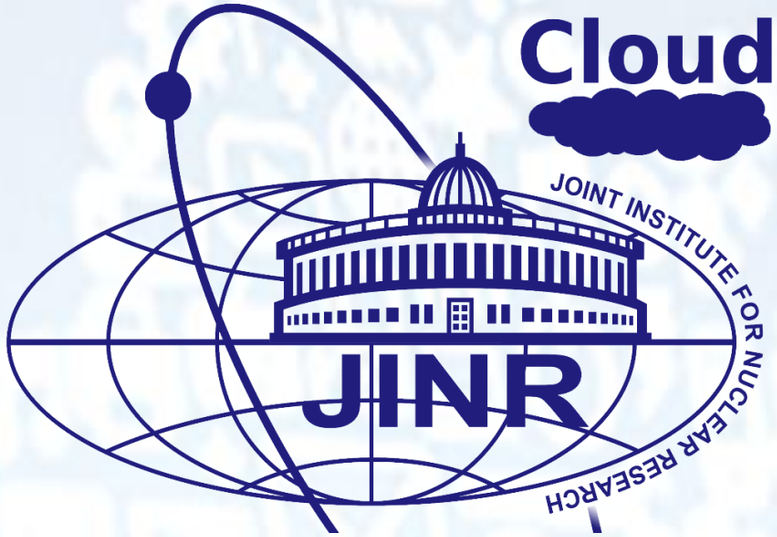

INTEGRATION OF THE CLOUD INFRASTRUCTURES OF LIT JINR AND INP'S ASTANA BRANCH - PE “NULITS”

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Relevance

JINR participates in a large number of research projects, in many of which computer infrastructures are an important tool for obtaining significant scientific results.

In this connection, the pooling of JINR's computational resources and organizations from its member countries is an important and urgent task, the solution of which would significantly accelerate the conduct of scientific research.

INP’s Astana branch - PE “NULITS” cloud

The Institute of Nuclear Physics (INP) of the Ministry of Energy of the Republic of Kazakhstan is a leading scientific organization in the Republic of Kazakhstan in the field of nuclear physics and solid state physics, radioecological research, nuclear and radiation technologies. The INP’s Astana branch was founded with the purpose of forming an interdisciplinary scientific and research complex as a regional center of natural sciences and scientific and technical accompaniment for specialists training for Kazakhstan’s nuclear industry. Complex is based on heavy-ion accelerator DC-60, put into effect in 2006.

AEO “Nazarbayev University” was created for testing, development and implementation in the Republic of Kazakhstan the best practices in the organization of educational, scientific, methodical and innovative activities in the field of higher education. At the moment, Nazarbayev University has a number of private establishments (PE) performing certain strategic tasks. In particular, PE “Nazarbayev University Library and IT services” (NULITS) is engaged in providing Nazarbayev University with IT infrastructure, information and library services.

In order to store and process data from the installation, to simplify access to application software, to use JINR’s software and experiments data was decided to create a cloud infrastructure and integrate it with JINR cloud.

INP’s Astana branch - PE “NULITS” cloud

Cloud service is based on an open-source IaaS platform OpenNebula.

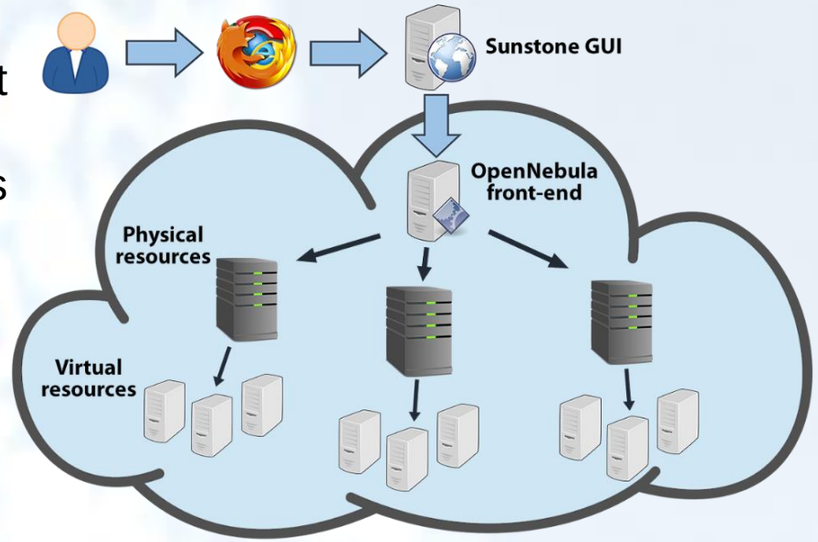
Two main components of the system can be marked out:

- front-end node (FN) which contains the system core and user interfaces to interact with the service;
- cluster nodes (CNs): the physical servers which host the users’ virtual machines (VMs).

Two user interfaces are available to access the service:

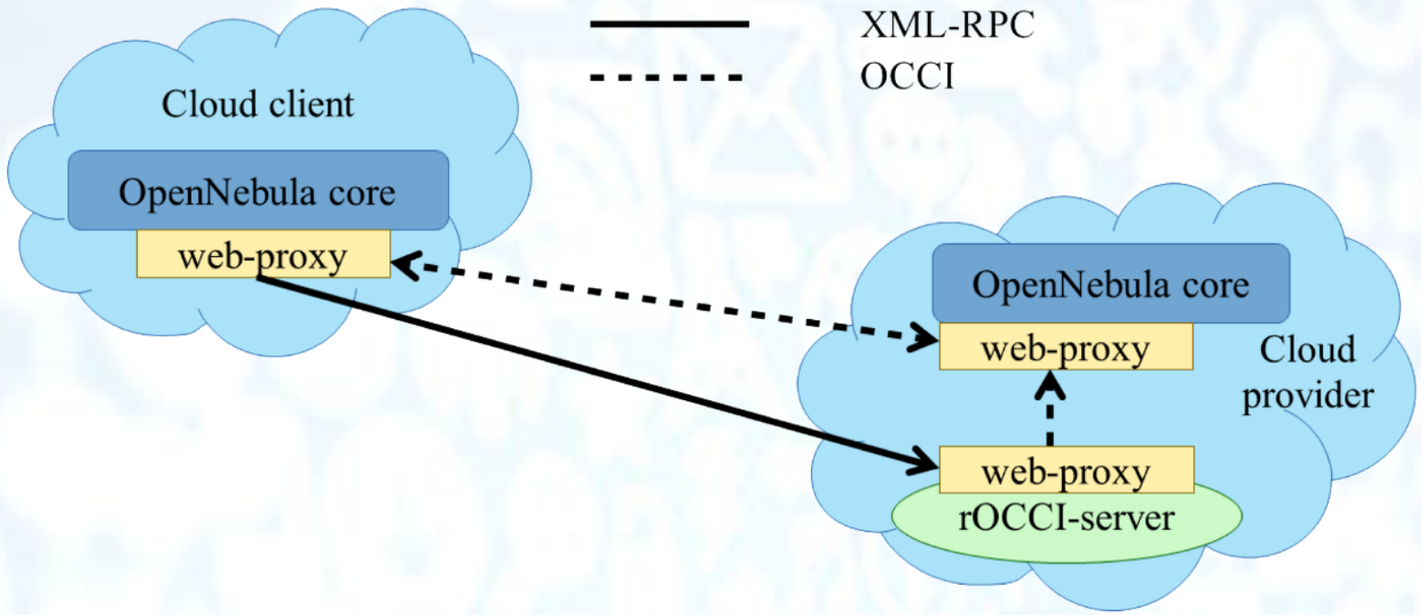
- full-featured command line interface (CLI);
- web-based graphical user interface “Sunstone”.

Currently cloud uses KVM virtual machines (full hardware virtualization) virtualization technologies to provide virtual instances (VI).



Integration of cloud infrastructures

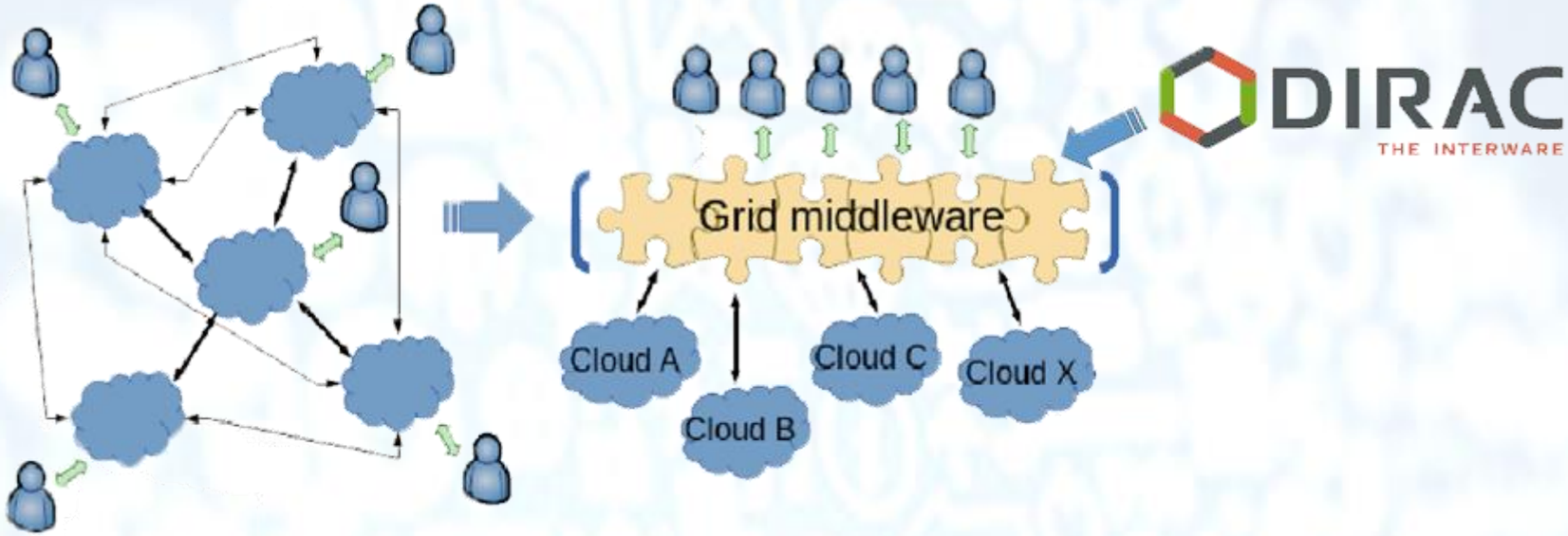
The cloud bursting driver developed by the JINR cloud team had been successfully used during several years as a tool for joining clouds from the JINR Member State organizations for solving common tasks as well as to distribute a peak load across them.



The driver allows to integrate with each other various clouds based on any cloud platform which supports Open Cloud Computing Interface (OCCI).

Integration of cloud infrastructures

The implemented in the cloud bursting driver approach allows to link each cloud with another one following “peer-to-peer” model. A growing number of participants of such distributed cloud-based infrastructure increases a complexity of its maintenance sufficiently. That’s why a research work was started to evaluate possible alternatives. A chosen approach for clouds integration relies on the usage of grid middleware based on DIRAC.
The DIRAC services are deployed at the JINR cloud which provides a computational resource for that distributed DIRAC-based platform itself as well as clouds from the JINR Member State organizations.

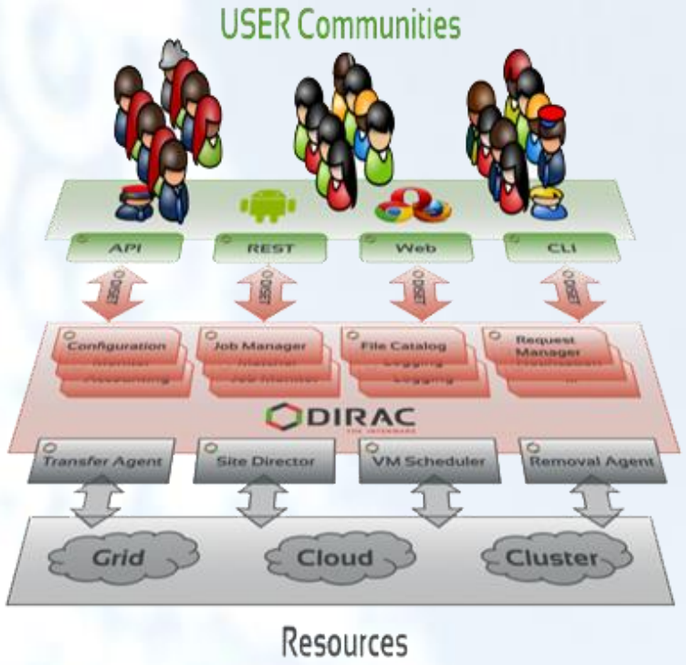


Driver allows you to integrate the JINR cloud with partner clouds that run either on the OpenNebula platform (and in this case you can enable monitoring of external cloud resources in real time) or on any other cloud platform that supports the Open Cloud Computing Interface (OCCI), for example OpenStack.

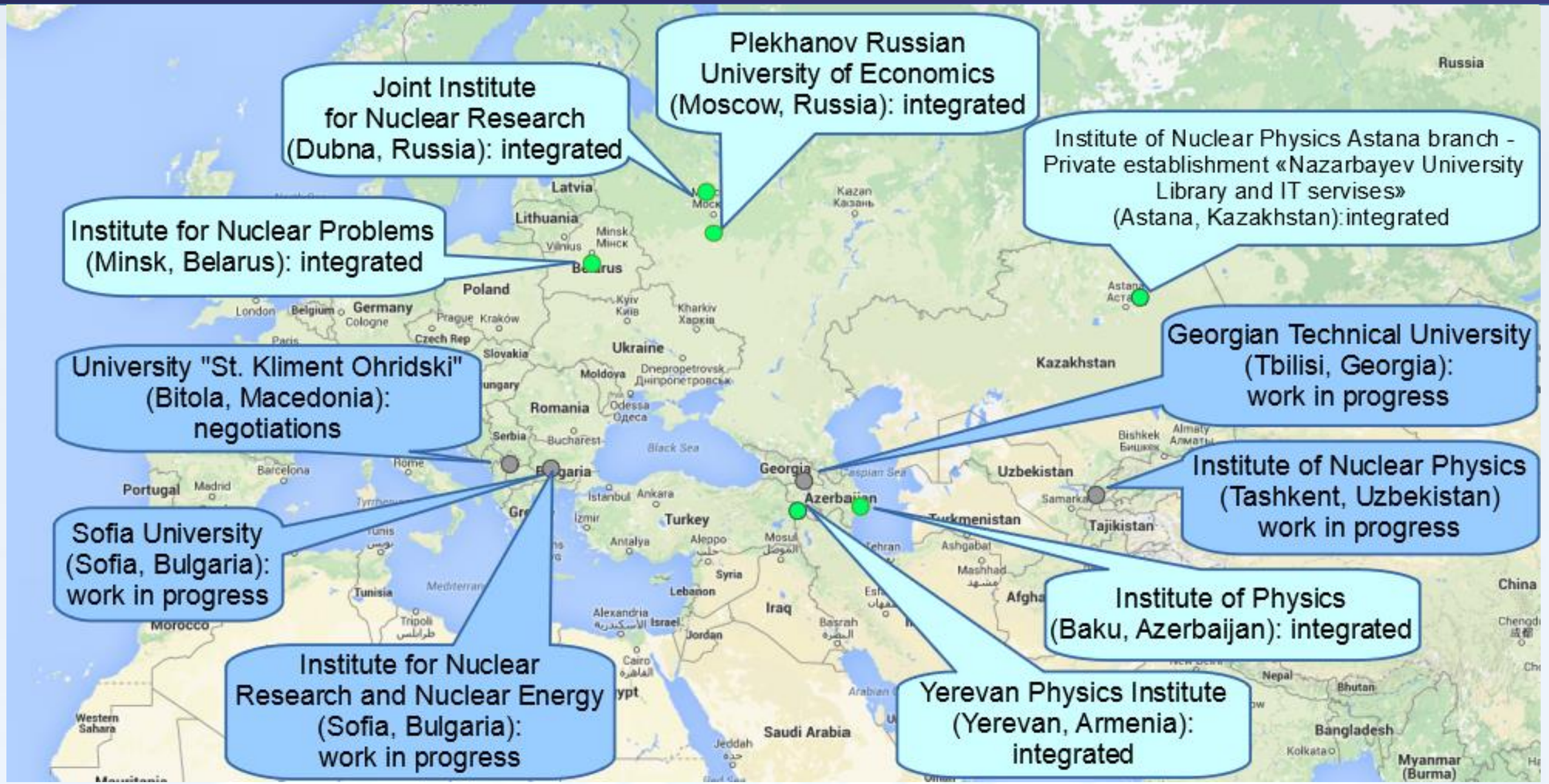
Integration of cloud infrastructures

DIRAC (Distributed Infrastructure with Remote Agent Control) INTERWARE is a software framework for distributed computing providing a complete solution to one (or more) user community requiring access to distributed resources. DIRAC builds a layer between the users and the resources offering a common interface to a number of heterogeneous providers, integrating them in a seamless manner, providing interoperability, at the same time as an optimized, transparent and reliable usage of the resources.

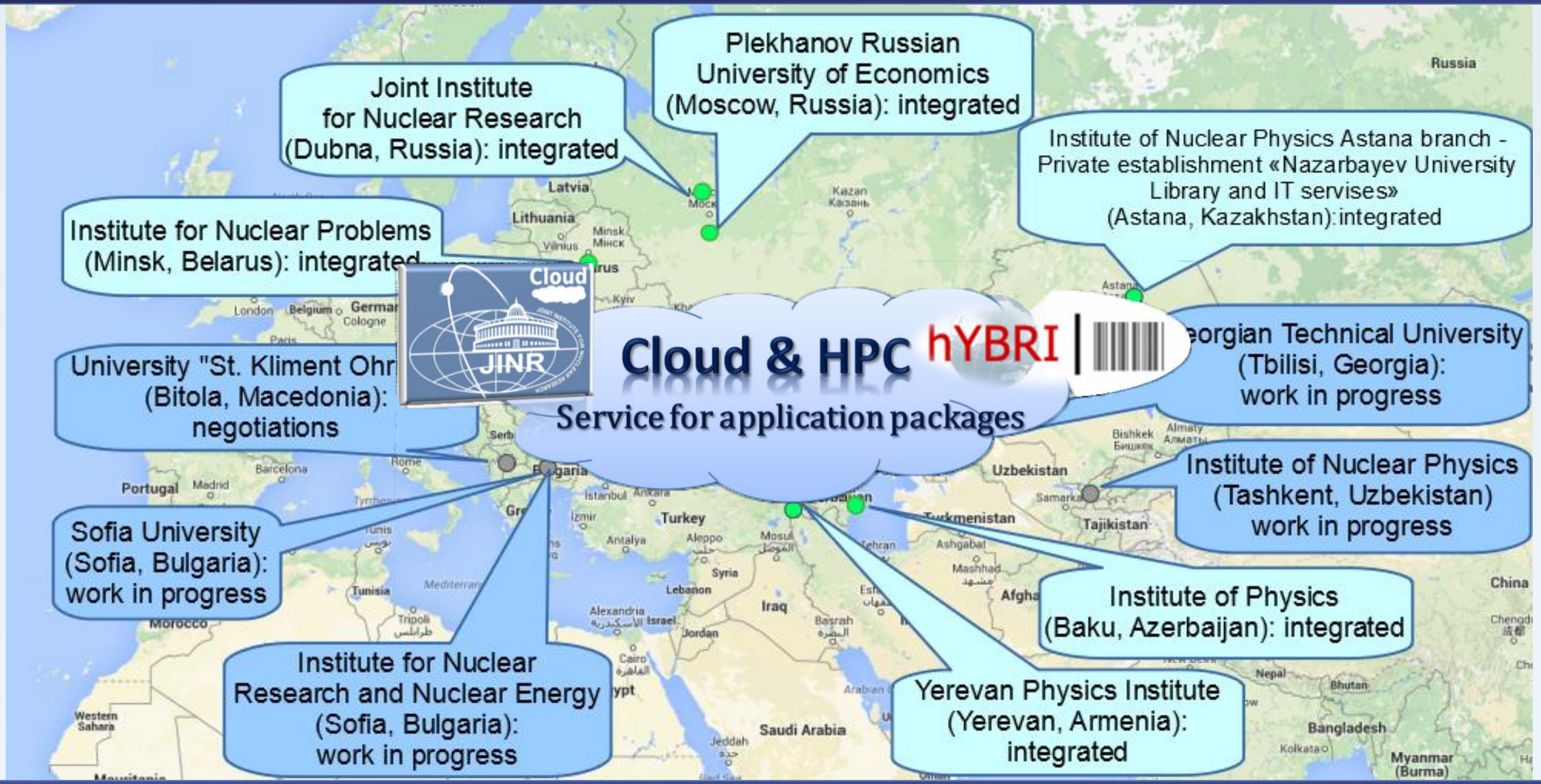
The Workload Management System with Pilot Jobs introduced by the DIRAC project is now widely used in various grid infrastructures. This concept allows to aggregate in a single system computing resources of different source and nature, such as computational grids, clouds or clusters, transparently for the end users .



Participants of the distributed cloud infrastructure



Participants of the distributed cloud infrastructure



Project implementation plan by years

1. Study of possible solutions for pooling resources (2017);
2. Purchase of equipment and construction of a test site for the selected solution (2017-2018);
3. Conducting training events for Kazakhstani specialists (2017-2018);
4. Integration of the resources into a single distributed information and computing environment (DICE) (2018);
5. Testing of the DICE (2018);
6. Involvement of potential participating organizations in the project (INP of the Republic of Kazakhstan, LN Gumilyov ENU, E. Buketov State University, Al-Farabi Kazakh National University, private companies) (2018-2019).

Completed work

Nowadays:

- prepared and signed protocol with the Astana branch of the INP on joint work in the field of creation and development of a common information space of existing ones, which provides an opportunity for data exchange between the JINR Member States and JINR collaborating international organizations;
- studied existing solutions for building a distributed information and computing environment (DICE), chosen a solution based on the OpenNebula platform;
- conducted organizational and training activities for specialists from Kazakhstan, including the implementation of OpenNebula and the use of the resources of the DICE.

Completed work

- To build a test site and create a JINR DICE, server hardware was purchased;
- The equipment was installed and the work was done to install software to create the cloud infrastructure and directly integrate it with the JINR cloud.
- Currently, the distributed information computing environment is being tested.

Наименование	Кол
S26361-K1566-V401 Серверное шасси PY RX2540 M2 8x 2.5' expandable 'Rack based server 19" (2U), BU without processor and RAM, without hot plug power supply module, 5 hot plug fans redundant; RMK optional; dual systemboard for Xeon DP processor and 24 slots for registered DDR4 ECC RAM; iRMC S4 onboard server management incl. graphics controller and 10/100/1000MBit Service LAN port, DynamicLoM mit 2x/4x 1/10 Gbit Ethernet LAN optional, RAID0/1-Controller for 4 SATA-HDDs onboard, Modular 8-Port RAID Controller optional; 1 bay 5.25" x 1.6" for backup devices, 8 drive bays for hot plug 2.5" SAS/SATA drives expandable; ServerView Suite Software Pack	4
S26361-F3933-E160 Процессор Intel Xeon E5-2660v4 14C/28T 2.00 GHz	8
S26361-F3849-E100 Cooler Kit 2nd CPU	4
S26361-F3694-E10 Идентификатор заводской сборки Independent Mode Installation	8
S26361-F3934-E515 Модуль памяти 32GB (1x32GB) 2Rx4 DDR4-2400 R ECC	32
S26361-F2495-E440 Config 4: 8x 2.5" HDD	4
S26361-F5618-E64 Жесткий диск SSD SATA 6G 64GB DOM N H-P	4
S26361-F5531-E560 Жесткий диск HD SAS 12G 600GB 15K HOT PL 2.5' EP	8
S26361-F3842-E1 Контроллер PRAID CP400i	4
S26361-F3961-E202 Сетевой адаптер FC Ctrl 8Gb/s 2 Chan LPe12002 MMF LC LP	4
S26361-F5302-E401 Адаптер PLAN EM 4x1Gb T OCl14000-LOM interface	4
S26361-F2735-E175 Монтажный набор Rack Mount Kit F1 CMA QRL LV	4
S26361-F4530-E10 Монтажный набор Mounting of RMK in symmetrical racks	4
S26361-F2735-E82 Кабель Rack Cable Arm 2U	4
S26361-F3301-E100 Наклейка Made in Germany sticker	4
S26361-F1452-E140 Набор документов Region-kit Europe	4
S26361-F1790-E311 Лицензия eLCM Activation License	4
S26361-F1790-E243 Ключ активации iRMC advanced pack	4
S26113-F574-E13 Блок питания Modular PSU 800W platinum hp	8
T26139-Y1968-E100 Кабель питания Cable powercord rack, 4m, black	8
S26361-F3120-E40 serial port option	4
FSP:GN3S20Z00RUSV2 Сертификат на сервисную поддержку TP 3y OS,9x5,NBD Rt	4
ИБП 3000ВА APC “Smart-UPS X 3000”	1

Conclusion

- The possible ways of integrating territorially distributed computing resources are explored.
- The approach based on the DIRAC grid middleware usage was considered as an optimal one.
- A complex of training events for specialists from Kazakhstan on creating cloud platforms based on OpenNebula and using the resources of distributed information and computing environments was organized and conducted.
- The cloud resources have been integrated into a single distributed information and computing environment.

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Thanks for attention!