INFORMATION TECHNOLOGIES @ JINR DEVELOPMENT STRATEGY

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on behalf of the LIT strategy group

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Dubna

Working and Experts' Group

International group

Ian Bird – CERN
Peter Hristov – Bulgarian Academy of Sciences/ CERN
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Oxana Smirnova – Lund University/NeIC
Alexei Klimentov – CERN/BNL
Patrick Fuhrmann – DESY
Gaetano Maron – INFN

Local group

Vladimir Korenkov
Andrey Dolbilov
Valery Mitsyn
Tatyana Strizh
Dmitry Podgainy
Petr Zrelov
Irina Filozova
Vladimir Gerdt
Oxana Streltsova
Nikolay Voytishin

Meetings and discussions

- Conferences
- Workshops
- Visits/Seminars

JINR is a part of Worldwide LHC Computing Grid

WLCG:
An international collaboration to distribute and analyse LHC data integrates computer centres worldwide, which provide computing and storage resources, into a single infrastructure accessible by all LHC physicists.

Tier-0 (CERN):
data recording, reconstruction and distribution
Tier-1:
permanent storage, re-processing, analysis
Tier-2:
simulation, end-user analysis

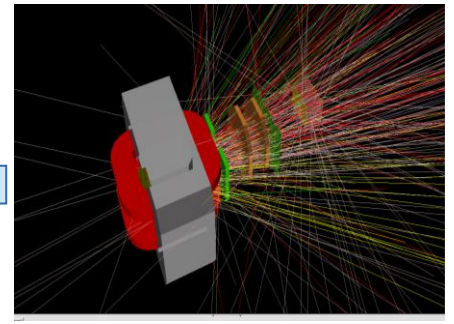
~170 sites
42 countries
1 000 000 cores
1 EB of storage
> 3 million jobs/day
10-100 Gb links

Worldwide LHC Computing Grid - 2019

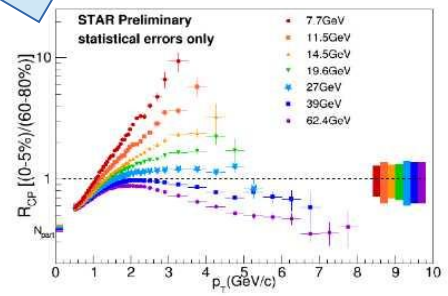
NICA Computing Concept & Challenges

Lattice QCD calculations

Simulation of nuclear reactions



Event reconstruction



Physics analysis

New Joint Computing Platform for Neutrino Experiments

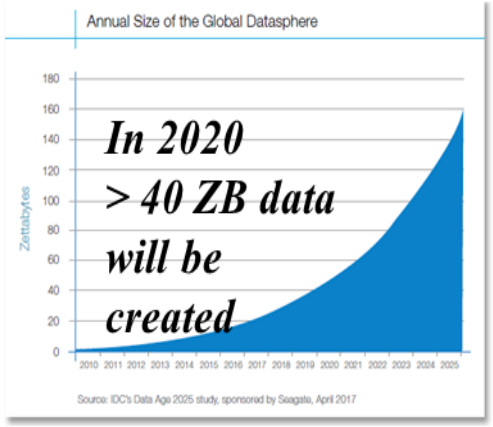
LIT contribution:

engineering infrastructure (electricity, UPS, cooling, network, racks, manpower)

DLNP contribution:

computing and storage resources (CPUs/GPUs&disks)

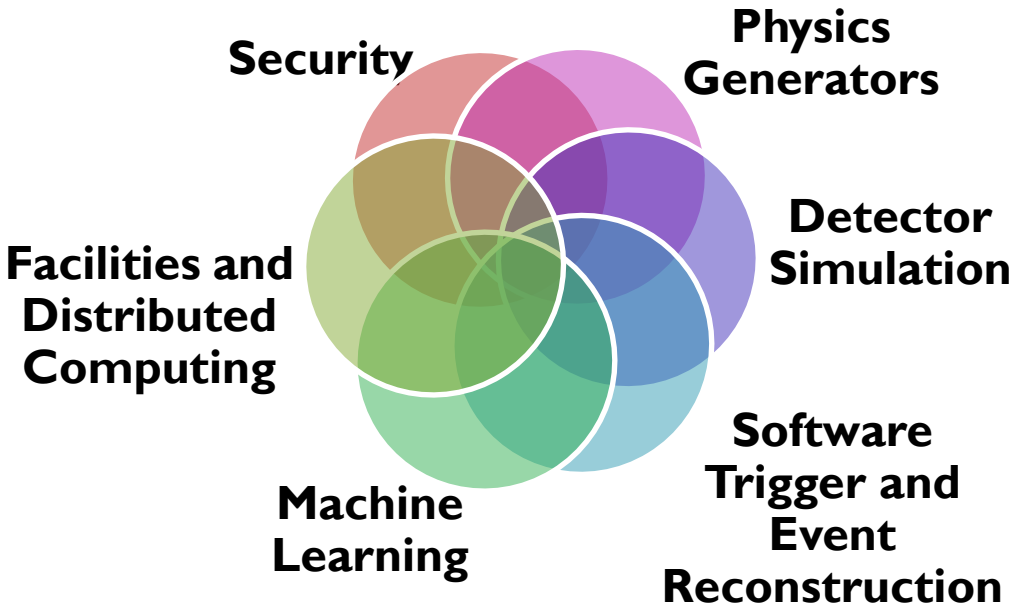
CHALLENGE: *R&D of software to acquire, manage, process and analyze large amounts of data to be recorded*

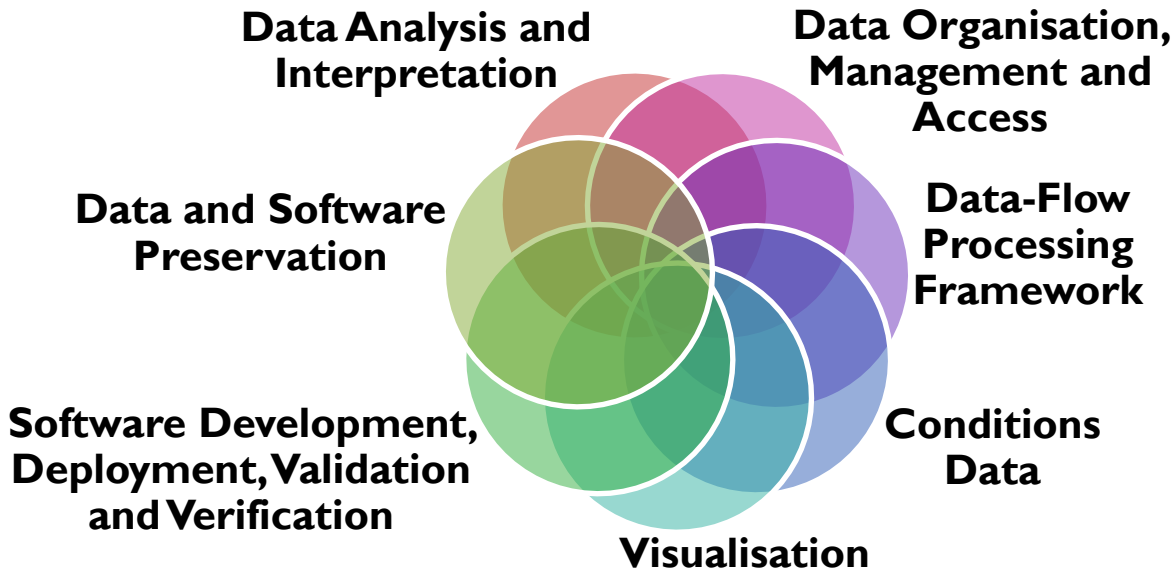


The annual data production follows the exponential law.

Square Kilometer Array radio telescope (SKA)
> 1 Eb/Year
(estimation)

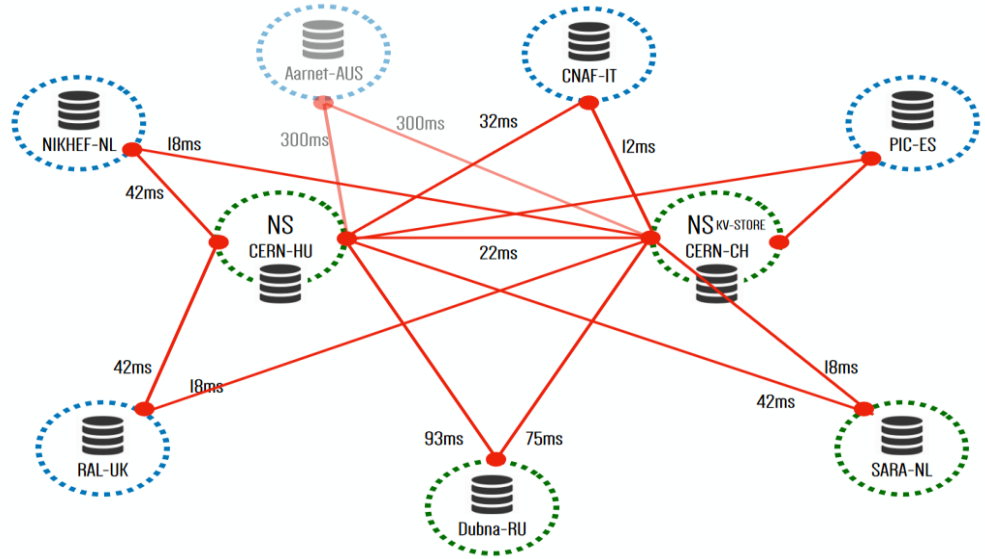
CERN Large Hadron Collider
> 20 Pb/Year, > 200 Pb stored





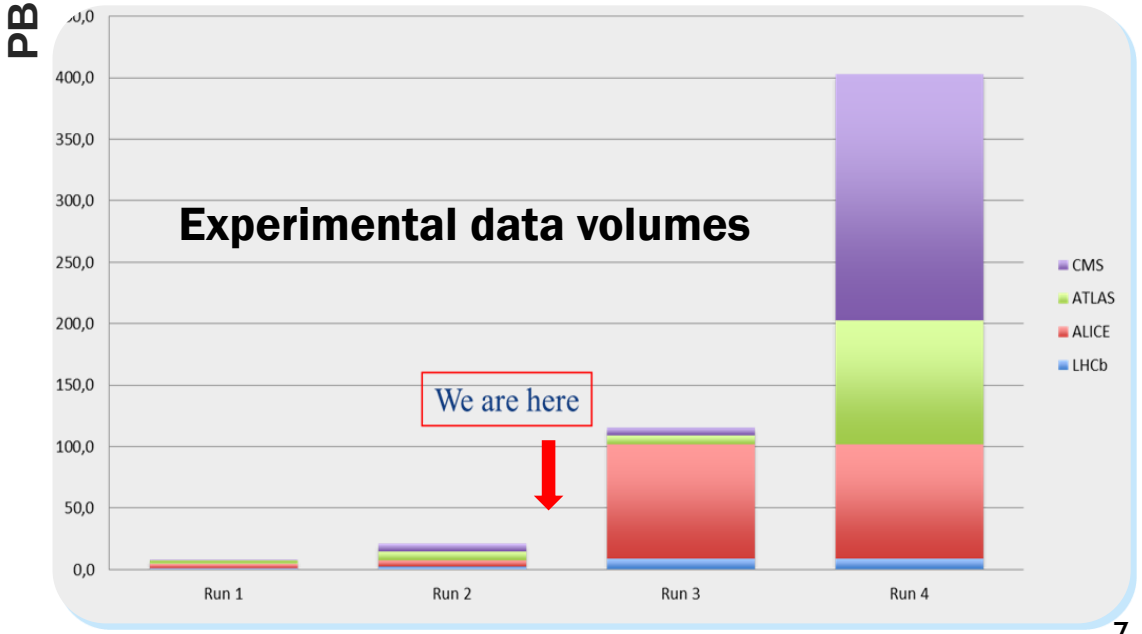
JINR DataLake

Multifunctional Information and Computing Complex

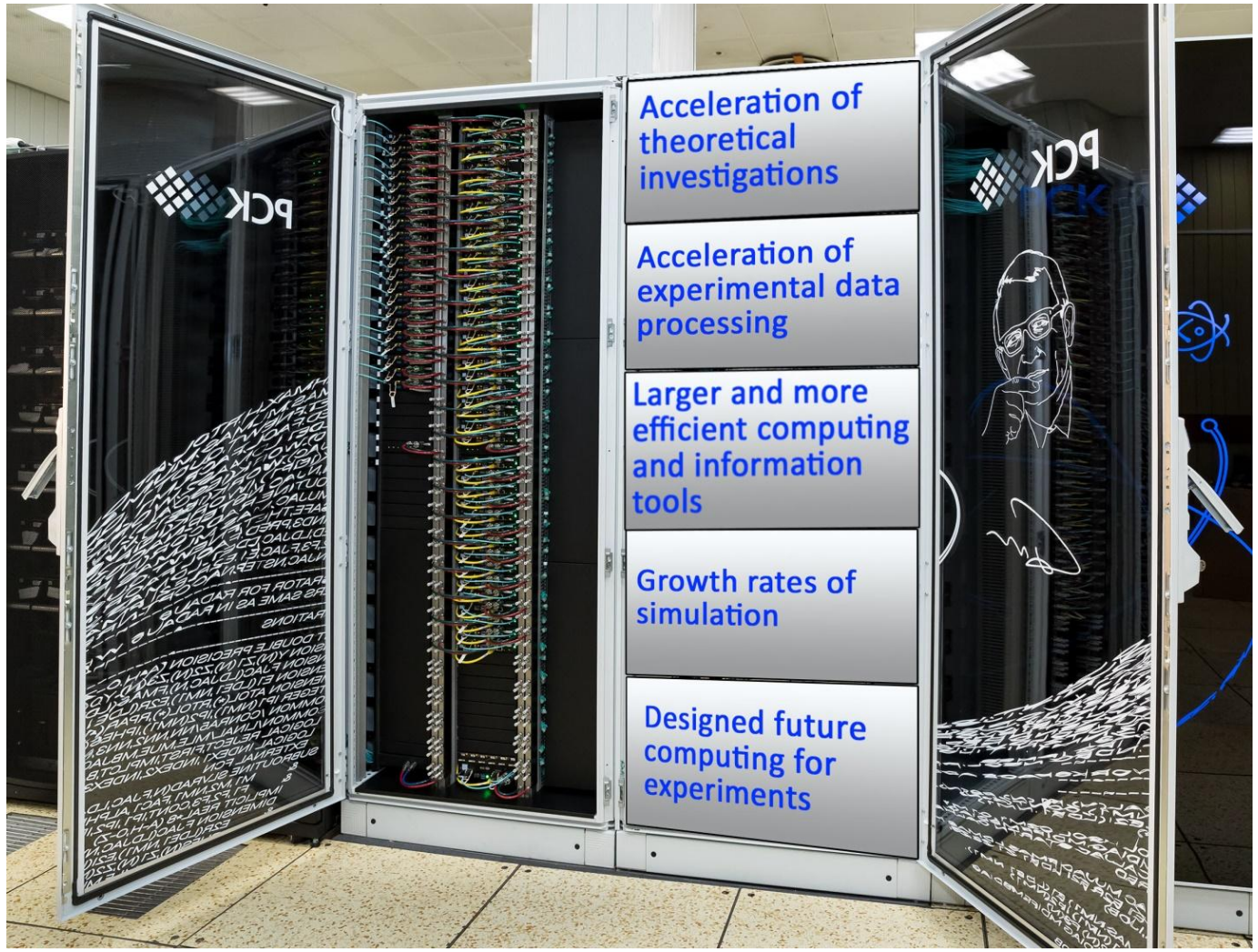


EU DataLake

- DataLake deployed at JINR
- The new storage system successfully integrated into the MICC structure
- It shows great performance for storing and accessing big arrays of information.
- It can be applied for all the steps of data handling.



Extension of the HybriLIT heterogeneous platform including the “GOVORUN” supercomputer



- Unique heterogeneous and hyper-converged system (500 Tflops for double-precision operations)
- Multipurpose high-performance system with direct hot liquid cooling of all system components
- The most energy-efficient system in Russia (PUE = 1,06)
- First 100% hot liquid cooling of Intel® Omni-Path interconnect
- Record power density – up to 100 kW per 42U cabinet

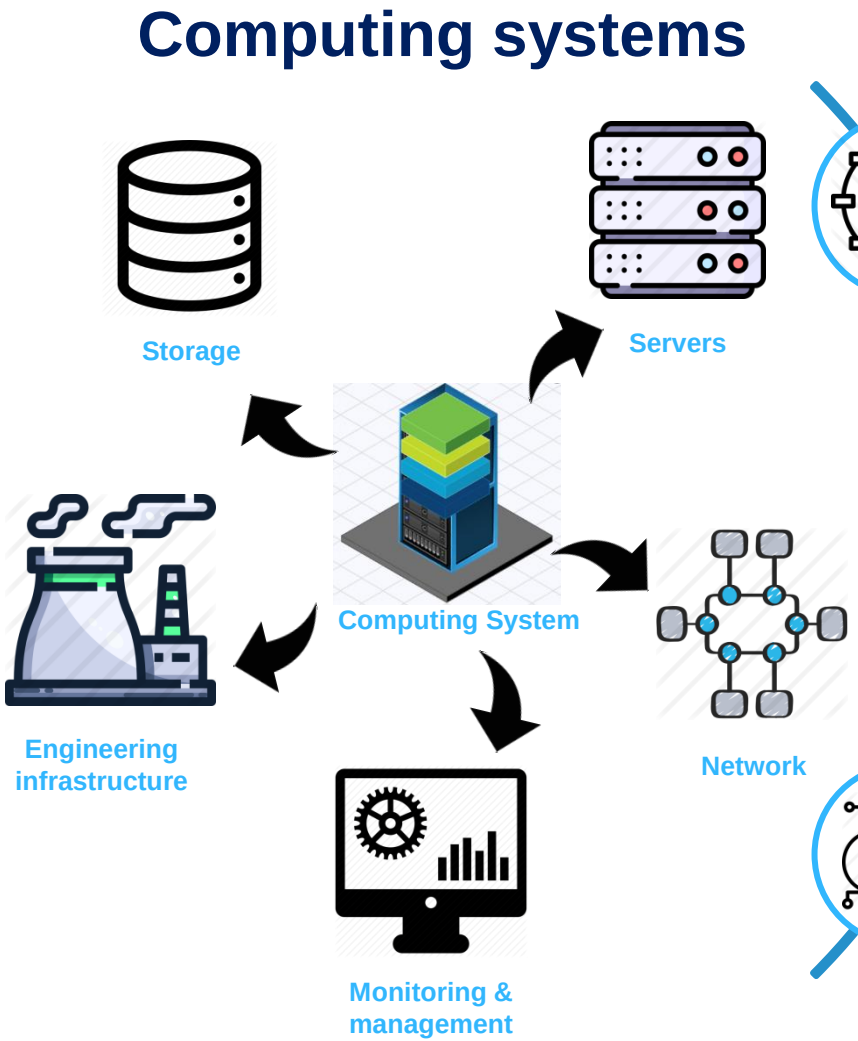
The total enlargement in the performance of CPU and GPU components will amount up to **90 TFlops** for double-precision operations per year.

Long-Term Concept of a Scientific IT-ecosystem at JINR

Telecommunication technologies

- terabit networks
- on-demand networks, networks of networks, software-defined networks, etc.
- dynamic resource allocation network systems
- networks enabling the large amount of data transfers
- networks allowing distributed processing of the exabyte data volume.

Long-Term Concept of a Scientific IT-ecosystem at JINR



- distributed software-configured platform
- supercomputer (heterogeneous)
- grid and cloud technologies
- effective use of novel computing architectures

Long-Term Concept of a Scientific IT-ecosystem at JINR

Algorithms and software

- complex computing problems
- machine learning
- data mining
- quantum computing

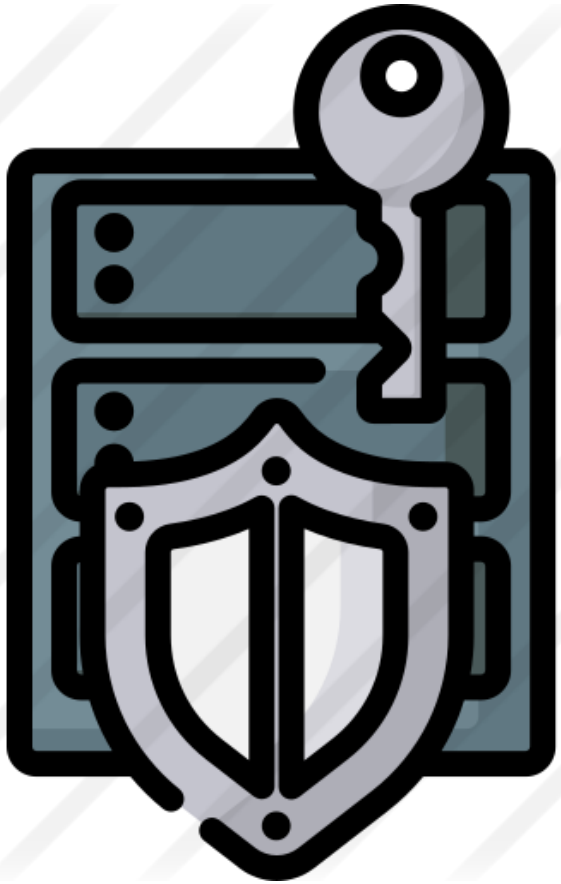
Long-Term Concept of a Scientific IT-ecosystem at JINR

Technologies of data processing and analysis

- computing with the use of supercomputers
- processing of multi-dimensional and hierarchical data of Exabyte volumes
- Big Data analysis and processing
- AI and robotics
- SyMSim: modeling of computing architectures and workflows

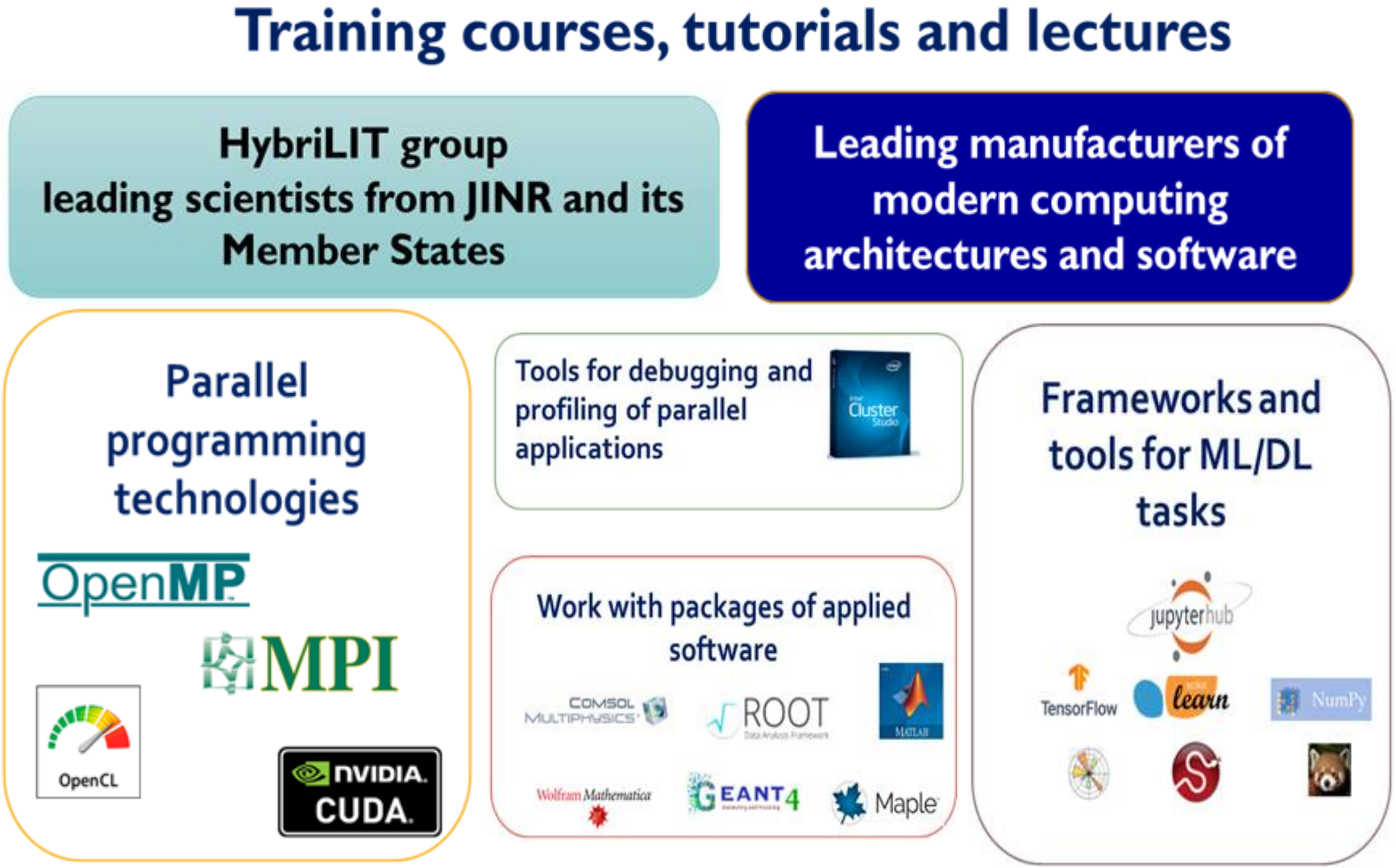
Long-Term Concept of a Scientific IT-ecosystem at JINR

Information security



- new security paradigms including quantum cryptography and neurocognitive principles
- novel and up-to-date tools and software systems for data and information protection

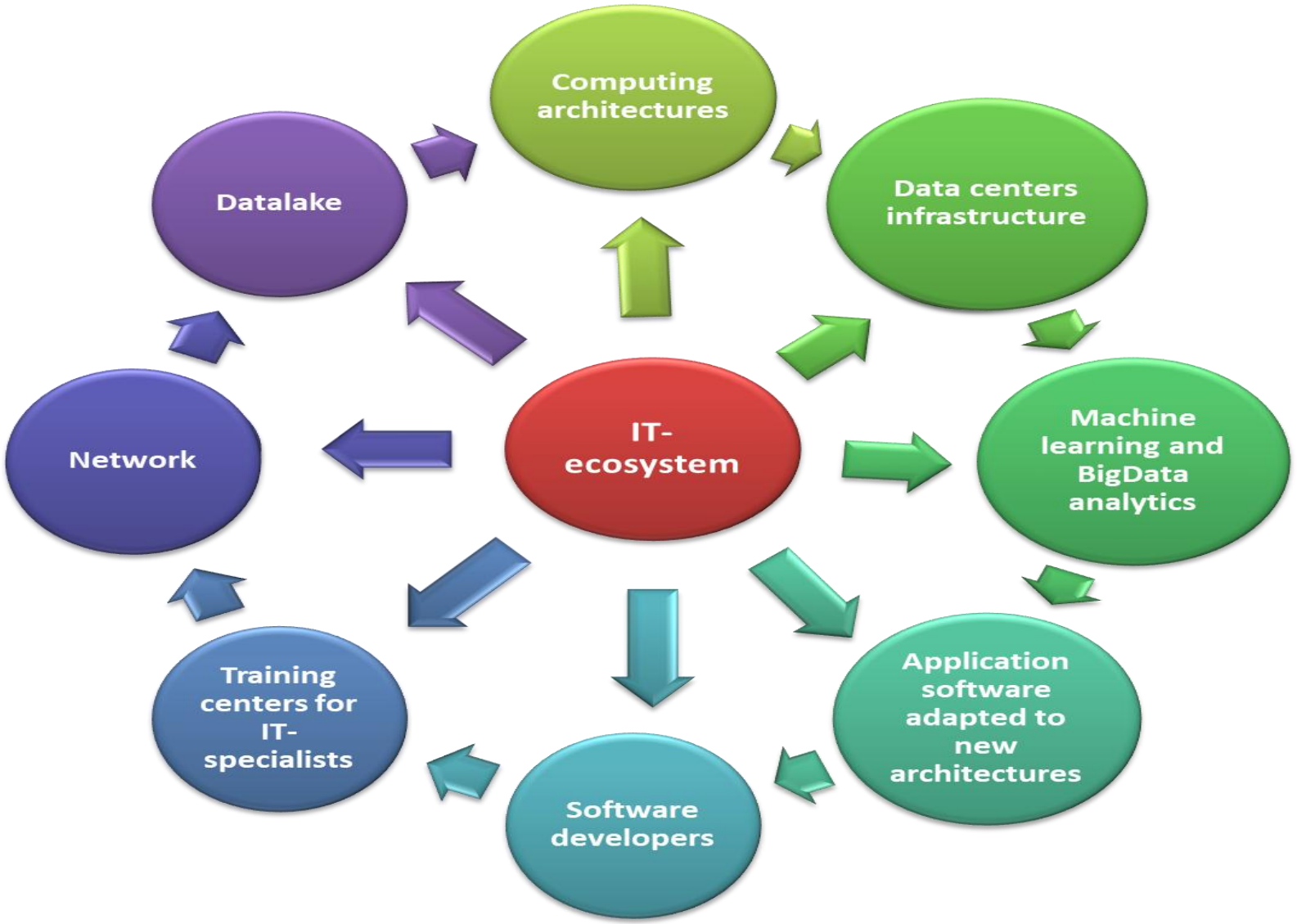
Development of the system for training and retraining IT-specialists



Training of the Institute staff, students and young scientists from the JINR Member States is carried out within :

- activities organized by the JINR University Centre;
- the framework of special courses from leading software developers;
- conferences and schools organized by JINR;
- international cooperation programs at JINR Member States institutes.

STRATEGIC LONG-TERM PLAN



AIM

Expandable worldwide dynamicaly evolving IT-ecosystem that combines a variety of technological solutions, state-of-art computing concepts and methodologies.

PURPOSES

Significantly reduce the time spent on the implementation of projects that require computing resources and IT expertise

BENEFICIARIES

JINR, its Member States and international collaborators