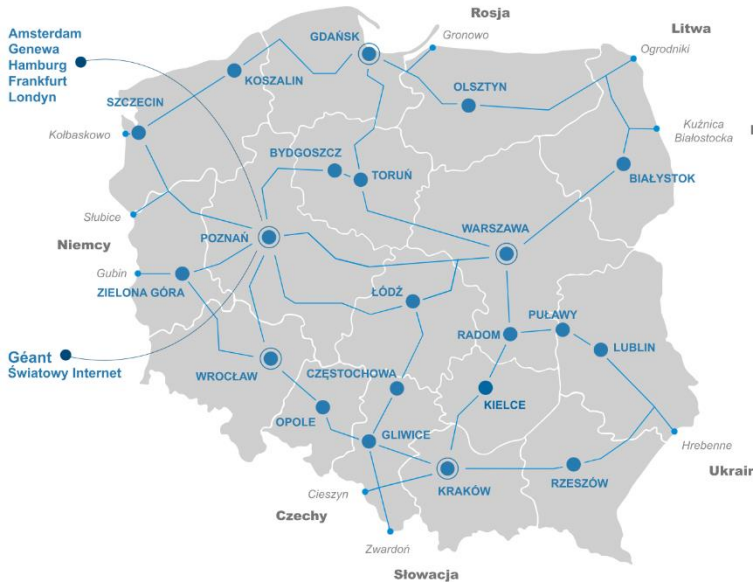


## National Platform for Integrating Research Infrastructures with Ecosystems of Innovation



- Laboratory of Innovative Network Technologies
- Distributed Time and Frequency Laboratory
- Smart Campus as Smart City Laboratory
- Regional "Living" Innovation Labs inspired by ICT
- Cloud Services Laboratory
- Multi-scale Simulation Laboratory
- Laboratory and e-Training Services (in the scope of PIONIER-LAB and technology-inspired innovations)
- Preincubation Laboratory

### Research and integration

- **Connecting and integrating distributed laboratories**
  - Support for building unified research ecosystem
  - One technological and organizational environment enabling the use of resources of many complementary laboratories in one experiment or a series of experiments.
- **Research on network technologies**
  - Flexible infrastructure supporting new technology evaluation and deployments
  - Highly distributed architecture
  - Research in a wide range of telecommunications and ICT technologies
  - Applying innovative network technologies at levels typical for telecommunications networks
    - Metropolitan
    - Regional
    - National.

## Infrastructure

- **National core**
  - DWDM optical system
    - ROADMs (NG-OTN)
    - Automatic optical path restoration
    - Alien lambda
  - MPLS based packet network
    - High-end MPLS and IP routers
    - Located in 21 academic and HPC centers
    - 100/400/800Gbps
- **Metropolitan and regional access**
  - Seamless MPLS based services integrated with national core
  - Direct access to universities and research institutes
  - 1/10/100/400Gbps



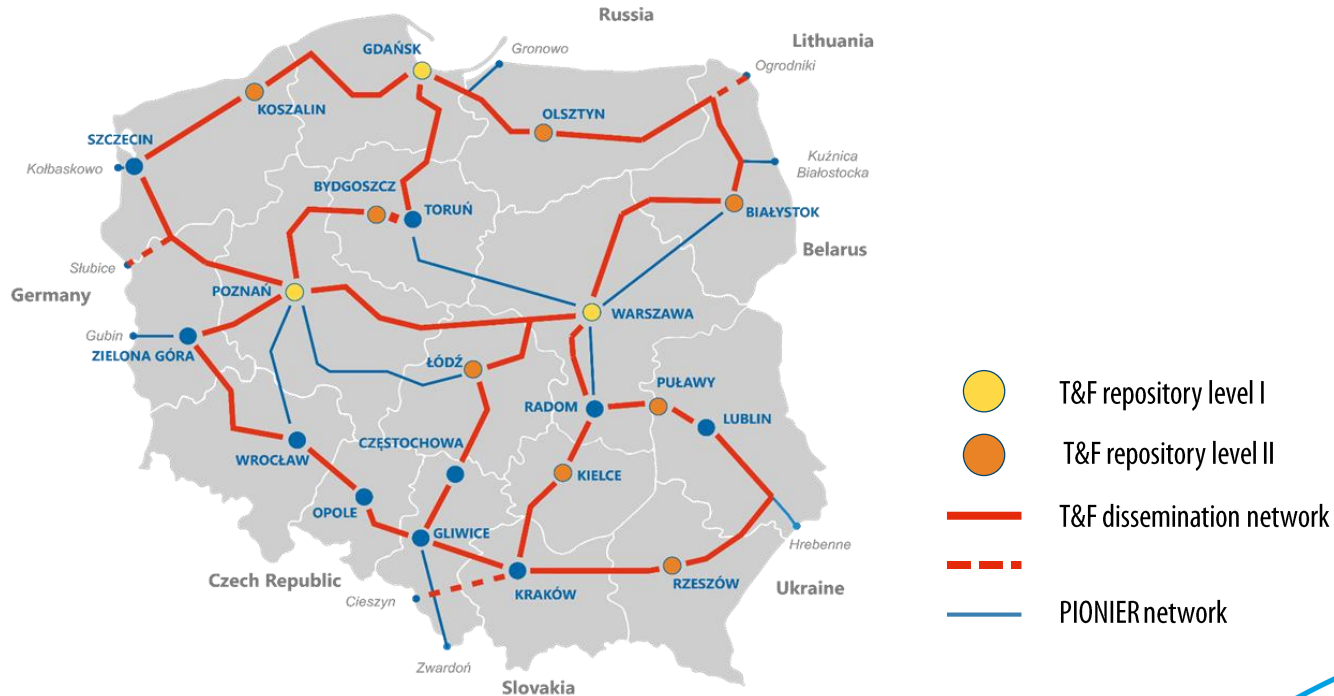
### Transmission services

- **Lambda service**
  - Point-to-point connections based on the infrastructure of PIONIER-LAB laboratories with the use of the DWDM transmission system.
  - Dedicated lambdas with a capacity of 100Gps, 400Gbps or 800Gbps
  - Alien lambda
- **MPLS based services**
  - Point-to-point connections - fast and efficient transmission of Ethernet frames between two locations, regardless of the type and type of higher layer protocols
  - A layer 2 virtual network linking multiple sites - connecting multiple locations, regardless of the type and type of higher layer protocols
  - Virtual Layer 3 Network - transmission of IP, IPv6 or MPLS packets between multiple locations, regardless of the type and type of higher layer protocols.
- **Internet access service**
  - The service provides research infrastructure for technologies that require access to public Internet resources.
  - High availability and reliability of the service is provided through dedicated and redundant connections (main Tier 1 operators)
  - Domestic and foreign Internet exchange points (PLIX, AMSIX, DCIX and LINX)

### Measurements and environments

- **Network measurements**
  - Measurements with the use of dedicated equipment for comprehensive analysis, generation and simulation of network traffic
  - Next-generation signaling protocols emulation
  - 100Gbps, 400Gbps and 800Gbps interfaces
- **IP fabric environment**
  - “Distributed router” built in the IP Fabric architecture
  - Research on DC/cloud centric applications and protocols
  - Advanced mechanisms for monitoring and detailed analysis of data flows with high efficiency

### Topology of Distributed Laboratory of Time and Frequency



## Services offered



**Virtual Atomic Clock service**



**NTP high accuracy service**

NTP



**PTP time synchronization service**

PTP



**Legal time service**



**Time stamp service**

# Services offered

## 1. Virtual Atomic Clock service

The user will have access to ultra-precise time (1 PPS) and frequency (10 MHz) signals transmitted over fiber optic links using ELSTAB technology. The accuracy of the delivered time signals is the same as the accuracy of the signals generated by the atomic clock connected to the system and will be at the nanosecond level or better. The user must have access to a fiber-optic link at the place where T&F receiver will be installed.

## 2. NTP high accuracy service

The user will receive a time signal transmitted using the commonly used Network Time Protocol (NTP). The accuracy of the delivered time signals will be at the millisecond level. The user must have an Internet connection.

## 3. PTP time synchronization service

The Precision Time Protocol (PTP) is a time transmission standard that provides much higher accuracy than the commonly used NTP standard. The user will get access to time signals with accuracy of single microseconds or better. The user must have access to a fiber-optic link.

## 4. Legal time service

The user will receive access to legal time. The source of legal time will be Central Office of Measures in Warsaw. The legal time service will be provided by the Virtual Atomic Clock service, the PTP protocol, or the NTP protocol. The user will receive legal time with the accuracy achieved by the previously mentioned time transfer services, from millisecond to nanosecond.

## 5. Time stamp service

The user will access to a server that will provide a document time stamp service. This service will certify the moment in time by adding the timestamp at which the document was delivered. This service will provide a reliable, secure and dependable source to confirm when a particular document operation took place.



Smart Spaces



fot. hikvision.com

Smart Parking



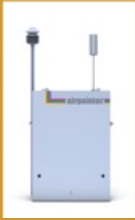
fot. innogy.pl

Smart Lockers



fot. electroclass.com

Air Quality Monitoring



fot. ml.u.edu

Smart Vending



fot. rheavendors.pl

Indoor Positioning



fot. estimote.com

Smart Outlets



fot. lumel.com.pl

Smart Inventory

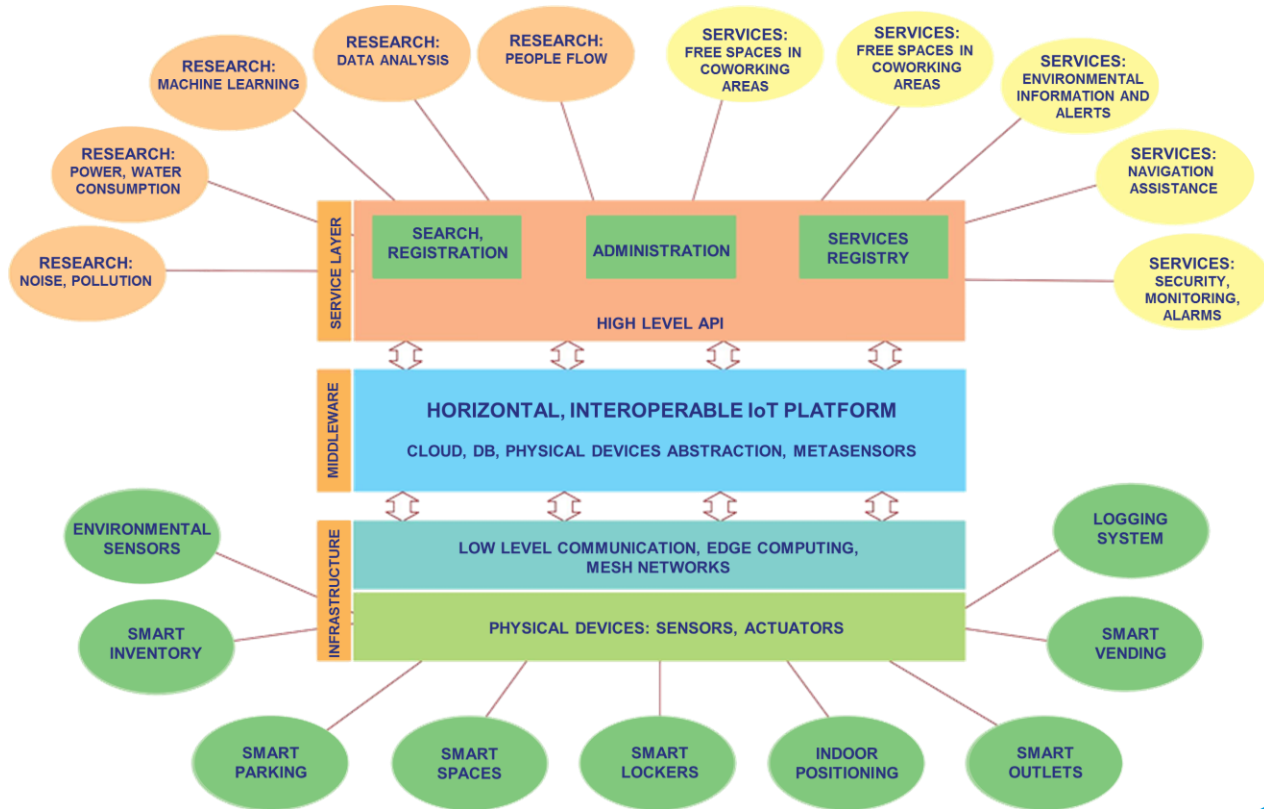


fot. www.fresh222.us

Logging System



fot. hikvision.com



- **Access to big amounts of gathered sensory data, which can be used for analytics or machine-learning purposes,**
- **Access to the infrastructure using provided API in a living-lab manner,**
- **Providing help/guidance/consulting services in own IoT-oriented prototyping and research works,**
- **Development kits built using the same elements as the ones installed on site, which can be rented to perform own research works.**

## Regional Living Laboratories Inspired by ICT

Networked, nationwide living laboratory for scientists, researchers, start-ups, SMEs, industry and local societies for development, testing and integration of new applications designed to work with novel human-computer interaction interfaces and improved communication between human beings and new generations of networked services and ICT products.

## Partners



Nationwide network of living labs for R&D  
on now ICT products and apps

## Services offered

- **Countrywide network of open research spaces equipped for conducting experiments with new applications and services developed by the scientific community, industry or local societies to develop new cost-effective human-computer applications and systems, based on requirements of particular target groups**
- **Support to individuals and start-ups to develop and test new applications and products**
- **New interfaces to enable interaction of human beings with virtual environments and computing software**



**EUROPEAN OPEN  
SCIENCE CLOUD**

pracelab

KMD  
Kierunek Rozwój

pracelab 2

PSNC

- **Virtual machine (SaaS) – predefined set of offerings.**
- **Cloud environment (IaaS) – the environment extended by TOSCA Workflows tools.**
- **Support from the expert.**
- **Object data storage system.**
- **Access to the Kubernetes platform (PaaS).**
- **Large scale external computing support - providing infrastructure for user services.**
- **Application service – provision of preinstalled end-user scientific applications and Operating Systems.**

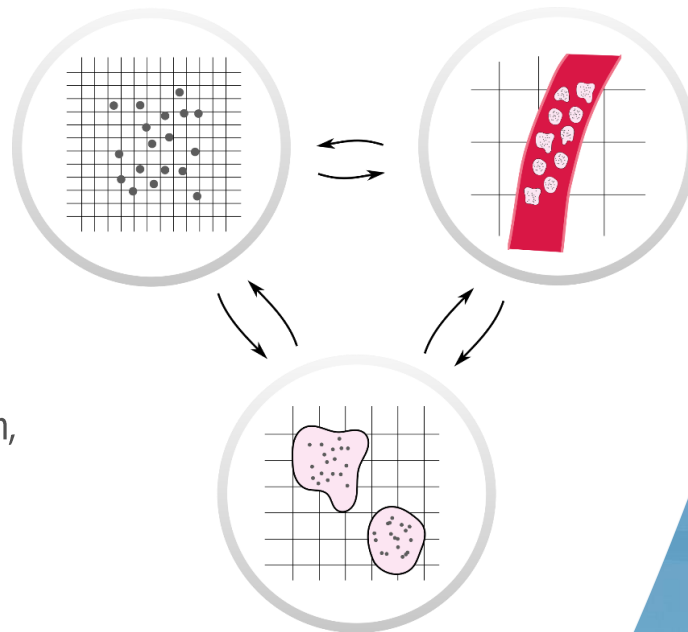


- The offers are available in the central PIONIER-LAB portal (SUZIML).
- The resources are provided by infrastructures: PRACE-LAB, PRACE-LAB2 and KMD (National Data Warehouse).
- Access to the API by the resource dispatcher.
- General accounting for users is available in SUZIML portal.
- Standardised SSO mechanisms are being used for accessing the services and resources.
- Managing the third-party applications' licenses.
- Targeted offer.

## Overview

### MAIN GOALS

- Promotion of multiscale simulations paradigm
- Support scientists and industry in development and running multiscale applications on HPC/Cloud resources
- Provisioning of specialised services to facilitate implementation, testing and execution of multiscale applications





■ **Five large HPC centers in Poland:**

- Poznań Supercomputing and Networking Center – leader
- Academic Computer Centre Cyfronet AGH
- Centre of Informatics Tricity Academic Supercomputer and network
- Wrocław Centre for Networking and Supercomputing
- Interdisciplinary Centre for Mathematical and Computational Modelling UW

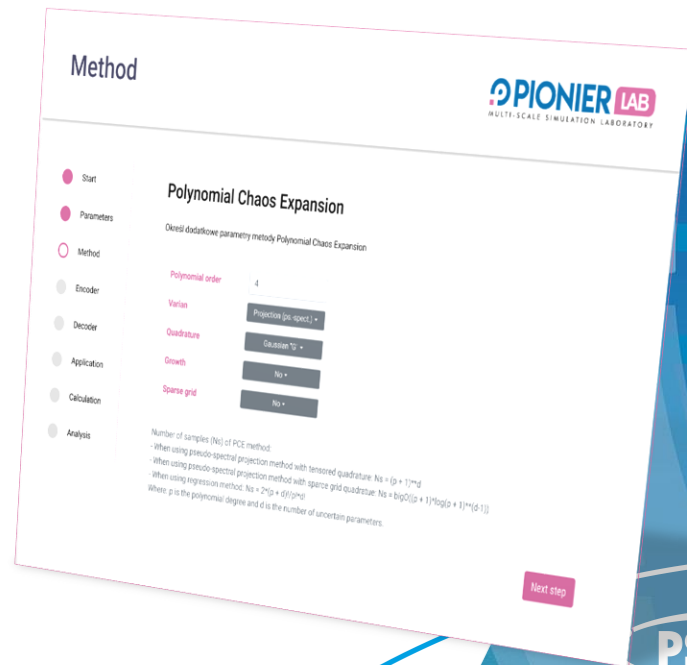
## PLATFORM FOR DEVELOPING AND ANALYZING MULTISCALE APPLICATIONS

### ■ Service 1: Multi-scale application development, testing and optimization

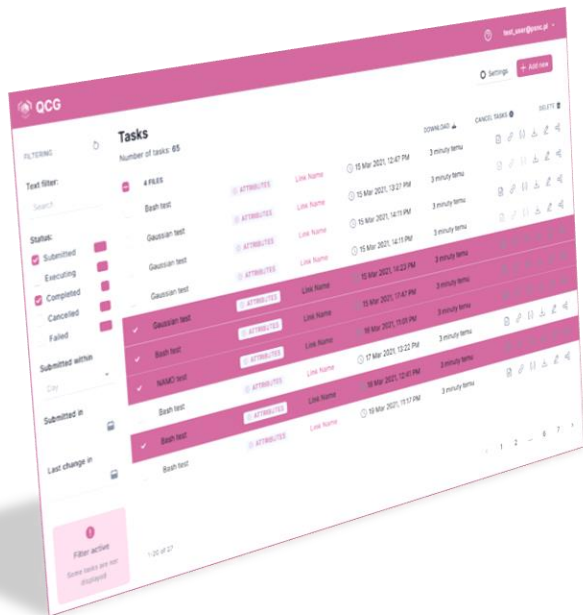
provides a hardware and software environment for efficient development, testing and optimization of multi-scale applications. By using high-performance computing nodes and the PIONIER network, the service provides the ability to conduct reliable pre-production testing in an environment as close to production as possible.

### ■ Service 2: Uncertainty quantification and sensitivity analysis for multiscale applications

provides a comprehensive Portal solution for Uncertainty Quantification (UQ) and Sensitivity Analysis (SA) of computational applications, especially complex multiscale applications and single-scale models included in them.



## PLATFORM FOR LAUNCHING, MANAGING AND MONITORING MULTISCALE SIMULATIONS



- **Service 3: Multiscale computations execution**  
provides access to the computational resources of the PIONIER-Lab consortium to enable computation and control of multiscale experiments. The intuitive access to the environment is backed by the QCG web portal, while the efficiency of calculations is supported by QCG-PilotJob.
- **Service 4: Multi-scale computations monitoring**  
allows tracking the progress of computational experiments running on computing resources and supports the process of verifying the correctness of calculations while they are running (e.g., convergence evaluation).



QCG-PilotJob is a user-level scheduler designed to schedule and execute many small jobs inside an existing scheduling system allocation.



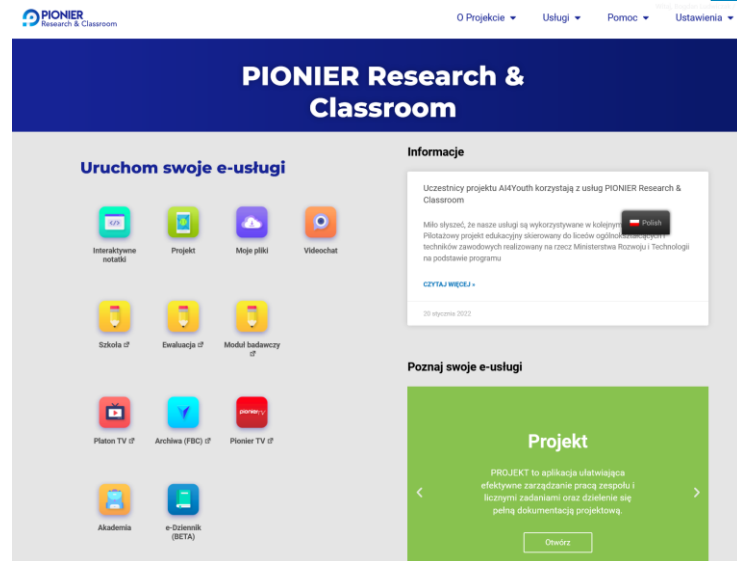
QCG-Portal is a user-friendly remote interface to HPC resources. Easy integration with SLURM, and customizable application templates, are among its main advantages.



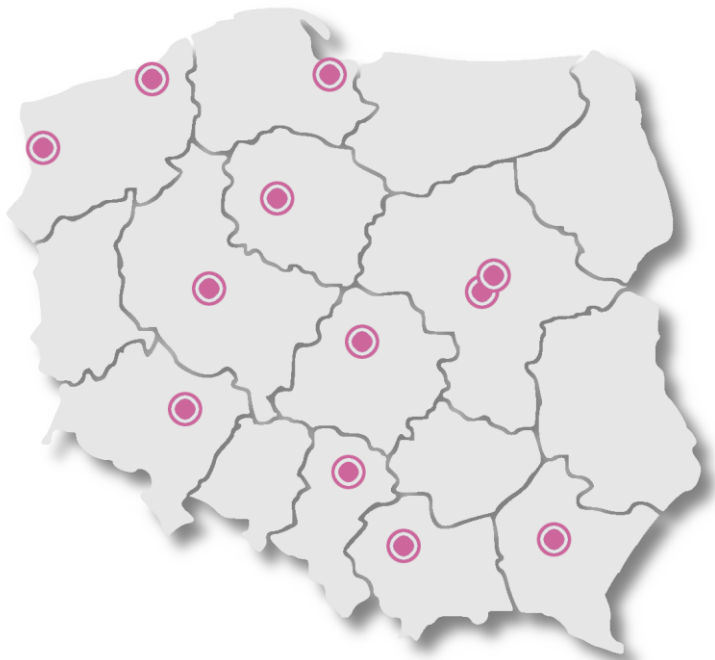
VECMAtk enables automated Verification, Validation and Uncertainty Quantification (VUQ) for complex single- and multi-scale applications that can be deployed on emerging exascale platforms and provides support for software applications for any domain of interest.

## Laboratory and e-training services

This lab enables research on increasing the efficiency of the education process (gaining knowledge) based on e-training. It allows researchers to investigate new paradigms of training, concentrated on personalization of the whole teaching process. Lab helps to select appropriate instruments for training so that the transmitted content is assimilated in an optimal way



## Partners



Key University nodes  
across Poland including:  
Warsaw, Poznań, Łódź,  
Bydgoszcz, Gdańsk,  
Koszalin, Szczecin,  
Wrocław Częstochowa,  
Kraków and Rzeszów



- Shared national platform (storage, cloud services and analytical tools) for preparing, editing, releasing and sharing of modern e-course
- Consulting and adaptation of the existing educational resources and courses to the form of modern MOOC and modern platforms
- Nationwide platform for scientific communities to create and publish e-training courses in different fields of scientific disciplines (Polish MOOC Platform)

The pre-incubation laboratory supports at the seed stage the creation of startups and the development of innovations in the following fields:

market and  
competition  
assessment

patent protection

prototyping and  
testing

business  
modeling

networking &  
seed funding

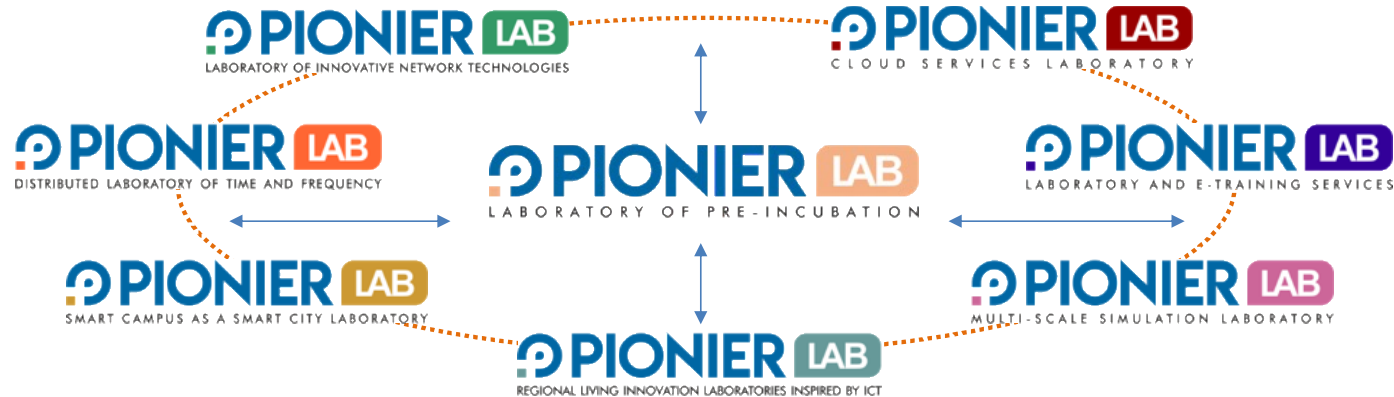
using the available infrastructure:

hardware

physical space

virtual space

The launch of a dispersed space of pre-incubators as part of the Pionier-Lab project will enable the creation of a collaboration ecosystem around the laboratory and will extend the science-business cooperation models to distributed and remote models.



## research & need analysis

- Competition analysis and benchmarking
- target group needs identification
- Creative consulting for modern technologies
- Estimating the market value of an innovative solution

## ideation & creation

- Organization and service of a hackaton event
- Solving design problems based on the Design Sprint methodology
- Science Safari - study visits to scientific units
- Data input & obtaining

## prototyping and testing

- Providing the space of PIONIER-LAB laboratories with equipment
- Proof of Concept
- Managing the MVP building process
- Validation of the prototype on potential users with the use of available digital solutions
- Distributed real-time MVP tests on a group of potential recipients
- UX / UI testing

## business modeling & seed funding

- Protection of intellectual property rights
- Legal and tax analysis of IT contracts
- Creating a business model (Lean Model Canvas / Value Proposition / Blue Print)
- Identification of funding sources