

INFORMATION TECHNOLOGY

The mission of the Laboratory of Information Technologies (LIT), is two-fold:

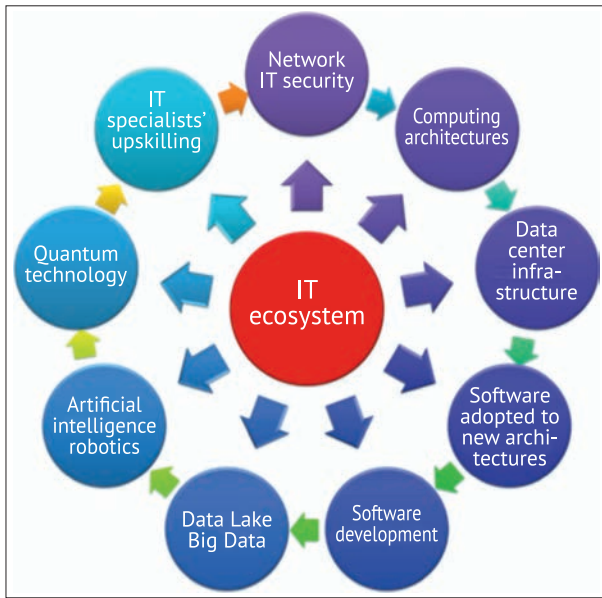
- to serve the scientists of JINR and its Member States in the pursuit of their research projects by developing Methods, Algorithms and Software for Modelling Physical Systems, Mathematical Processing and Analysis of Experimental Data;
- to assure that the IT infrastructure and IT know-how of JINR experts are always of latest state of the art as to performance and energy efficiency.

Presently, the JINR IT infrastructure has been developed in close connection with CERN and other Institutes of Nuclear and High-Energy Physics. JINR is a strong part in the Worldwide LHC Computing Grid (WLCG), which represents a geographically distributed computing environment for processing and storing experimental data of all the LHC experiments, and supports other large-scale experiments not only in particle physics. It is capable of managing hundreds of petabytes of data, providing access to the entire community to computing resources and data storage systems and integrating national and international structures.

The original concept of grid has been changed to a complex, heterogeneous computing system that combines computing resources of various concepts: HTC (High Throughput Computing), HPC (High Performance Computing), Volunteer computing, commercial and non-commercial cloud computing.

The JINR research programme for the next decades is aimed at conducting ambitious and large-scale experiments on the Institute's basic facilities and in the framework of worldwide cooperation. The programme is connected with the implementation of the NICA megaproject, the construction of new experimental facilities, the JINR neutrino programme, the upgrade of the LHC experimental facilities and the programmes on condensed matter physics and nuclear physics. The implementation of the projects mentioned above entails adequate and commensurable investments in the systems providing the processing and storage of increasing data volumes. In this regard, the further development and performance extension of the JINR Multifunctional Information and Computing Complex (MICC), as well as the provision of novel IT solutions to the Complex users and the increase in its operation efficiency, are the uppermost tasks of LIT.

The JINR computing infrastructure consists of numerous computing components and IT technologies to solve JINR tasks, from theoretical studies to experimental data processing, storage and analysis. The JINR MICC is the key element of this infrastructure and plays a defining role in research, which requires modern computing power and data storage systems. It encompasses the IT ecosystem for the NICA project, Tier-1 of the CMS experiment at JINR, Tier-2/CICC providing support to the experiments at the LHC, FAIR and other large-scale experiments, as well as support to users of the JINR Laboratories and its Member States;



IT ecosystem

the integrated cloud environment of the JINR Member States for support of JINR users and experiments (NICA, BES-III, NOvA, Daya Bay, JUNO, etc.); the HybriLIT platform with the “Govorun” supercomputer as a major resource for high-performance computing being a hyper-convergent system built on 100% liquid cooling in the “hot water” mode and having an energy efficiency of less than 1.06. Besides carrying out massively parallel calculations, first of all related to the research programme in theoretical physics, the “Govorun” supercom-

puter is used for modelling an entire system of computing for all the experiments of the NICA complex. It truly represents a designed future computing solution for any experiment.

LIT plans to establish an IT ecosystem, i.e. a dynamically evolving IT platform, which responds to the rapidly developing IT world. The promising directions of modern information technologies are Artificial Intelligence and Robotics, Machine Learning as well as Quantum Technologies and Big Data Analytics, Machine Learning. The development of the scientific IT ecosystem will depend on novel technologies for acquiring, analysing and sharing data. This system must be very flexible and open to new computing methods such as quantum, cognitive calculations, machine learning methods and data mining, as well as to any developments of new algorithmic bases.

The IT ecosystem will be a basic platform for training IT specialists, able to elaborate algorithmic and software solutions in all fields needed at JINR.

In summary, JINR LIT will further provide forefront service to scientists involved in JINR collaborations, on- and off-site of Dubna, by continuing to develop telecommunication technologies, computing systems, algorithms and software, technologies of data processing and analysis, as well as information security.