University POLITEHNICA of Bucharest

two centuries of innovational wisdom

*October 5th, **2019***

POLITEHNICA University OF BUCHAREST

1818














UPB.RO

Who we are

- **The most prestigious technical university in Romania, with over 30 000 students and 200 years of history**
- **The most important research centre in the region, with outputs towards the private sector**
- **An international partner to some of the most prestigious and innovative universities in the world**

Quality teaching and learning

30,000 students enrolled in BSc, MSc, and PhD studies

2,785 total staff; 1,334 academic staff – **366** full professors, 370 PhD coordinators

15 faculties, **35** study programs in **English**, **German** and **French**

Bachelor

- **18 major fields**
- **over than 95 study programs**
- **4 years duration**

Master

- **more than 184 study programs**
- **2 years duration**

PhD

- **16 fields of Engineering Sciences**

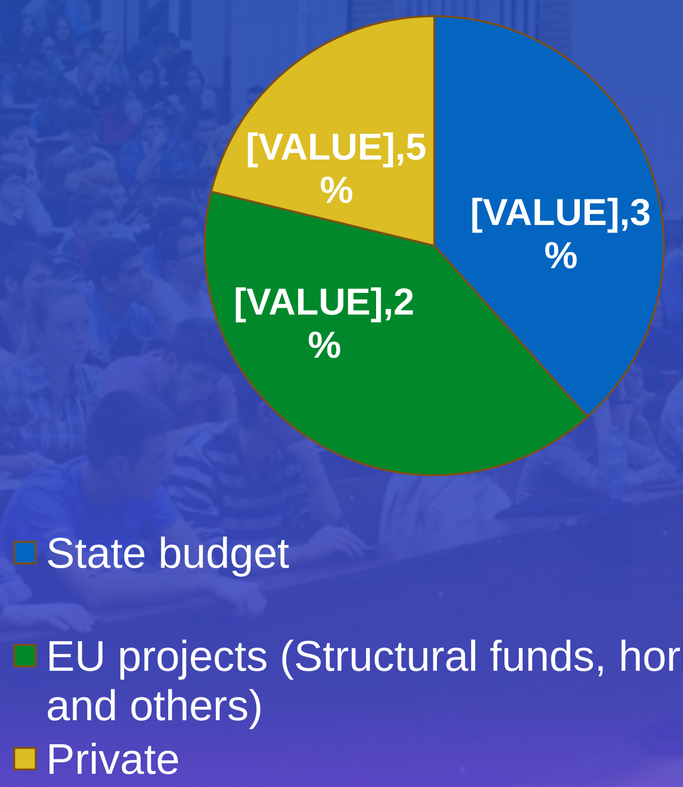
Budgeting for the future

Over **half a billion invested in research, education and human resource** in the past decade

Budget for 2018:
180 milion Euros

- 51 research centres
- 70 **new** state-of-the-art laboratories
- 115 pending patents
- over 1,000 WOS publications yearly
- over 200 R&D job opportunities **per year**
- 50.000 m^2 new buildings in 6 years
- **17 000 m^2** dedicated to research

Budget sources



Two new research facilities (CAMPUS & PRECIS)

- TOTAL PROJECT VALUE – 16.300.000 EUR
- 41 state-of-the-art research labs
- oriented towards private sector services and international cooperation

- TOTAL PROJECT VALUE – 10.937.586 EUR
- 28 research labs
- oriented towards private sector services and international cooperation

NEW RESEARCH CENTER

P·R·E·C·I·S

QUICK FACTS:

- FINALIZED DECEMBER 2015;

- 28 new R&Ds created by the project;
- 8370 m2 built-up surface for the new building;
- 35 jobs created in R&Ds;
- 9 international projects in which the infrastructure will be involved.
- Purchase of the latest technological equipment and related equipment:
- 291 research equipment development, of which 3 equipment with an individual value of over 100,000 Euro:
  - a state-of-the-art computational cluster with over 10TFlops over-the-counter and over 50TFlops
  - a complete line of PCB prototyping for wiring, printing, component mounting and soldering
  - an integrated multi-level monitoring system on wide indoor / outdoor air quality;

The Research Center includes 28 laboratories:

L1:Product Driven Manufacturing Management;
L2:Innovative Processes in Intelligent Product Exploitation;
L3:Energy Efficient Processes and Critical Infrastructures;
L4:Robots for Production Processes and Innovative Services;
L5:Innovative products for Sustainable Processes Development;
L6:Complex Cyber Physical Systems;
L7:Organizational Interoperability and Knowledge Management;
L8:The Enterprise of the Future;
L9:Innovative Products and Processes to Increase Life Quality;
L10:Advanced Control Systems for Real-Time Applications;
L11:Interoperable Products and Services to Support Decisions Based on Geospatial Data;
L12:Computer Based Innovation and Collaborative Knowledge Development;
L13:Innovative Products and Processes for Knowledge Extracting;
L14:Technologies for Ambient Intelligence, Fluid Interface and Semantic Lighting;
L15:Humanoid Robots and Drones;

L16:Digital Business Ecosystems for Innovative Product and Process Development;
L17:Pervasive Products and Services;
L18:Innovative Services Laboratory for Smart, Digital and Collaborative Future Society;
L19:Innovative Products for Mobile Systems and Services;
L20:Innovative research and use of advanced computational methods in the areas of aerospace, astrophysics, seismology, meteorology and hydrology;
L21:Cloud-based Innovative Services;
L22:Cluster and Grid Computing based Innovative Systems;
L23:Innovative Products and Processes in the Software Industry;
L24:Data Security and Services in Complex Networks;
L25:E-Health Platform Services;
L26:Cognitive Robotics Applied in Assistive Medicine;
L27:Virtual Reality;
L28:Laboratory for Reconfigurable High-Precision Medical Devices.

Groups of Labs and link with H2020

Horizon 2020
Priorities and Challenges

Priority 2: Industrial Leadership

COMPONENTS AND SYSTEMS
Systems of systems, Complex system engineering, Smart embedded components and systems

L1 L6 L10 L23

NEXT GENERATION COMPUTING
Cloud computing, Parallel computing, Simulation software

L21 L22 L24

FUTURE INTERNET
Networks, Software and services, Cyber security, Privacy and trust, Wireless communication, Connected enterprise

L17 L20

CONTENT TECHNOLOGIES AND INFORMATION MANAGEMENT
Technologies for language, Learning, Interaction, Content access and analytics, Advanced data mining and machine learning, Statistical analysis

L12 L13

ADVANCED INTERFACES AND ROBOTS
Service robotics, Cognitive systems, Advanced Interface, Sentiment machines

L14 L15

ADVANCED MANUFACTURING PROCESSES
Adaptive and smart manufacturing systems, Digital, virtual and resource-efficient factories, Collaborative and mobile enterprises

L2 L4 L5 L8 L16

Priority 3: Societal challenges

HEALTH, DEMOGRAPHIC CHANGE AND WELLBEING
E-health, Assisted living, Health data collection

L9 L25 L26 L27 L28

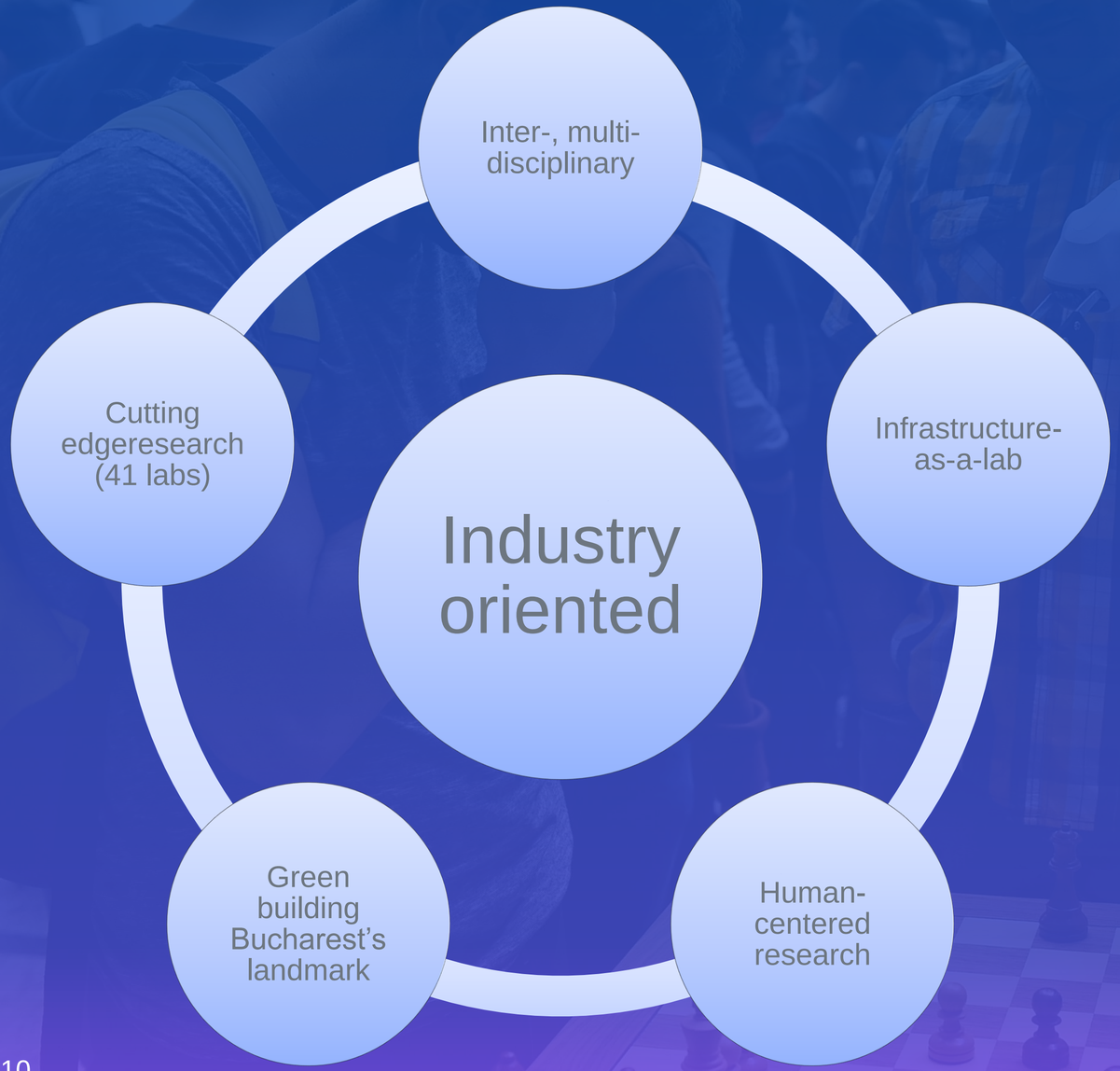
SECURE, CLEAN AND EFFICIENT ENERGY
Smart cities, Smart grids, Smart meetering

L3

INCLUSIVE, INNOVATIVE AND SECURE SOCIETIES
Social innovation platforms, E-government, E-skills and E-learning

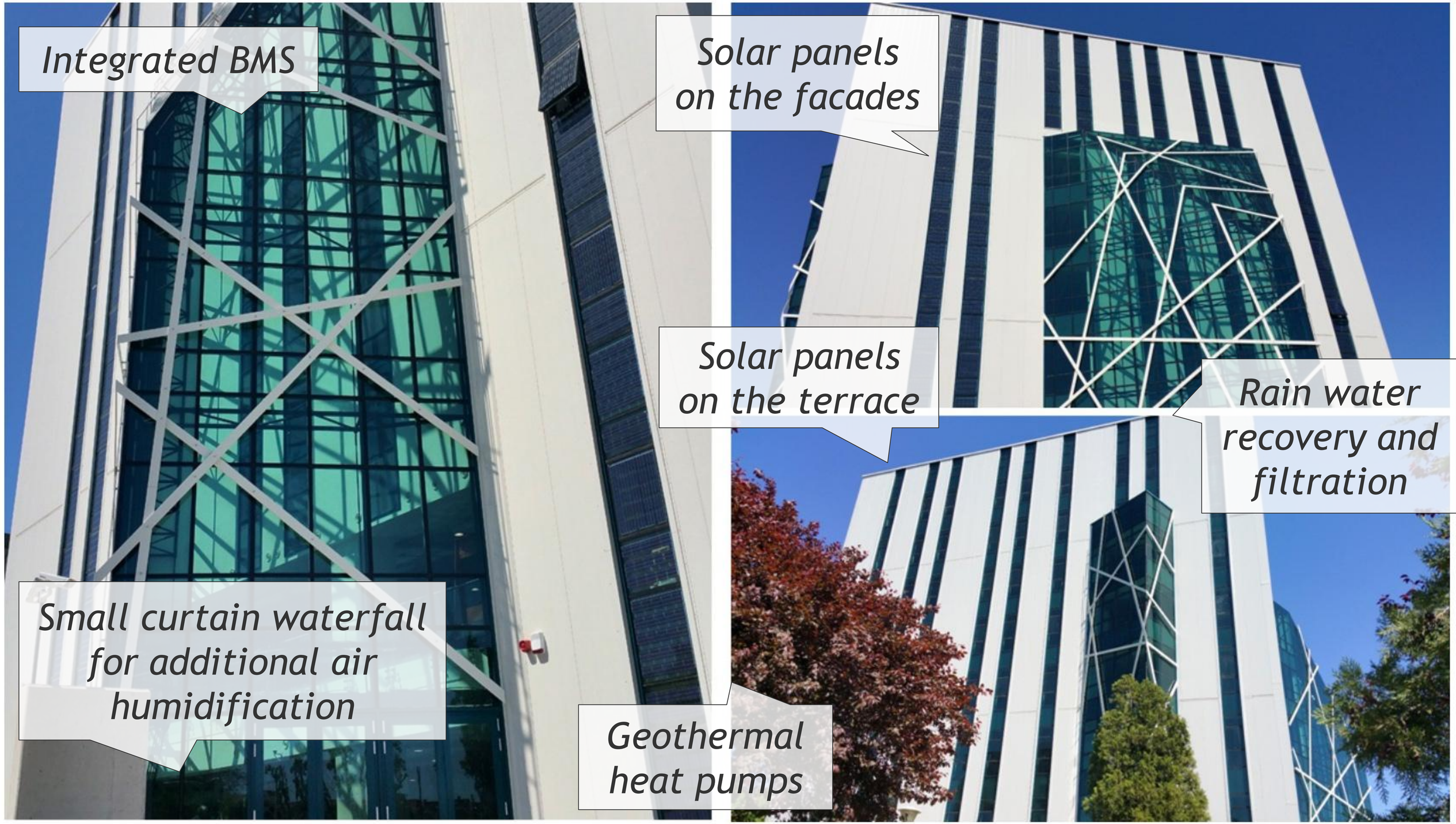
L7 L11 L18 L19

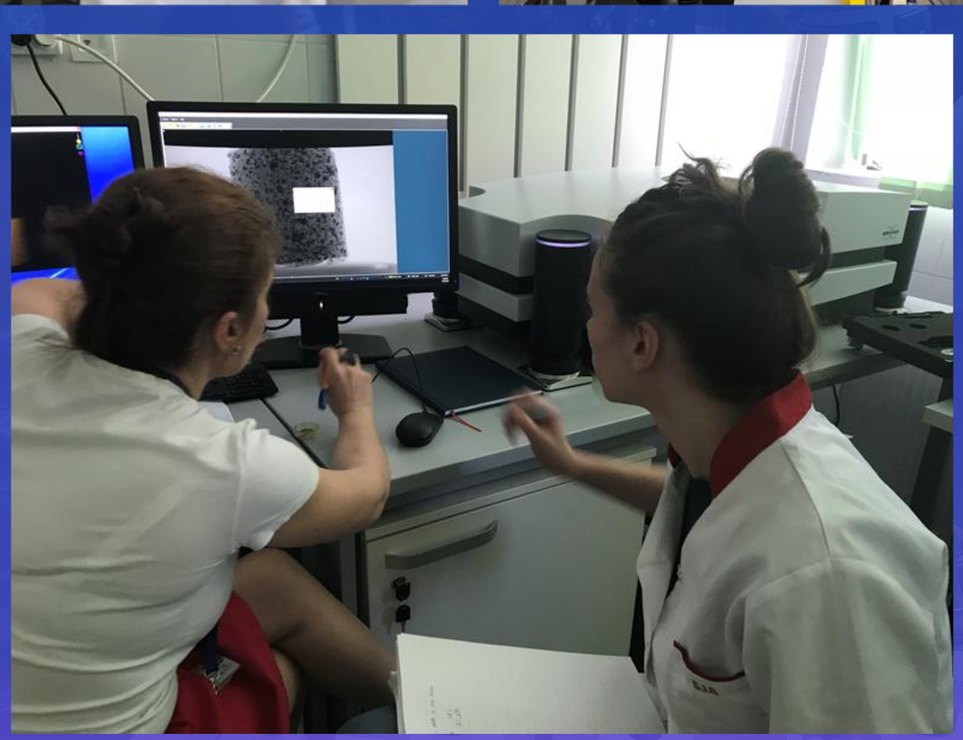
CAMPUS University Politehnica of Bucharest - Center for Advanced Research on New Materials, Products and Innovative Processes

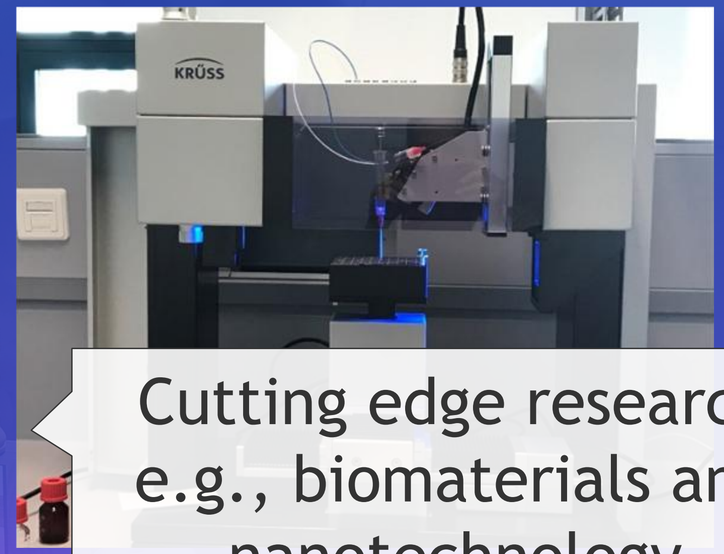


Quick facts:

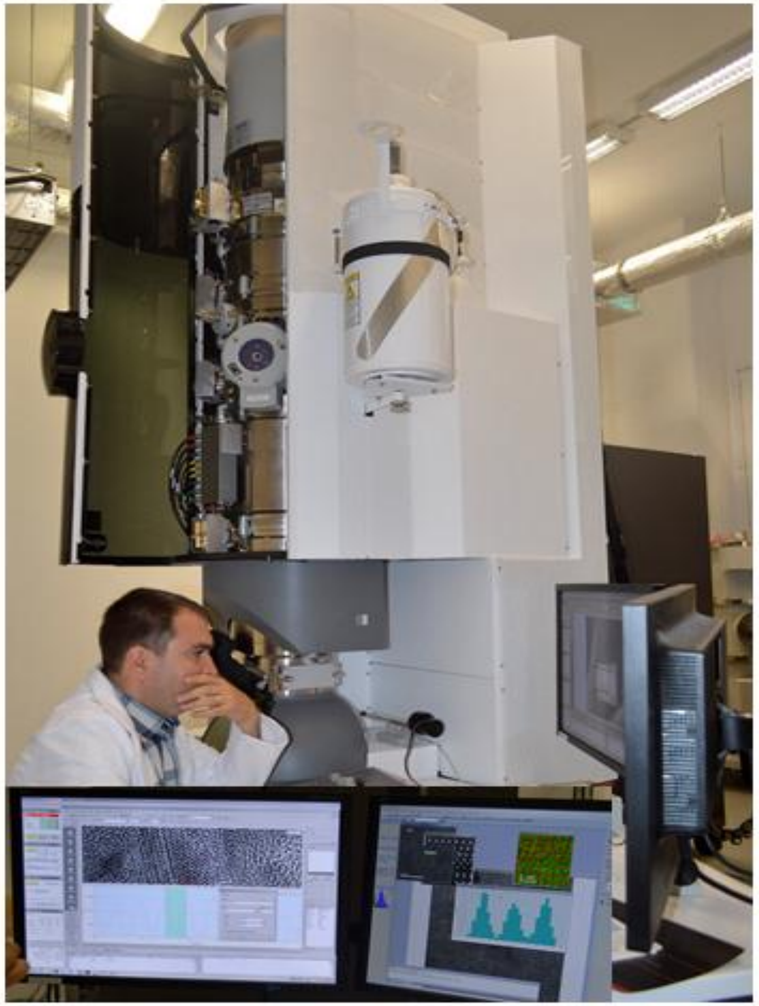
- finalized December 2015;
- investment 16M Eur (building) + 17M Eur (equipment);
- 8,500 mp, 200 people.

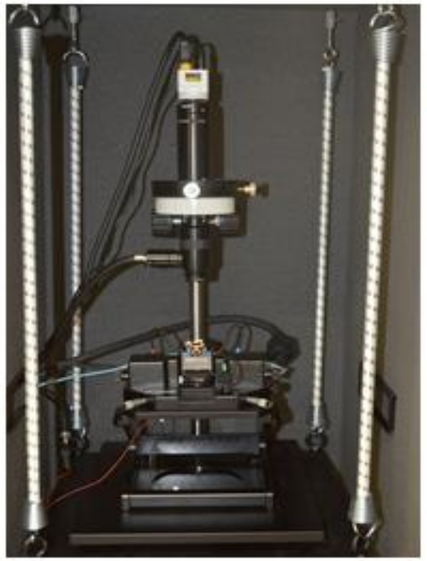

Integrated BMS
Solar panels on the facades
Solar panels on the terrace
Rain water recovery and filtration
Small curtain waterfall for additional air humidification
Geothermal heat pumps

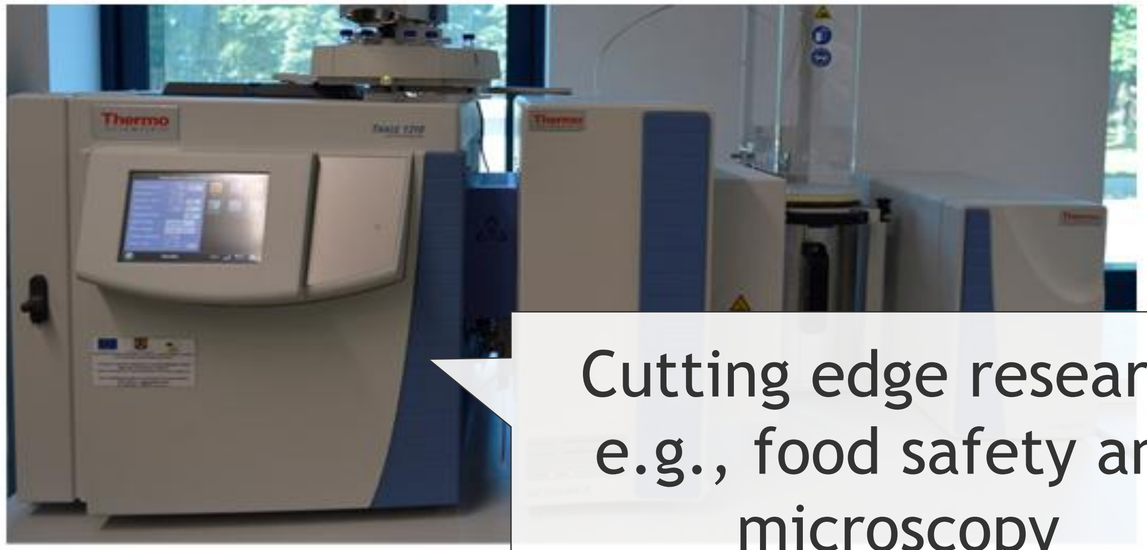




Cutting edge research e.g., biomaterials and nanotechnology



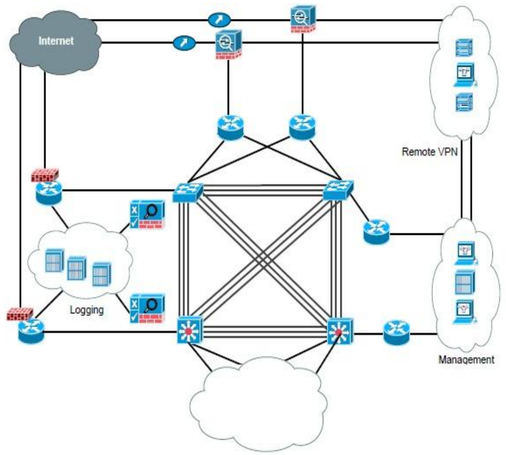




Cutting edge research e.g., food safety and microscopy

Cutting edge research
e.g., artificial intelligence

Data Centers



CISCO CERTIFIED INTERNETWORK EXPERT (CCIE) LABORATORY

NCIT Cluster - EF108

CPU Nodes (Xeon, Opteron, Power)
- 2500 Cores
- 3 TB RAM

GPU Nodes (Nvidia Tesla)
- 3584 Threads
- 40 GB RAM

Storage (IBM, Dell, HP)
- 40 TB

Local Network Interconnect
- Infiniband – 56 Gbps
- Giga/10Giga Ethernet

Cisco 4500

2x10Gbps

PRECIS

CPU Nodes (Xeon): 270 Cores and 2 TB RAM
GPU Nodes (Nvidia Tesla): 25000 Threads and 108 GB RAM
Storage (HP MSA): 120 TB
Local Network Interconnect : Infiniband – 56 Gbps and Giga/10Giga Ethernet

Cisco 6880

2x10Gbps

2x10Gbps

GÉANT

GEANT

2x10Gbps

RoEduNet

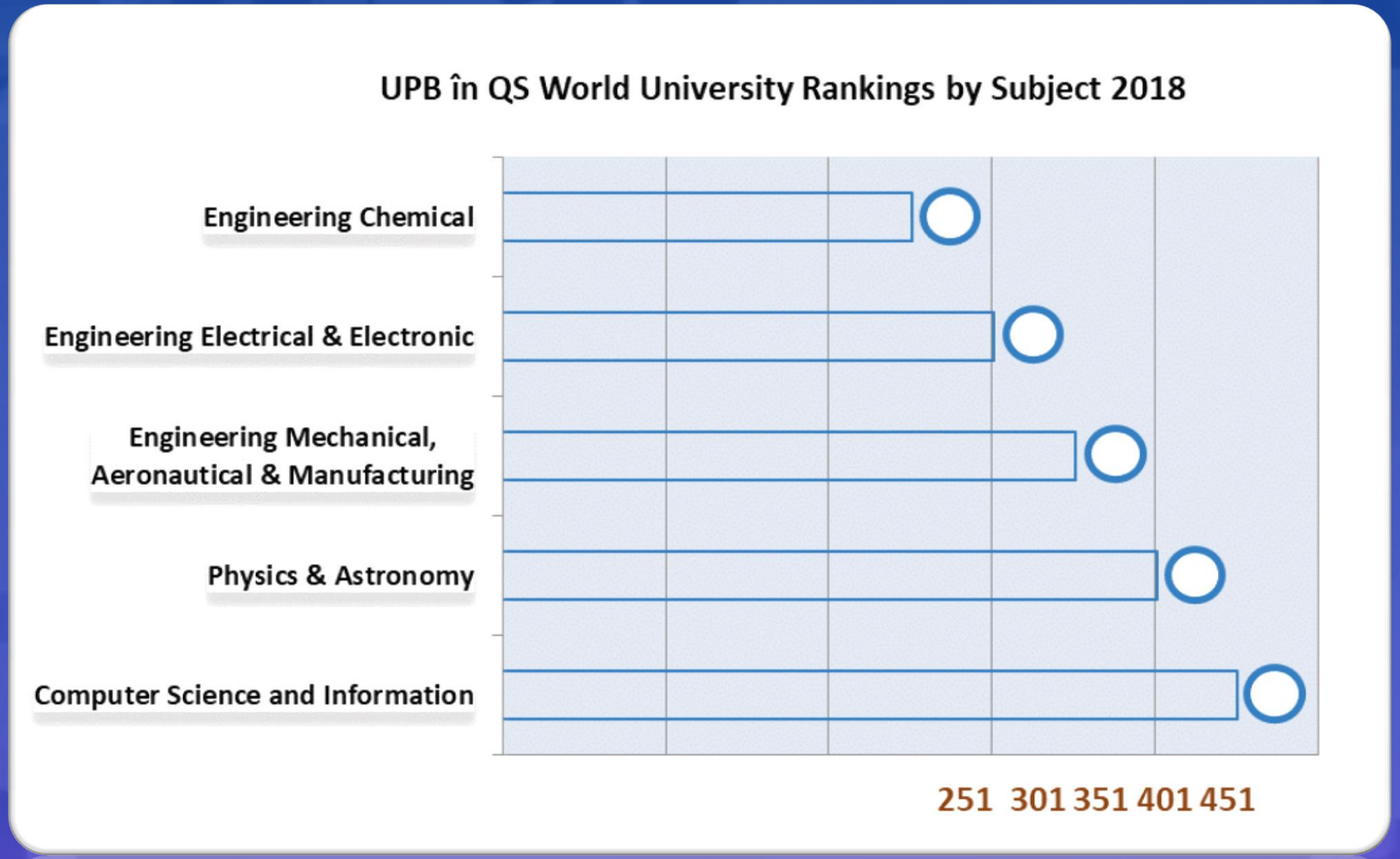
CAMPUS

Lenovo G8264

CPU Nodes (Xeon): 900 Cores and 7 TB RAM
Storage (EMC2): 66 TB
Local Network Interconnect : Infiniband – 56 Gbps and10Giga Ethernet

Rankings:

Academic Ranking of World Universities – ARWU (Shanghai Ranking)
QS (Quacquarelli Symonds) World University Rankings by Subjects



Grown locally, spread internationally

FREE UNIVERSITY OF AMSTERDAM
UNIVERSITE PIERRE ET MARIE CURIE
DELFT UNIVERSITY, THE NETHERLANDES
UNIVERERSITY OF OULU, FINLAND
TECHNICAL UNIVERSITY OF KONSTANZ, GERMANY
TECHNICAL UNIVERSITY OF DARMSTADT, GERMAN
TECHNICAL UNIVERSITY OF TAMPERE, FINLAND
CITY UNIVERSITY LONDON, UK
UNIVERSITA DI CATANIA, ITALY
INSTITUTO POLITECNICO DI TORINO, ITALY
TECHNICAL UNIVERSITY OF WIEN, AUSTRIA
GRANADA UNIVERSITY, SPAIN
UNIVERSITE DE MONTPELLIER, FRANCE
ECOLE POLYTECHNIQUE DE NANTES, FRANCE
UNIVERSITE DE SCIENCE ET TECHNOLOGIE DE LILLE, FRANCE
UNIVERSITE DE SAVOIE, FRANCE
UNIVERSITE JOSEPH FOURIER, GRENOBLE, FRANCE
L' INSTITUT POLITECHNIQUE DE GRENOBLE, FRANCE
KATHOLIEKE HOGESCHOOL SINT LIEVEN, GENT, BELGIUM
TAMPERE UNIVERSITY OF TECHNOLOGY, FINLAND

collaborating with universities from over **100 countries**

UPB on the World Map – International Associations Membership

- With regards to the international dimensions, our university is part of over 20 larger academic associations:

  European University Association (EUA),

  The Conference of European Schools for Advanced Engineering Education and Research (CESAER),

  L’ Agence Universitaire de la Francophonie (AUF),

  T.I.M.E. Association,

  Magna Charta Observatory (MCO),

  European Distance and E-Learning Network Ltd. (EDEN) etc.

UPB. 11 Double Degree Agreements

- National Institute of Applied Sciences (INSA Group)
- National School of Arts and Crafts (ENSAM)
- Catholic School of Arts and Crafts of Lyon (ECAM)
- University of Corsica Pascal Paoli
- University of Montpellier
- Technical University of Moldova
- University of Burgundy
- Telecom SudParis
- Central Supélec
- University of Porto
- University of Lorraine

In the last five years,
65
UPB students are graduates of partner universities.

Măgurele Science Park Association

- UPB is one of the main partners of the project ELI-NP is going to be the most advanced research facility in the world focusing on the study of photonuclear physics and its applications, comprising a very high intensity laser of two 10PW ultra-short pulse lasers and the most brilliant tunable gamma-ray beam.
- The **Măgurele Science Park** is aiming at attaining the regional development role of the facility, while economically valorizing the scientific research results on the entire Măgurele platform.

Platforma CANTI – Echipamente de realitate virtuală

COMPUTER SCIENCE AND ENGINEERING

Education in Computer Science and Engineering

- **Bachelor (4 years)**
  - C1. Computer Systems Architecture
  - C2. Embedded systems
  - C3. System Software
  - C4. Application Software Systems and Artificial Intelligence
  - C5. Information Technology
- **Master (2 years- research program)**

Nr. crt.	Master Program	Coordinator
1.	Advanced Computer Architecture	Prof.Dr.Ing. Nicolae Tapus
2.	Parallel and Distributed Systems – English track	Prof.Dr.Ing. Valentin Cristea
3.	Artificial Intelligence – English track	Prof.Dr.Ing. Adina Florea
4.	Advanced Software Services	Prof.Dr.Ing. Valentin Cristea
5.	Internet Systems Engineering	Prof.Dr.Ing. Stefan Trausan-Matu
6.	System graphics, Multimedia and Virtual Reality	Prof.Dr.Ing. Florica Moldoveanu
7.	Security of Complex Information Networks	Prof.Dr.Ing. Nicolae Tapus
8.	Management in Information Technology	Prof.Dr.Ing. Florica Moldoveanu
9.	Data base Administration	Prof.Dr.Ing. Florin Radulescu
10.	E-Government	Prof.Dr.Ing. Mariana Mocanu
11.	Advance Cyber Security	Prof.Dr.Ing. Nicolae Tapus
12.	Financial Engineering	Conf. Andrei Olaru

- **Ph.D. studies (3-4 years) Computer Science and Engineering**

Curricula, Computer Science and Engineering Bachelor

Background in Engineering
General courses
(3 semesters)

Mathematics
Physics
Mechanics
Electrical engineering
Electronic Devices
Digital Circuits

Introduction to CS
Computer Programming
Data Structures
Algorithms Analysis
Data Processing
Assembly Languages
OO Programming
Numerical Methods
System Theory
Operating System Usage

Background in Computer field
Core courses
(3 semesters)

Programming Paradigms
Digital Computers
Communications Protocols
Formal Languages and Automata
Parallel and Distributed Algorithms
Algorithm Design
Local Area Networks
Computer Engineering
Software Engineering
Computer Graphics
Microprocessor Based System Design
Computer Systems Architecture
Databases Systems
Operating Systems

Specialization (2 semesters)

Diploma project

Parallel Computer Architectures
Multiprocessor Based Systems
Computer Network Design
VLSI Design
Distributed Services Design

Computer Systems Architecture

Microprocessors Systems
Signal Processing
Embedded Systems
Digital Systems Testing
Fault Tolerant Systems

Embedded Systems

Operating Systems Design
Databases Design
Compiler Design
Software Systems for Computer Networks
Artificial Intelligence
Tools for programs development

System Software

Graphic Processing Systems
Artificial Intelligence
Human Computer Interface
Automatic Learning
CAD/CASE Systems
Integrated Application

Application Software Systems and Artificial Intelligence

Data Base Operation
WEB Programming
E-Commerce
Performance Evaluation
Software Project Management
Informatic Systems Integration

Information Technology

University Partners / Company Partners

FREE UNIVERSITY OF AMSTERDAM
UNIVERSITE PIERRE ET MARIE CURIE
DELFT UNIVERSITY, THE NETHERLANDES
UNIVERERSITY OF OULU, FINLAND
TECHNICAL UNIVERSITY OF KONSTANZ, GERMANY
TECHNICAL UNIVERSITY OF DARMSTADT, GERMANY
TECHNICAL UNIVERSITY OF TAMPERE, FINLAND
CITY UNIVERSITY LONDON, UK
UNIVERSITA DI CATANIA, ITALY
INSTITUTO POLITECNICO DI TORINO, ITALY
TECHNICAL UNIVERSITY OF WIEN, AUSTRIA
GRANADA UNIVERSITY, SPAIN
UNIVERSITE DE MONTPELLIER, FRANCE
ECOLE POLYTECHNIQUE DE NANTES, FRANCE
UNIVERSITE DE SCIENCE ET TECHNOLOGIE DE LILLE, FRANCE
UNIVERSITE DE SAVOIE, FRANCE
UNIVERSITE JOSEPH FOURIER, GRENOBLE, FRANCE
L' INSTITUT POLITECHNIQUE DE GRENOBLE, FRANCE
KATHOLIEKE HOGESCHOOL SINT LIEVEN, GENT, BELGIUM
TAMPERE UNIVERSITY OF TECHNOLOGY, FINLAND

Laboratories for research and training in partnership with companies:
INTEL,
Microsoft,
IBM,
CISCO,
FreeScale
Oracle,
HP,
UTI,
IXIA

Major research areas:

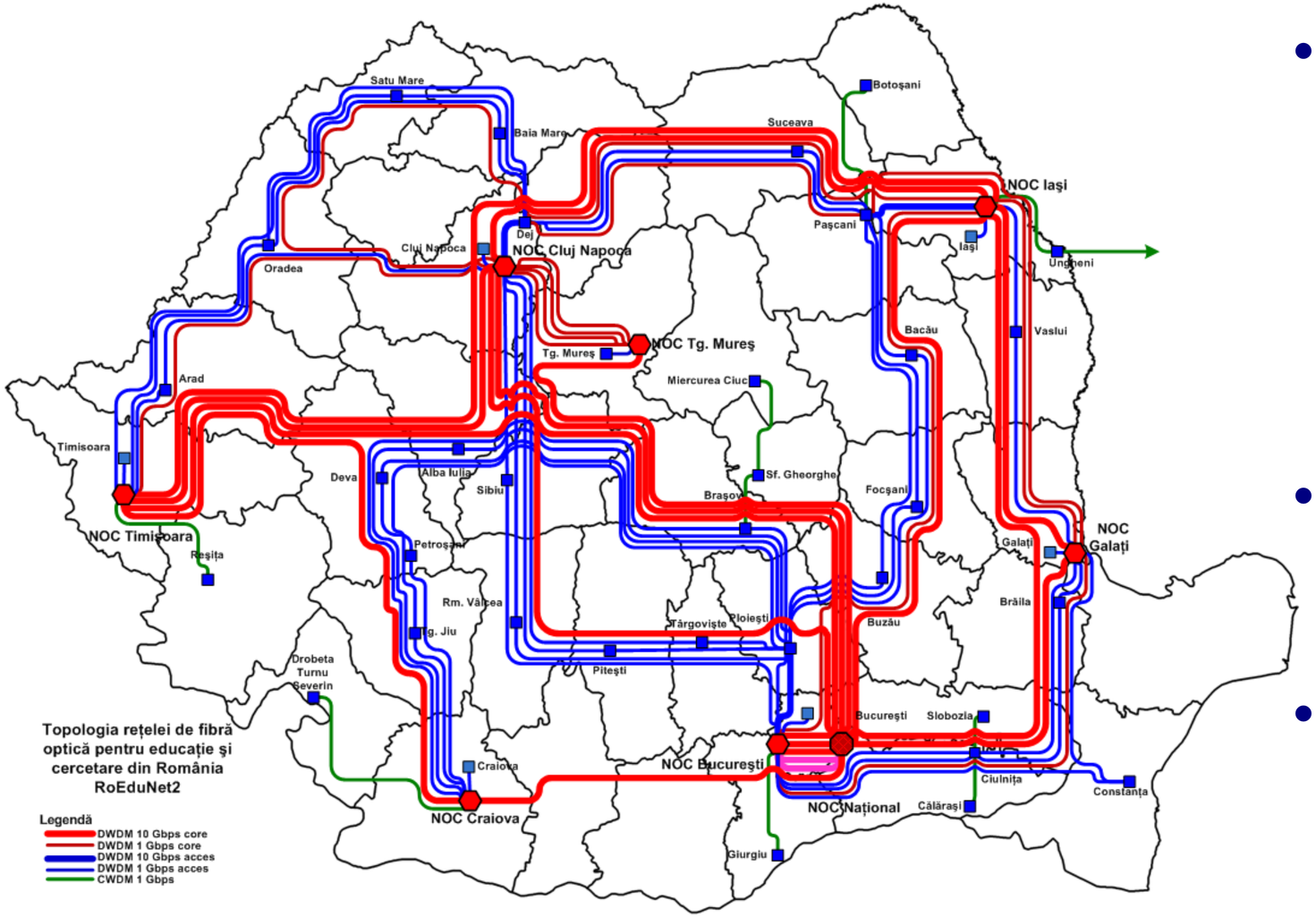
- *Large Scale Distributed Systems; (Cluster, GRID and Cloud Computing)*
- *Artificial Intelligence; Multi-Agent Systems;*
- *Semantic Web technologies; Service Science;*
- *Embedded Systems & Wireless Sensor Networks*
- *Computer Networks and Mobile Systems*
- *Distributed Databases;*
- *E-Learning.*

NCIT

Distributed Systems and Grid Laboratory Cluster

- *Projects in collaboration with California Institute of Technology and the European Organization for Nuclear Research (CERN) (MonAlisa – UPB, CERN, Caltech)*
- *Modelling, simulation, monitoring and evaluation large scale distributed systems Development of scalable, fault tolerant, high performance platforms for information gathering and visualisation of processing tasks*
- *Resource management, activity scheduling and optimization techniques*
- *Prototyping, monitoring and evaluating heterogeneous wireless sensor and actuator networks*
- *Partner in FP6 projects: EGEE and SeeGRID,*
- *FP7 projects: P2P-next, SENSEI, Cooper, LTfLL, HP-SEE, Erric, TwisNET, EuWB, LEXNET, etc*
- *Internationally recognized results: CENIC awards in 2006 and 2008 for the MonAlisa project*

ROEDUNET NATIONAL COMMUNICATION INFRASTRUCTURE



- *The RoEduNet network provides connectivity to*
  - *universities*
  - *high-level education institutes*
  - *research institutes*
  - *high schools*
  - *elementary schools*
  - *not-for-profit governmental institutions*
- *Its backbone operates at 10 /100 Gbps and connects 7 NOC situated in the cities with large universities.*
- *The link to GÉANT is 10 Gbps.*

(Partial 100Gbps)

- *Real-time monitoring is an essential part of managing distributed systems. The MonALISA system is designed as an ensemble of autonomous multi-threaded, self-describing agent-based subsystems which are registered as dynamic services, and are able to collaborate and cooperate in performing a wide range of monitoring tasks and to analyze and process this information in a distributed way to provide optimization decisions in large scale distributed applications.*

- *Monitoring all aspects of complex systems :*
  - *System information for computer nodes and clusters*
  - *Network information : WAN and LAN*
  - *Monitoring the performance of Applications or services*
  - *The End User Systems*

Iosif Legrand California Institute of Technology & UPB
research team

Cluster Services

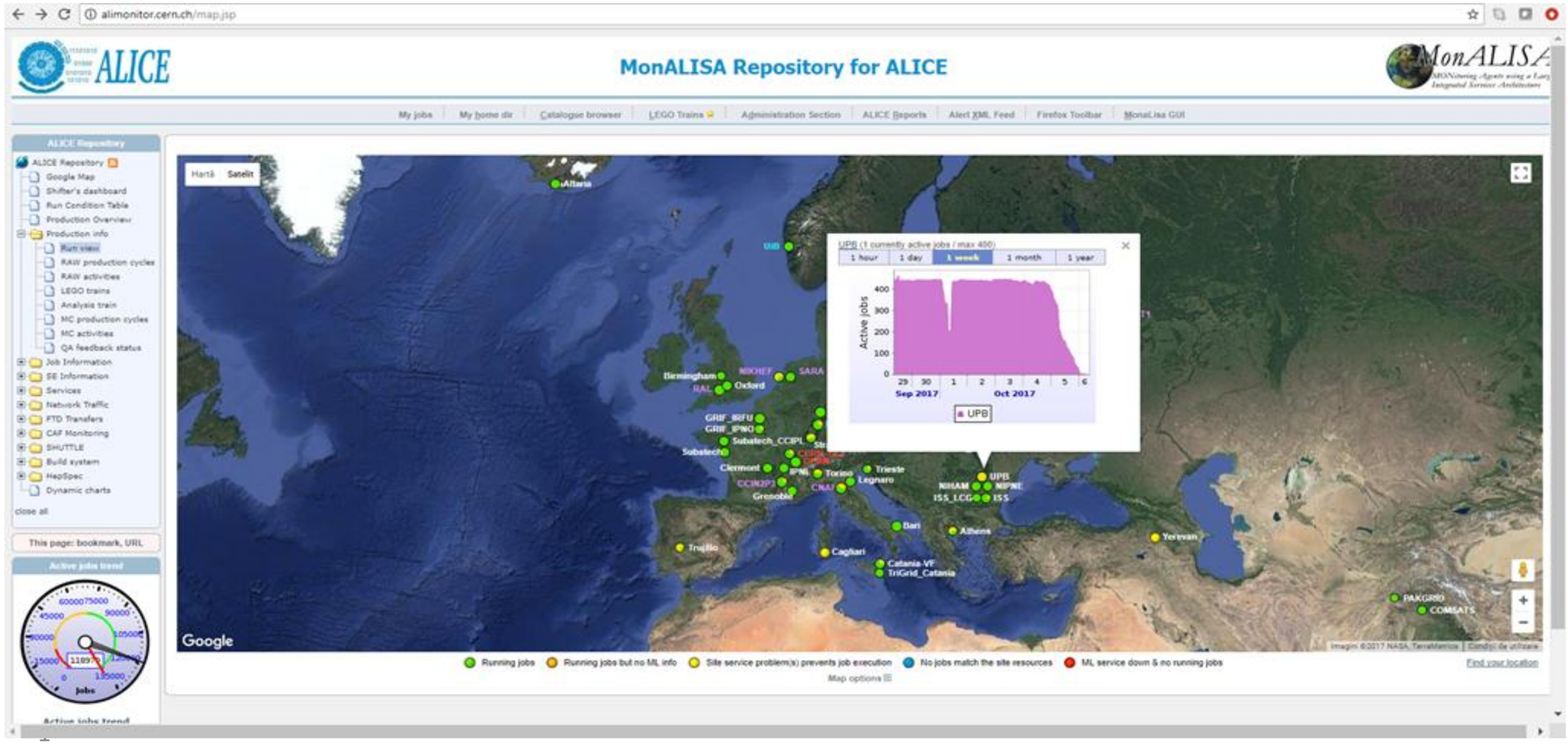
- *High Performance Computing Services*
- *European Grid Infrastructure (EGI) - RO-03-UPB*
- *Cloud Services*
- *E-learning platforms*
- *Cisco Certified Internetwork Expert (CCIE) laboratory*
- *Performant and High Available Directory Services*
- *E-mail services*
- *High Available and Performant hosting environment*

HPC Services

- *High Performance Computing for users*
- *More than 3500 CPU cores and 12 TB RAM dedicated*
- *More than 30000 GPU cores*
- *Hybrid architectures (Intel Xeon, AMD Opteron, Power7, CellBE, GPU)*
- *220 TB distributed storage (GluInfiniband interconnect)*
- *Modern batch system (Open Grid Scheduler) for scheduling management*
- *Access through fep.grid.pub.ro*

EGI – RO-03-UPB

- *Part of the European Grid Infrastructure (EGI)*
- *Certified site RO-03-UPB*
- *RA administrator for UPB:http://www.romaniangrid.ro/ra.htm*
- *Runs jobs for CERN Alice experiment*



Cloud Services

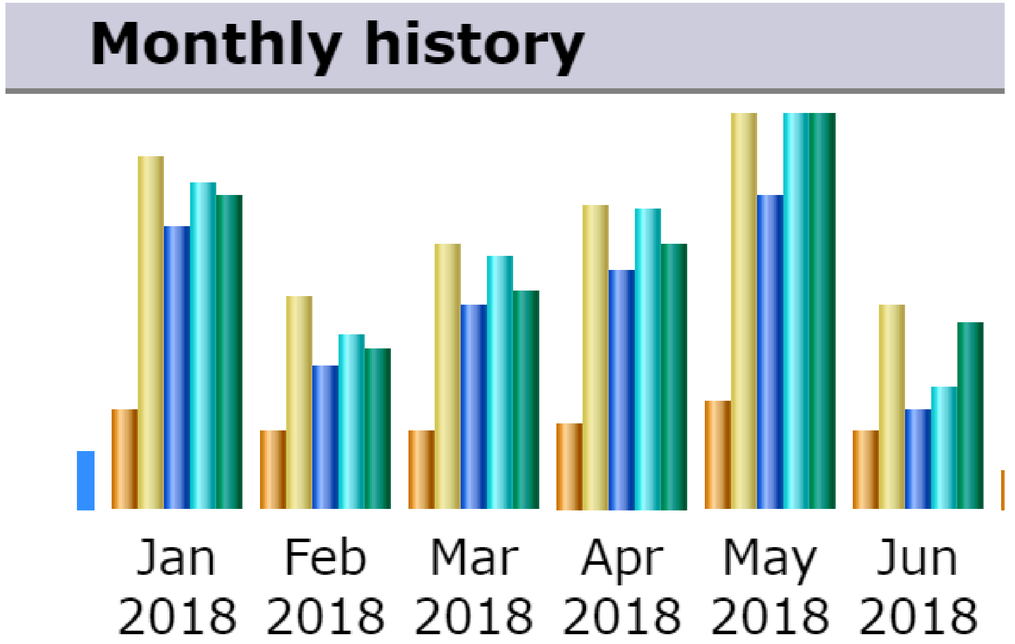
- *Private cloud for UPB students based on OpenStack deployment (http://cloud.curs.pub.ro)*
- *More than 800GB RAM available for virtual machines*
- *More than 15 OS templates (Linux and Windows)*
- *One can create virtual topologies to simulate different environments*

Identity Management

- *Performant and High Available Directory Services*
- *Automatic account creation through integration with http://studenti.pub.ro and Emsys platforms.*
- *More than 70.000 users with a unique account for any service provided*
- *Synchronized 389DS (LDAP) and Active Directory*
- *Cloud synchronized accounts for access to Microsoft Office and e-mail subscriptions*

E-learning platforms

- *E-learning platforms based on Moodle Framework (www.curs.pub.ro)*
- *Each faculty has its own dedicated platforms (*.curs.pub.ro)*
- *We ensure versioning of the platforms each year*
- *Automatic account creation for students and teachers*
- *Scalable course structure creation and enrolment*



Month	Unique visitors	Number of visits	Pages	Hits	Bandwidth
Jan 2018	37,119	131,741	7,447,701	8,593,848	509.13 GB
Feb 2018	28,113	80,111	3,786,554	4,599,753	263.63 GB
Mar 2018	29,402	99,167	5,357,089	6,715,664	352.45 GB
Apr 2018	32,782	114,346	6,343,210	7,898,895	428.95 GB
May 2018	39,630	147,582	8,339,202	10,442,227	643.03 GB

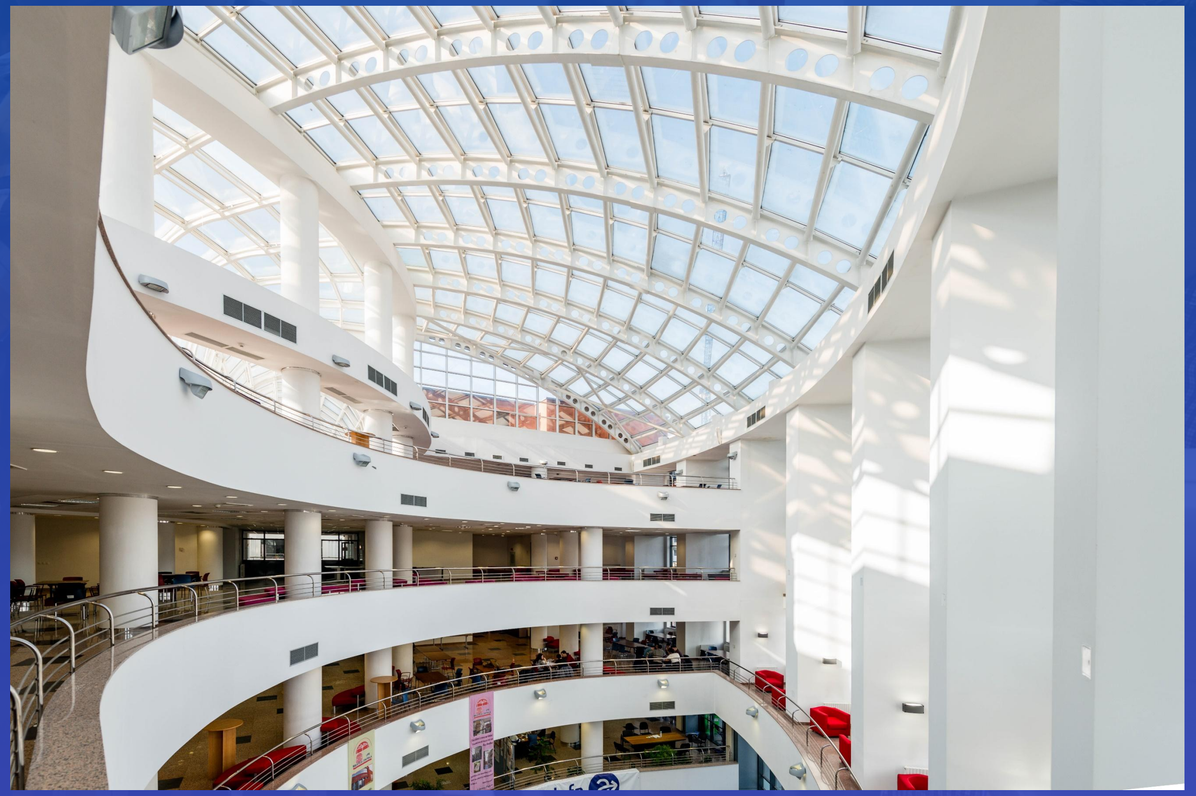
The UPB Hub

Aula Magna Conference Center
1300 places

The UPB Hub

Central library
event halls

The UPB Hub



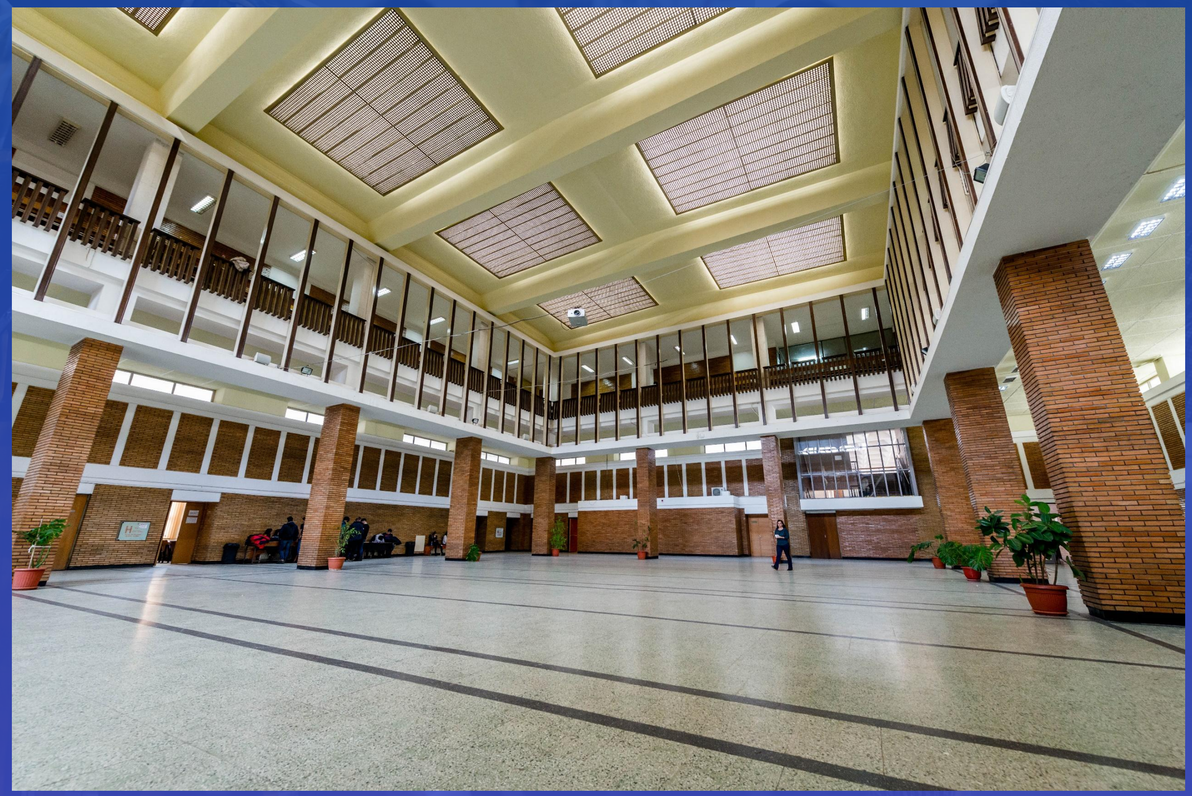
Central library halls

The UPB Hub

Central library halls

The UPB Hub

Amphitheater



Events halls

The UPB Hub

The central Rectorate Building

The UPB hub

Hotel


Thank you!