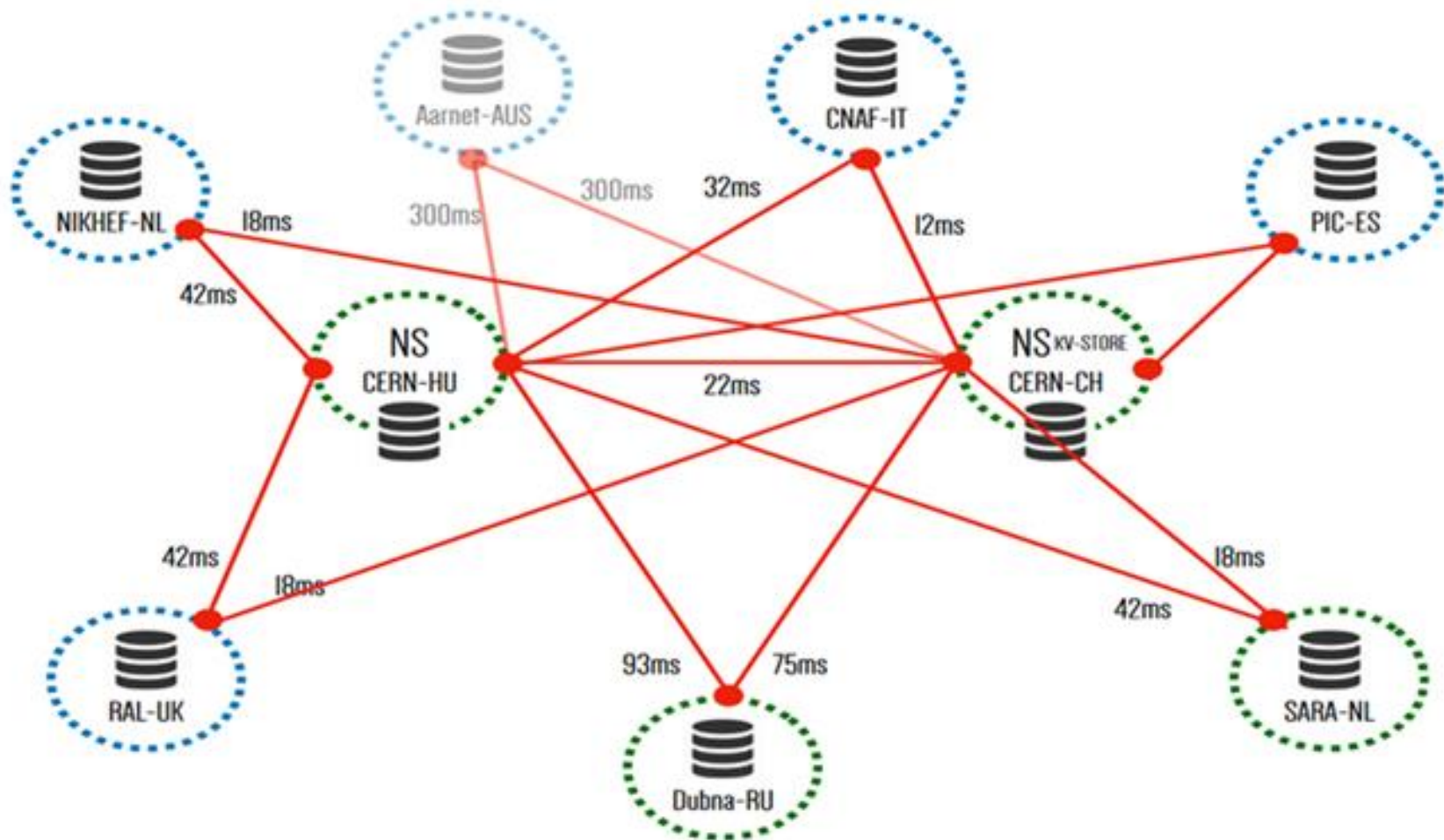
**0.9** PFlops for double precision

**300** Gb/s Data input/output rate with 250 TB ultrafast disk memory system

# Off-Line: LIT VMs HPC Cluster



# Distributed data storage evolution with shared file systems such as GlusterFS, Ceph, EOS + Data Lake.





# Off-line cluster “Center NICA”



**20** PB drives,  
**20** K CPU cores



# NICA On-Line & Off-Line software

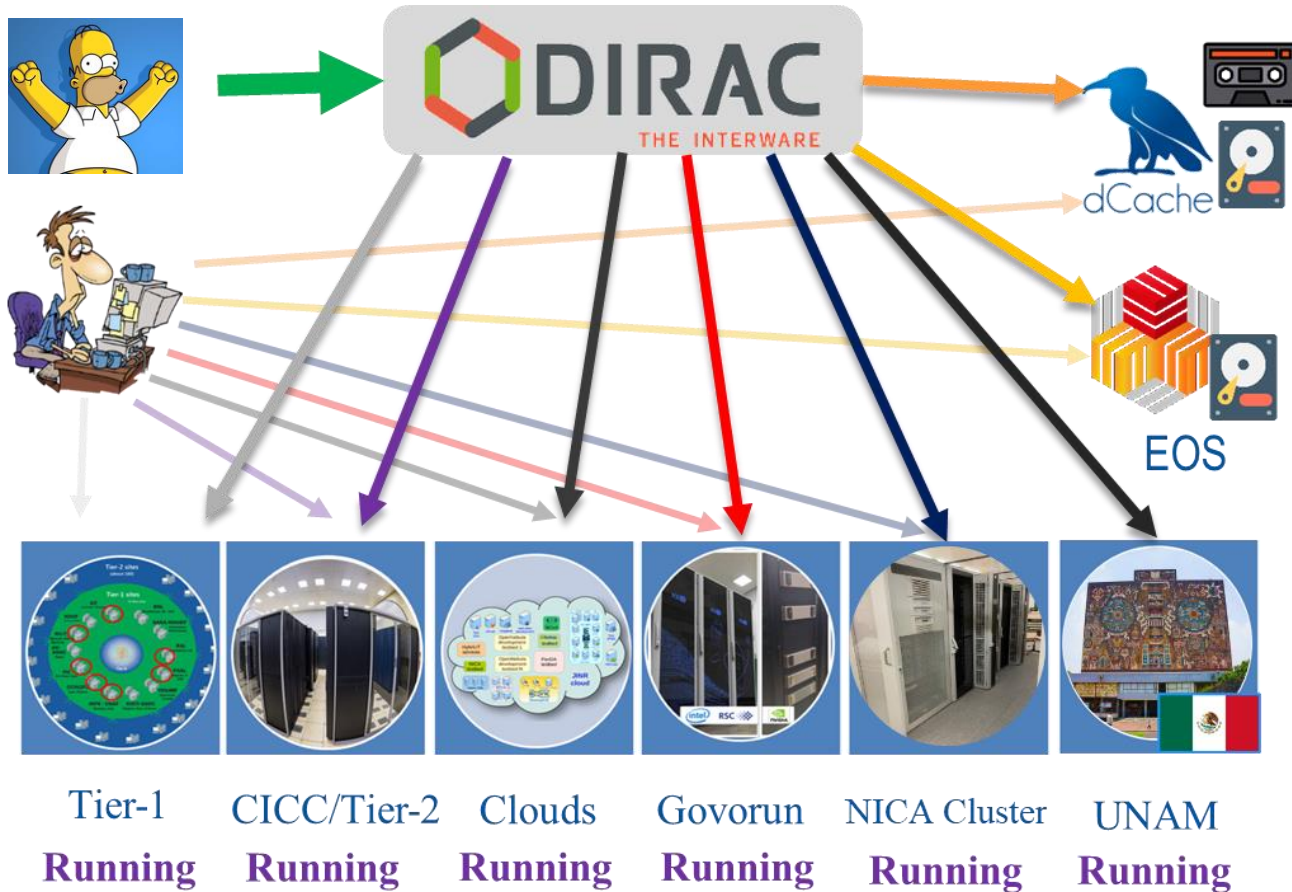
## Free software

- Computing frameworks for the NICA experiments
- (Ceph, EOS, GlusterFS, MPDRoot, BMNRoot and SPDRoot)
- Software for Simulation
- Monte-Carlo (UrQMD, QGSM, pHSD, Hybrid UrQMD and THESEUS)
- Databases
- DCDB, ECS, DAQ, Trigger database, DCS, Archive DB, HLT, NICA Machine database

## Commercial software

- CADs (MathCAD, AutoCAD, SolidEdge, PCAD)
- Video Systems (Vidyo, Wowza Media Systems)
- Simulation Systems (ANSYS, OPERA)
- Operation Systems (MS Windows, MS Office)
- Anti-virus (NOD32, Kaspersky)
- Applied equipment and software
- 6 Video conference rooms of NICA Center

# DIRAC Interware @ JINR



# Monitoring of the distributed NICA Cluster



# Engineering infrastructure of the computer unit.



- system of guaranteed and uninterruptible power supply;
- cooling system;
- ventilation and gas removing system;
- automatic fire suppression system;
- structured cabling system;
- video surveillance system;
- access control and management system;
- alarm system;
- dispatch system.

# Power consumption by computer clusters of the NICA complex

Cluster	Energy consumption
On-line	300 kW
Off-line cluster LHEP	400 kW
Off-line NICA Center	800 kW
Off-line NICA LIT	1600 kW



# Thank You

6th Collaboration Meeting of the BM@N Experiment at the  
NICA Facility

27-10-2020