5G ORAN PROJECT

Request for Proposal (RFP)

# Preface

The Skolkovo Institute of Science and Technology (Skoltech) is a private graduate research university in Skolkovo, a suburb of Moscow, Russia. Established in 2011 in collaboration with MIT, Skoltech educates global leaders in innovation, advance scientific knowledge, and fosters new technologies to address critical issues facing Russia and the world. Applying international research and educational models, the university integrates best Russian scientific traditions with twenty-first century entrepreneurship and innovation.

Skoltech is organized as a permanent, modern, international university with a physical campus for research and education in Skolkovo, Russia. Skoltech has a wide range of opportunities for supporting R&D projects for industrial customers and partners. Based on Skoltech, there is a large number of laboratories and R&D teams that already solve a lot of cutting-edge problems for industry (incl. telecom). Skoltech – the largest technology vendor in Russia in the 5G/5G+ research areas of coding algorithms, neural networks, deep learning and AI.

Since 2018, Skoltech has been coordinating a consortium of companies and telecom operators that are launching a massive project to create a complex "full-stack" solution for 5G networks deployment supported by the Russian government.

In January 2020, Skoltech along with the Enterprise “Eltex” and “Radio Gigabit” LLC (Alliance) won a first grant as Leading Research Center (LRC) of the government Digital Economy Program for OpenRAN 5G. The center has several interest topics, and as one of them is the development of a solution for the 5G radio access network in accordance with the OpenRAN paradigm: until 2022 the Alliance plans to develop a set of equipment for the 5G radio access network (RAN), including 4 types of Transceiver Modules (RU), Distributed Modules (DU) and Control Unit (CU) with full-stack software, as well as launch their production on the basis of Eltex in 2022.

Within an Alliance, we divided the areas of responsibility between our companies:

1. Enterprise “Eltex” - responsible for the production and hardware design of CU and DU development;
2. “Radio Gigabit” LLC - responsible for the RU hardware development and 5G NR L1 software (with 7-2x O-RAN compliant split in collaboration with Xilinx);
3. Skoltech - responsible for the 5G L2/L3 software, as well as the integration of L1-HighPHY and L2, and full-solution testing.

# RFP Overview

## Purpose

Skoltech delivers the RFP to invite Vendors (developer companies who can provide required solutions and products) to submit a Proposal and related documents for the upcoming project. The proposal and related documents shall provide product technical features, solutions, technical support, service and commercial policies, according to which Skoltech could choose a qualified partner. In addition, the proposal and related documents also shall correspond to the requirements listed in the RFP one by one.

## Secrecy

All contents covered in this RFP and the attached documents are to be of commercial ownership of Skoltech. They only serve as a reference for the compilation of Proposal. Without authorization of Skoltech, any Vendor shall not be allowed to provide the contents of the RFP to third parties in duplication or by any other means.

## Response Rule

The Proposal must be compiled following the requirements presented in part 5 of the RFP.

## Schedule

|  |  |  |
| --- | --- | --- |
| **Start Date** | **End Date** | **Event** |
| - | March 07th, 2020 | Skoltech releases RFP |
| February 11th, 2020 | March 23th, 2020 | Vendor submits Proposal to Skoltech |
| March 23th, 2020 | April 10th, 2020 | Skoltech performs the Technical audit (see 2.6) of solutions |
| April 11th, 2020 | April 30th, 2020 | Skoltech finishes the evaluation and announces the winner of the competition |
| May 01st, 2020 | June 15th, 2020 | Skoltech signs a contract with the winner or authorized reseller provided by the vendor |

## Other Requirements

The Vendors should compile the Proposal according to the RFP, and provide English Delivery in the format required in part 5 of this article.
The Vendors should provide e-mailed or signed or sealed Proposal to Skoltech and additional documents, that shall include:

1. The signed proposal
2. The technical audit plan, proposed date and location

## The technical audit

To verify the existing capabilities of the solution offered by the Vendor, Skoltech specialists should perform a technical audit. A technical audit plan can be proposed by the Vendor but should include the main parts:

1. Technical demonstration: demo stand demonstration, basic performance test (5G UE attach/detach, UE throughput test)
2. Development process demonstration: code examples demonstration, testbeds and test suits demonstration, CI/CD demonstration, testing capabilities etc.
3. Technical support capabilities & SLA

The technical audit can be located (proposed by the Vendor):

1. At the Vendor’s premises
2. At Skoltech 5G Wireless laboratory (Russia, Moscow, Skolkovo, 3 Nobel Str.)

# Project Overview

This section introduces the basic information on the project, acting as a reference for the compilation of the proposal.

## Service Purpose

The L2/L3 5G NR Software stack licensing for use in the developed products.

## Scope

Skoltech’s mission is to promote the best world technology transfer from the RoW into Russia.

To do that, Skoltech is encouraged to engage a broad number of the international partners to bring in the top-notch hardware and software solutions from wherever it is possible at the very best terms and conditions attached.

While being non-profit organization, Skoltech should follow the best business practices leads, ensuring the maximized performance-to-price ratios in all its expenditures.

By doing so, Skoltech has to leverage its considerable research capacity, expand its innovation portfolio, and claim leadership in 5G ORAN focused research.

This falls in line with Skoltech’s mission to foster an ecosystem of innovation and entrepreneurship by becoming a launchpad for startups founded by Skoltech students and researchers based on practical applications of their research.

## About the Skoltech 5G Project

The main goal of the Skoltech 5G ORAN project is just to protect the local cellular industry sector of RF against whatever potential threats, like imposed sanctions, trade limitations etc.

To do that, Skoltech is obliged to provide a smooth and cost-efficient way for its domestic partners, like Eltex, Radio Gigabit, whoever else, to localize the design and serial production of the key components of the ORAN ecosystems, like RRus, CDUs, BDUs, etc.

In order to reach that goal, Skoltech is going, through this particular RFP’s strict selection process, to pick up the cream of the crop technical solutions, making that doable and achievable at the lowest cost in the shortest time frame, thus picking up the mostly ready to go, off-the shelf products from the open, unrestricted market.

Such a product pack to be acquired should allow for the following features/functions as they are key to providing Skoltech researchers with the tools and information that they will need in their R&D and design activities.

# Part 4 - Project Requirements

## Filling Information

The requirements for the supplied software are described below.

Please, try to **fill out all the fields** of the document according to the following rules:

1. If a feature is supported, describe its current capabilities and a further development roadmap if planned
2. If a feature is not supported currently, describe whether it will be supported in future?

**Note!** If the proposed feature is marked with a star **(\*)**, it should be filled only if applicable.

Each field should be filled in 3 sections:

1. Current status
2. Development roadmap
3. Comments, if applicable

## Administrative Requirements

### Source code & licensing

* Access to the source code and the possibility of any software modification is a mandatory requirement in this project. Can this requirement be met?
* Licensing options should take into account the possibilities of:
	+ Full redemption of software IP in Russia (exclusive license for Russia and the CIS)
	+ Granting a license without royalties
	+ Granting a license with royalties
	+ Sublicensing
	+ Other options

### Company registration

* **Jurisdiction**
	+ Please, confirm that the platform IP owner is registered in non-off-shore jurisdiction.
* **Shareholding**
	+ Please, confirm that you are willing to disclose software beneficiary owners.
* Scheme of contracting
	+ Please, tell us with which of these schemes (one or more) you agree to contract with Skoltech:
		- Direct contract with vendor, payment in US dollars;
		- Direct contract with vendor, payment in Russian rubles to bank account opened in Russian bank (post payment);
		- Contract with your authorized reseller in Russia, payment in Russian rubles.

## Functional Requirements

### General & Architecture

#### 3GPP standards compliance

Compliance with 3GPP 38-series TS documents with Release 15.4 and above. Please, write a list of standards that your solution meets.

#### O-RAN standards compliance

Compliance with O-RAN Working Group standards. Please, write a list of standards that your solution meets.

#### NR-L1 (PHY) integration

Interworking with 3rd party 5G NR L1.

1. Please, describe the interface for L1-L2 integration
2. 5G nFAPI Support: if yes, please provide specification version (e.g. Rel.10 SCF222.10.01)
3. Tested 5G PHY: Please, provide a list of tested L1 and current PHY capabilities and Licensing Options with prices

#### Core network integration

Supported core network integration options.

1. (Mandatory feature): Non-Standalone architecture support (ENDC Option 3/3a/3x)
2. (Mandatory feature): Standalone architecture support (Option 2)
3. Interoperability testing results: please, provide list of EPC/5GCs that have already been tested to work with your software.

#### Additional interfaces support

#### F1 interface

3GPP compliant interface between distributed (DU) and central (CU) units of 5G RAN for 3GPP Split 2. Please, provide information about supporting of F1 interface.

#### E1 interface

O-RAN compliant interface between Control and User Planes of CU. Please, provide information about supporting of E1 interface.

#### X2/Xn interface

O-RAN & 3GPP compliant X2 interface between LTE eNB and 5G gNB for NSA scenarios and Xn - between 5G gNBs for SA. Please, provide information about supporting of X2/Xn interface.

#### NG interface

3GPP compliant interface between 5G gNBs and 5GC for SA scenarios. Please, provide information about supporting of NG interface.

#### E2 interface

O-RAN compliant interface for OAM and C&M. Please, provide information about supporting of E2 interface

#### RU & LL-PHY integration (\*)

If applicable (L1 included for software package), please provide current status with:

1. Support of Split option 7-2x in accordance to O-RAN specification
2. Support of Split option 8 (with CPRI)

#### Availability of demo setup

Please, provide information on how to get access, BOM and current available features for testing.

#### Hardware integration

#### Hardware platforms support

Please, provide known best practice, vendors and available products for using as hardware platform for DU/CU.

* + - 1. Recommended HW platform requirements;
			2. Minimal HW requirements;
			3. x86 support: please, provide recommended HW requirements for best performance;
			4. ARM-based CPU support (NXP, Cavium Octeon TX2 SoC or any). If not, please provide a list of main difficulties to migrate/port to ARM-based architecture;
			5. Proprietary ASIC support. If yes, please provide a list of supported SoCs to us.

#### Functions offloading

Boosting up the performance by executing some parts of the overall functionality using for example FPGA.

* + - 1. MAC Functions offloading: please, provide which MAC functions of the stack could be offloaded and recommended hardware;
			2. PDCP Functions offloading: please, provide which PDCP functions of the stack could be offloaded and recommended hardware.

#### Synchronization

Please, specify synchronization options supported by the stack.

#### Hardware benchmarking testbed (\*)

The Alliance also develops hardware for CU and DU, and, to carry out testing and selecting, the planned hardware platform requires testing software for functional, load, and synthetic tests and testbeds to determine the platform with the best performance. If you can offer solutions for such tests, we are ready to consider it as an addition to the main software package, and please provide more information and current capabilities for this test suite.

#### Performance characteristics

#### Amount of users per RU

Please, provide the maximum amount of active/idle users for minimal and recommended hardware setup.

#### Amount of users per DU

Please, provide the maximum amount of active/idle users for minimal and recommended hardware setup.

#### Amount of users per CU

Please, provide the maximum amount of active/idle users for minimal and recommended hardware setup.

#### Scalability

Please, provide information about scaling opportunities of your solution.

#### Virtualization support

Please, provide the information about RAN virtualization and dynamic computational resources.

#### Amount of RU per DU

Please, indicate the maximum amount of RU per one DU instance for minimal and recommended hardware setup.

#### Amount of DU per CU

Please, indicate the maximum amount of DU per one CU instance for minimal and recommended hardware setup.

#### Throughput performance

Please, provide information about the archived throughput performance for minimal and recommended hardware setup. Also, please provide information about test setup, UE and L1 Vendor.

#### Latency performance

Please, provide information about the achieved latency (for CP and for UP) performance for minimal and recommended hardware setup. Also, please provide information about test setup, UE and L1 Vendor.

#### Uplink timing performance

Basis for UEs to maintain uplink synchronization.

#### SRS Performance

SRS enables the gNodeB to obtain channel information.

####  Software stack features

#### LTE and NR coexistence

Please, indicate the maximum amount of active/idle users for minimal and recommended hardware setup.

#### Same frequency (co-channel) and different frequency (adjacent channel/band) deployments

The stack can facilitate on the same carrier for FDD and TDD systems or adjacent channel NR-LTE coexistence.

#### Paired (FDD) and unpaired (TDD/SDL) spectrum deployments

On unpaired spectrum deployments (TDD), the NR network performs a DL transmission while the LTE network performs an UL transmission or vice versa. In paired spectrum deployments (FDD), adjacent NR and LTE operation is always in the same UL or DL direction.

#### Supported numerologies

Please, specify which SCSs and CP lengths for which frequency bands are supported.

#### FDD support

Please, indicate the modes supported.

#### TDD support

Please, indicate the modes supported.

#### LBT feature support (\*)

Please, specify if Listen-Before-Talk feature supported for LAA networks.

#### MIMO

#### MIMO supported configurations

Please, indicate MIMO configurations supported by Software stack.

#### Multi-beam support (\*)

#### Beam management (\*)

Techniques used to manage the logical consequences of using beams to transmit and receive data.

#### Dynamic beam tracking (\*)

Capability to track the rapidly moving source of the beam.

#### Beam sweeping (\*)

Beam Sweeping is a technique to transmit the beams in all predefined directions in a burst in a regular interval.

#### Beam Failure Recovery (\*)

Beam failure is detected by counting beam failure instance indication from the lower layers to the MAC entity.

#### Massive MIMO(\*)

#### DL MU-MIMO support (\*)

Downlink MU pairing allows the use of the same OFDM time-frequency resources on the base station.

#### UL MU-MIMO support (\*)

Uplink MU pairing allows two or more UEs to use the same OFDM time-frequency resources for the uplink data transmission.

#### SU-MIMO multiple layers (\*)

Support of spatial multiplexing of OFDM time-frequency.

#### Self-contained Frame Structure (\*)

Ability to independently decode slots and avoid static timing.

#### Slot Configuration

Capability of flexible slot configuration. Please, specify which configurations supported.

#### F-OFDM support (\*)

Filtered-OFDM support.

#### 100MHz bandwidth per cell support

Mandatory requirement.

#### 256QAM support

Please, provide information about MCSs supported.

#### 1024QAM support (\*)

Please, provide information about MCSs supported.

#### Carrier Aggregation support

Please, provide information about supporting of Carrier Aggregation modes supported.

#### Channel management

Please, provide information about supporting channel management modes for:

1. Logical channels;
2. Transport channels;
3. Physical channels.

#### Random access performance management

Please, provide information about currently supported Random Access modes and configurations.

#### Power control

Please, provide information about currently supported Power Control techniques for:

1. PUSCH Power Control;
2. PUCCH Power Control;
3. SRS Power Control;
4. PRACH Power Control;
5. PDSCH Power Control;
6. PBCH Power Control;
7. PSCH Power Control;
8. PDCCH Power Control.

#### Scheduling

#### MAC Scheduling Options

Please, provide information about type of scheduler options, scalability, offloading options.

#### QoS Management

Please, provide information about provided QoS modes.

#### Uplink Frequency Selective Scheduling feature support (\*)

The gNodeB selects the most suitable frequency band resources for UEs based on channel quality differences. The scheduler sets a sliding window width to determine the number of RBs required by each UE and selects a resource combination that delivers the maximum expected gain in the window.

#### Uplink Discontinuous Frequency Selective Scheduling feature support (\*)

Based on uplink CP-OFDM waveforms, this feature allocates multiple segments of discontinuous uplink resource locks (RBs) to UEs, with frequency selective scheduling enabled for each segment.

#### Enhanced Adaptive Retransmission feature support (\*)

Through accurately estimating an MCS required for retransmission and then reducing the number of RBs, resources can be saved for new transmission of other UEs, thus improving the spectral efficiency.

#### Radio Interface Ciphering & Integrity protection

Please, provide the AES, SNOW 3G, and ZUC- supported ciphering and integrity protection algorithms which gNB applies for RRC signaling messages and user-plane messages at the PDCP layer.

#### Mobility management

#### Handover support

Please, provide information about the types of handover being and to be supported in the future (NG, Xn/X2, Inter-Cell, Intra-Cell, Cell reselection, Intra- and Inter-RAT).

#### Security Mechanism

Please, provide a list of supported security mechanisms being implemented.

#### DRX/eDRX features (\*)

Please, provide information about the support of discontinuous reception and extended discontinuous reception mechanisms.

#### Network slicing support (\*)

Please, provide information about network slicing feature support and current status for its implementation.

#### URLLC features support (\*)

Please, provide information about supporting and roadmap for Ultra-Reliable Low-Latency Communications Features (Grant-free UL transmissions, flexible TDD frame structure, etc.)

#### MMTC features support (\*)

Please, provide information about supporting and roadmap for Massive Machine-Type Communications features (UL-centric transmissions, large amount of users, low rates transmission)

## Operations, Administration, Maintenance & Provisioning Requirements

The offered system provides essential and value-added OAM and C&M functionality.

### OAM

#### Support of alarm management

Operator can define the proposed system’s alarm type, e.g. throughput capacity alarm, amount of connected users, bandwidth usage alarm, link failure alarm, etc.

Operator can assign alarm priority, e.g. link failure alarm is serious alarm, and bandwidth alarm is common alarm.

Support of notifying instant alarm message via open API.

#### Support of performance management

Operator can monitor single instance current performance, e.g. amount of connected users, throughput, channel states, etc.

Operator can monitor all instances total performance.

#### Support of config management

Operator can configure the single and all instances (with/without downtime).

#### Support of software management

Operator can upgrade/deploy the software for current instances.

### Logging, Debugging, Reporting and Statistics Requirement

System status information is very important, so the offered system should generate rich information such as log files.

#### Generating system running log

The offered system should generate system running log with selected log-level.

## Source code requirements

### CI/CD environment

Vendors should provide development environment for building the source code, technical documentation and best practice for Continuous integration and Continuous development of the project.

### Testing automation

Vendors should provide information about:

1. Value of unit test and functional test coverage of the source code;
2. Functional test suits for development testbed.

### Technical documentation

Vendors should provide detailed technical documentation with the source code delivery.

### Software support

### Technical Support Service

The vendor should provide technical support and consultations by email or vendor Enterprise helpdesk.

* Priority technical support for bug-fixes;
* Main technical support with routine issues, integration, and interoperability testing;
* General system consultations;
* Products consultations;
* Software consultations.

The vendor should provide technical documents including the latest product technical information via email.

The vendor should provide the customer with hot-line telephone numbers and contact persons, and should warrant that all the contact persons will be reachable. The hot-lines and contact persons will not be forwarded to voice mail boxes.

The vendor should inform the customer of changing of hot-line number in written form (including FAX) three (3) days ahead of schedule.

#### Support plans & Options

The vendor should provide Support Plans, prices and options.

#### Service Language

The vendor should provide service in English.

#### Software Warranty Period

The software warranty should be extended for at least 3 years and shall come into effect from the sale date. After the 3rd year, software support should be determined by the selected Support Plan.

#### Available time during warranty period

The vendor’s technical support hot lines should be available on business days from 9:00 to 18:00 GMT+3 (Saturdays, Sundays and public holidays should be days off).

# Part 5 - Proposal Compilation Requirement

Vendors should compile the proposal in terms of the following contents and format.

## Company Introduction

Provide a detailed company introduction.

## Product Introduction

Provide a detailed product information and development roadmap.

## Response on Technology and Functions

Correspond to the above function requirements one by one.

## Response on Service

Correspond to the above service requirements one by one.

## Quotation

The vendor should list all products and services in the quotation list, and specify the principles of pricing accordingly.

List all the quotations separately according to the product function modules (if applicable).

If a price is to be quoted based on the different licensing options, please provide all available options and the pricing principles.

Finally, please offer the final quotation and pricing method (including the pricing method for the software to be expended in the future, if upgrades planned) for each scheme by considering the schemes provided by the participants.

Please specify the price list of the sub-module in accordance with the following parts:
(1) Software license fee: including the license fee and the license fee for the 3rd products (if applicable);
(2) Support expenses: incl, basic and extended support expenses;

(3) Training expenses.

If project training is not free of charge, please specify all the training expenses to be paid (including those suggested by the participants), for example, the expenses for development/maintenance of personnel training, customer training and teacher training.

(4) Expenses for future upgrades.

Please specify the content of the basic service contained in the purchased products. For maintenance and upgrade options that should be purchased separately, please include all the expenses for operation, maintenance and upgrade that should be paid by the assessment party, list the expenses for operation, maintenance and upgrade at different levels (including the expenses for on-site technical support). The hierarchy of after-sales service that can be provided, the content of agreement on the service level and the expenses for various service levels should be included, as well as the service coverage, user quantity and model scale. Please present the service packet available for similar companies upon taking your solution. Besides, please offer the estimation for the maintenance workload, that is, the estimation for the required support/maintenance personnel and workload for the assessment party in the operation stage.

Please quote the DDP Moscow, Skoltech price in USD.

Requirements
(1). Quotation should be made according to the template given below;

(2) Quotation reference template;

Quotation Template

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Item | LISTPRICE | Quantity | Discount | Amount |
| 1 | Software Purchase fee |  |  |  |  |
| 2 | Basic support expenses |  |  |  |  |
| 3 | Training expenses |  |  |  |  |
| 4 | Expenses for future upgrades |  |  |  |  |

(3) For detailed quotation, give an explanation according to your format.

(4) Please, send the quotation on addresses below:

e.soldatova@skoltech.ru

s.novichkov@skoltech.ru