Referee's report on the theme "Information and Computing Infrastructure of JINR"

In full accordance with the Seven-Year Plan for the JINR development in 2017-2023 the goal of the theme is the development of the network, information and computing infrastructure at JINR for the research and production activities of the Institute and its Member States on the basis of the state-of-the-art information technologies.

The key point of the theme is a Project aimed at development of the JINR basic facility, namely LIT Multifunctional Information and Computing Complex (MICC). The MICC is a huge combination of complexes, subsystems and other organizational units, which include data processing centers (Tier1 and Tier2), the cloud infrastructure, the GOVORUN supercomputer, data storage and data transmission network, the specific MICC engineering infrastructure and the monitoring system.

Achieved successful implementation of the MICC project (in 2017-2019) laid solid foundation for its further development on the basis of new requirements to the a computing infrastructure. The rapid development of information technologies and user requirements stimulate relevant development of the MICC components and platforms. One of such examples is the GOVORUN supercomputer commissioned in 2018 as a part of the MICC. It is a joint project of LIT and BLTP, supported by the JINR Directorate and aimed at a significant speed-up of complex theoretical and experimental studies. The implementation of the project on the basis of most advanced computing architectures and IT-solutions provided users with the opportunity to carry out effective parallel and hybrid calculations together with development of modern machine leaning (ML) algorithms. The ML approach allowed one to solve a wide range of tasks, in particular, including neural-network based data processing for the high level international experiments within the JINR neutrino program.

It is pleasure to stress that for successful implementation of the JINR neutrino program DLNP and LIT have created a unified information and computing platform based on the MICC resources, the NOvA neutrino experiment was the first actively using the LIT cloud resources, and now it has the largest amount of the allocated resources. Furthermore our flagship Baikal-GVD and JUNO neutrino experiments follow the same way and use the cloud infrastructure resources for computing and data storage. We believe within the next 5 years a cardinal extension in the field is expected.

To meet nowadays challenges, a as future-directed scientific computer-communicative infrastructure, the JINR MICC should be very reliable, multifunctional, available permanently with high performance and user-friendly interface, it should have a reliable data storage system, high-level information security and a customized software environment for implementations of various requirements of users.

One can conclude from information available that all these very complex requirements can be satisfied at JINR with the MICC Project due to set of MICC numerous computing components and IT-technologies aimed at solving JINR current tasks, from theoretical studies to experimental data processing, storage and analysis. In particular, already now one has the IT-ecosystem for the NICA project, Tier-1 of the CMS experiment at JINR, Tier-2/CICC providing support to experiments at the LHC (ATLAS, ALICE, CMS), FAIR (CBM, PANDA) and other large-scale experiments as well as support to users of JINR Laboratories and the JINR Member States. Furthermore MICC has the integrated cloud environment of the JINR Member States for support of JINR users and experiments (NICA,

ALICE, BESIII, NOvA, Daya Bay, JUNO, etc.), the HybriLIT platform with the GOVORUN supercomputer as a major resource for high-performance hybrid computing, etc. As an "intellectual glue", allowing perfectly work all above-mentioned resources, LIT has well developed high-speed telecommunication and network infrastructure together with a reliable engineering infrastructure.

The MICC project continuation is inevitable. It must be aimed at upgrade of the major hardware and software components of the computing complex, it should provide users with novel IT-solutions and with highest level of the operation efficiency.

Another important task of the theme is the information support of the JINR research and production activities based on the Institute corporate information system (CIS). One needs here upgrade and further development of the following information services and systems: 1C:ERP providing the solution to the problems of accounting and management accounting, payroll, personnel records; ADB2, a management accounting system; the electronic document system EDS "Dubna"; the project management system APT EVM for NICA; the information search system (ISS) providing various reports on personnel and financial information; "Document Base", a system of electronic signing, storage and search of documents of the JINR main office administration as well as documents of MES&CC (Management of Economic Services and Capital Construction) and PLS (Procurement and Logistics Service); Personal Information System (PIN), a system for storing and managing data on the results of research activities of JINR employees. One needs a personnel information system for recording the participation of JINR employees in projects.

Further development of these information systems will be performed taking into account recommendations of users and group coordinators, responsible on development of databases, electronic document management and information security. The development will rely on the modern concept of the cloud platform of a unified administrative and business information system.

It is clear, that without these services and systems JINR is unable to be a modern scientific center of highest level.

The 3rd activity concerns an actual approach for (re)training IT-specialists based on the MICC educational resources. Organization of the following training courses are planned: regular courses on modern IT-technologies both for the Institute staff and students and young scientists from the JINR Member States in frames of practices organized by the JINR University Center, lectures from leading software developers, courses and seminars in frames of conferences and schools organized by JINR; lectures in the JINR Member States in frames of international cooperation programs.

I would like to stress that special attention will be given to (re)training of IT-specialists. This allows them to be ready for solving data processing (analysis) challenges of, say, mega-science project NICA and the neutrino program experiments.

I strongly recommend to support the continuation of the theme "Information and Computing Infrastructure of JINR" until 2023 with the highest priority.

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