KREN
KOSOVO RESEARCH AND EDUCATION NETWORK

Development of the NREN in Kosovo

Kosovo Research and Education Network (KREN)

02 December 2021

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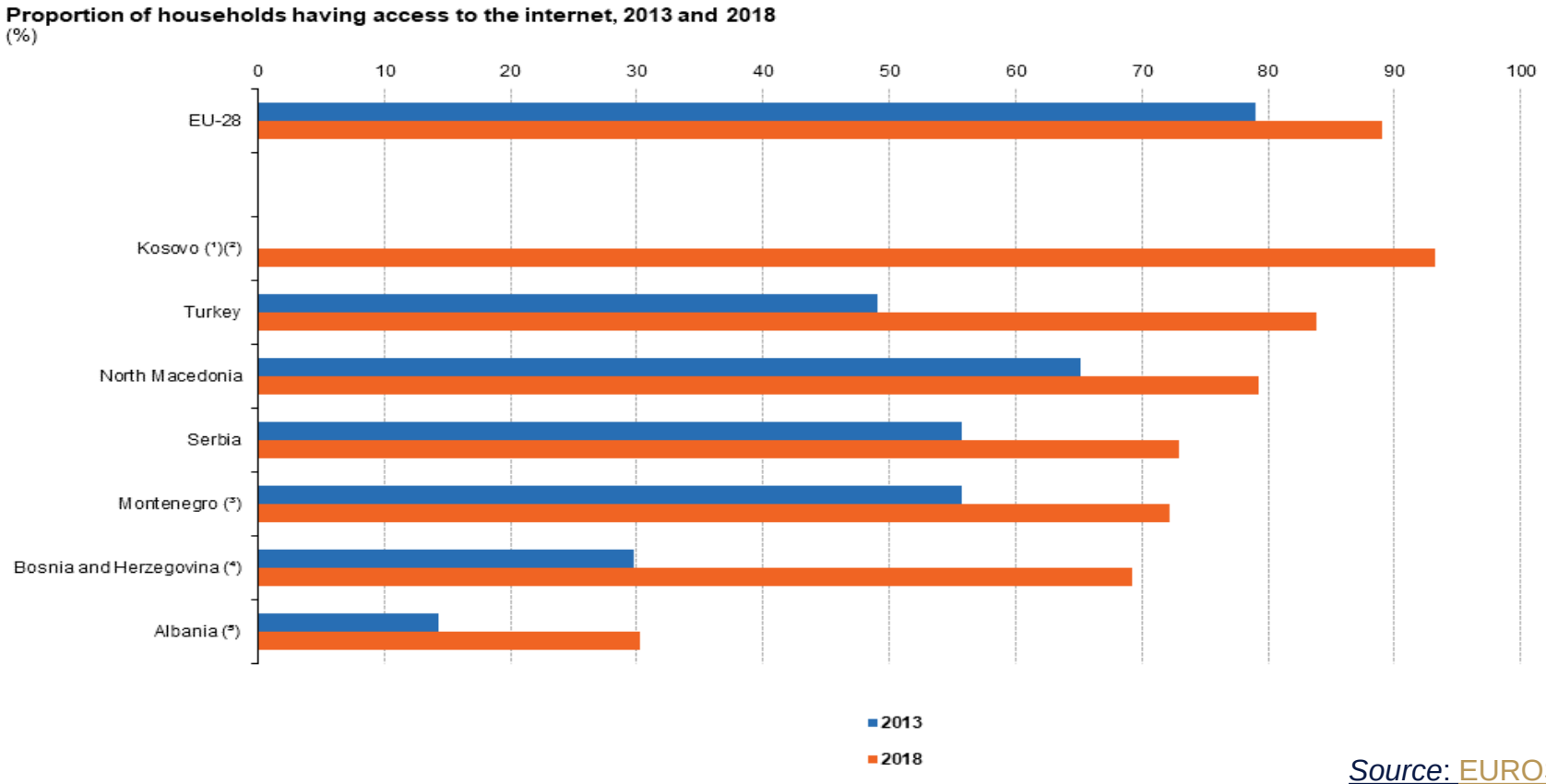
PRESENTATION OUTLINE

- Current situation – Internet Penetration in Kosovo
- KREN within KODE Project
- KREN infrastructure - implementation and challenges
- KREN Services – Azure and GÉANT
- Legal status
- Future Plans

INTERNET PENETRATION IN KOSOVO



Source: EUROSTAT

- Broadband penetration has reached 129% of households or 21.4% per inhabitant.
- Number of ISPs active in the market – about **70,** majority of the retail market is controlled by **4 ISPs**
- With the implementation of new technologies: 3G, 4G, LTE etc is enabled “mobile broadband”.

This is reached through KODE Project !

KOSOVO DIGITAL ECONOMY (KODE) PROJECT

The KODE Project (**€20.7 million**) is financed by the World Bank and implemented by Kosovo's Ministry of Economic Development throughout 2019-2023.

Main sub-components:

- Financing **Digital Connectivity** (Rural Broadband Co-matching Grant Scheme)
- National **Spectrum Monitoring** (NSMS) System
- **Youth Online and Upward** (YOU) Program
- **National Research & Education Network** (NREN)

Set up a National Research and Education Network (NREN) to improve access of students, researches and educators of Higher Educational Institutions (HEIs) in Kosovo to knowledge and research networks

KREN - Objectives

- KREN will serve the **Research And Education Community** in Kosovo, providing:
- Required **INFRASTRUCTURE** (hardware, software, connectivity)
- Constantly innovate and provide cost-effective and reliable **SERVICES**
- Manage **KREN R&E community** in communication with GÉAN

(NREN), is an asset for economic growth and prosperity.

KREN Location

FINISHED ACTIVITIES

- **Staff and logistic**
  5 KODE PIU, 2 external consultants and support from Ministry ICT Department.

- **Leasing capacity connection all HEI campuses**
  20 HEIs (32 campuses), up to 500 Mbps per link

- **Leasing capacity connection to PoP GÉANT -** 1Gbps

- **KREN Data Center infrastructure** - Azure Stack on Premise

- **Associate member of the GÉANT** - since November 2020

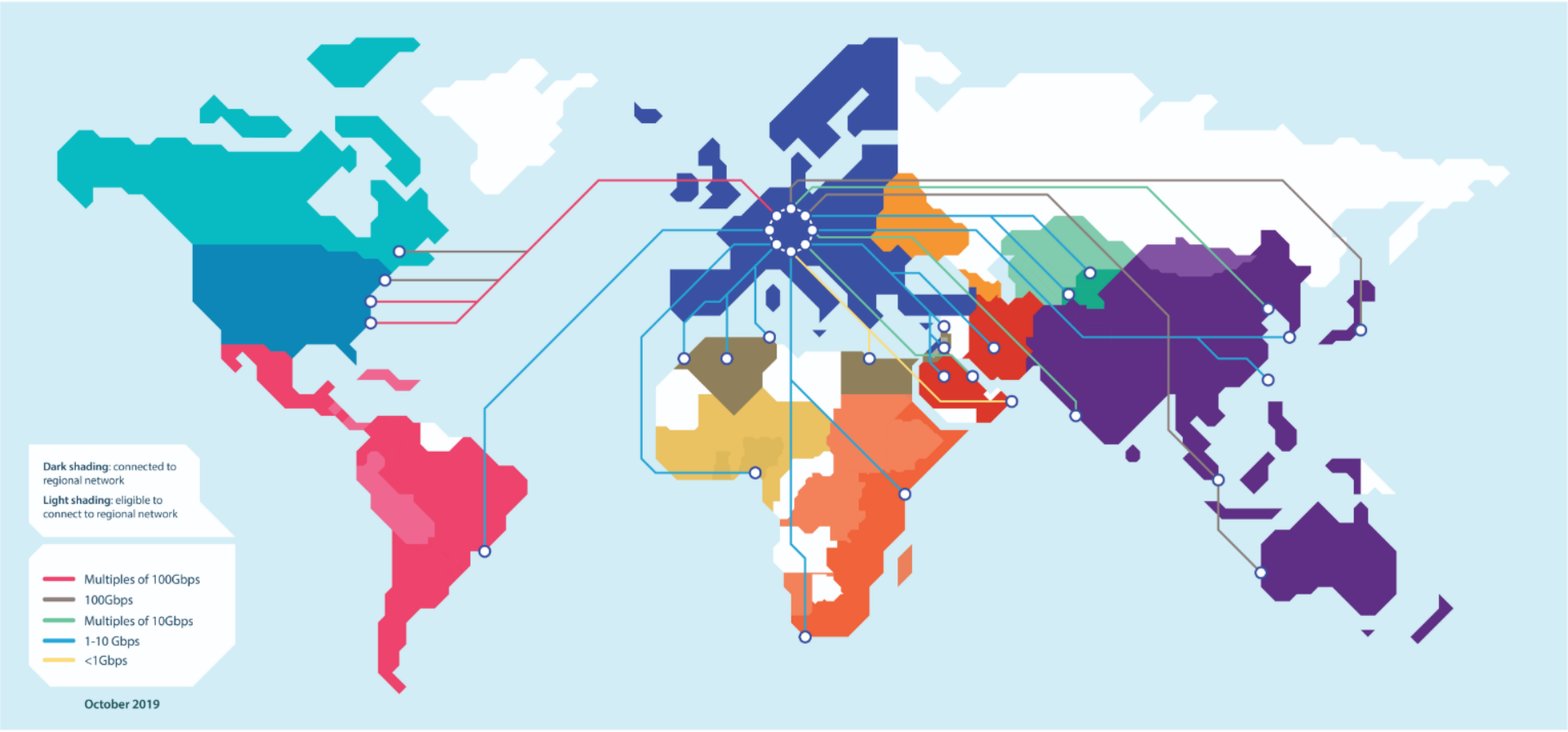
- **Member of the RIPE organization** – June 2021

KREN ACTIVITIES - Memorandum of Understanding

Memorandum of Understanding	
Nr	HEI name
1	UP Prishtina "Hasan Prishtina"
2	University of Mitrovica "Isa Boletini"
3	University of Peja "Haxhi Zeka"
4	University of Prizren "Ukshin Hoti"
5	University of Gjakova "Fehmi Agani"
6	University of Gjilan "Kadri Zeka"
7	University of Applied Sciences Ferizaj
8	Faculty of Islamic Studies
9	Kosovo Academy for Public Safety
10	AUK College
11	Dardania College
12	ESLG College
13	International Business College Mitrovica (IBCM)
14	Rezonanca College
15	Riinvest College
16	UBT College

///	
Nr	HEI name
1	Kolegji AAB
2	Akademia Evolucion
3	Kolegji Heimerer
4	Kolegji Universum

KREN IS MEMBER OF GÉANT GLOBAL NETWORK



Canada & USA

canarie

ESnet

INTERNET2

Latin America

RedCLARA

Europe

GÉANT

EaPConnect

North Africa & Eastern Mediterranean

ASREN

West & Central Africa

Eastern & Southern Africa

UbuntuNet Alliance

Central Asia

CAREN

Asia-Pacific

TEIN

Other R&E Networks

GÉANT Networks • Services • People

This map is produced as part of the GÉANT Specific Grant Agreement GN4-3 (No. 856726), that has received funding from the European Union's 2020 research and innovation programme under the GÉANT2020 Framework Partnership Agreement (No. 653998). The content of this document is the sole responsibility of GÉANT and can under no circumstances be regarded as reflecting the position of the European Union.

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KREN infrastructure – DATA CENTER

Fiber connection (leasing capacity) with GÉANT 1Gbps

750 TB Data Storage

8 TB RAM

730 Core Processors

Fiber connection (leasing capacity) with all HEI campuses – 100 to 500 Mbps

Campuses of HEIs

Access Point and other equipment

KREN Infrastructure

Azure Stack – On Premise

- Applications
- Data
- Runtime environment
- Middleware
- O/S
- Virtualization
- Servers
- Storage
- Networking

KREN infrastructure – Campus

1. Access Router

Cisco ISR 4431 Sec bundle w/SEC license PN: ISR4431-SEC/K9 – 45 pcs

Form Factor

- *Rack mounted*

Specifications

- *2 GB Data Plane Memory*
- *4 GB Control Plane Memory*
- *8 GB Flash*
- *Redundant hardware components and AC power supplies*
- *500 Mbps Aggregate throughput*
- *4 integrated 10/100/1000 ethernet RJ-45 ports*
- *4 integrated gigabit ethernet SFP ports*
- *3 x NIM slots*
- *2 x External USB 2.0 slots (type A)*
- *1xUSB console port -type B mini*
- *1xSerial console port - RJ45*
- *1x Serial auxiliary port - RJ45*
- *Equipped with 2 x 1000BASE-SX SFP*

PN GLC-SX-MMD=*Cisco 1000BASE-SX SFP transceiver module, MMF, 850nm, DOM...QTY: 2 PCs*

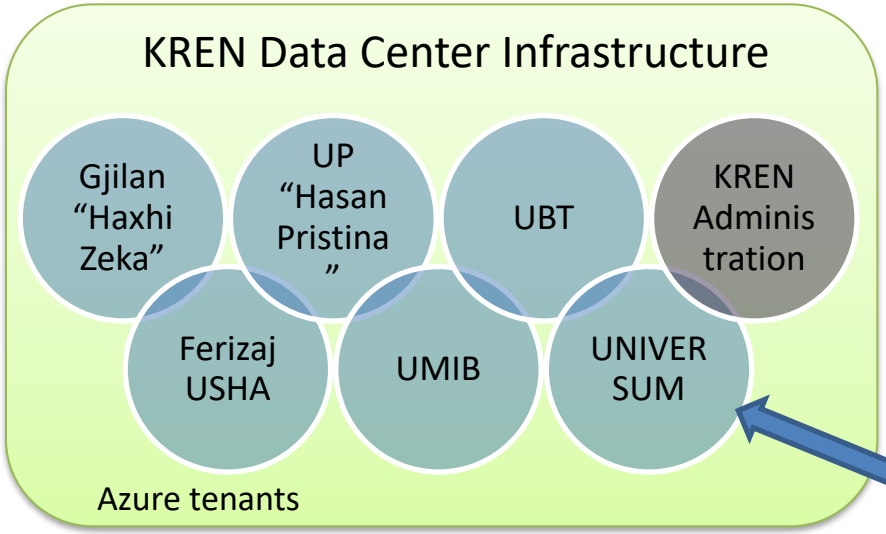
Features:

- *SD-WAN compatible*

3. Dedicated connection between HEIs and KREN Data Center (100+Mbps)

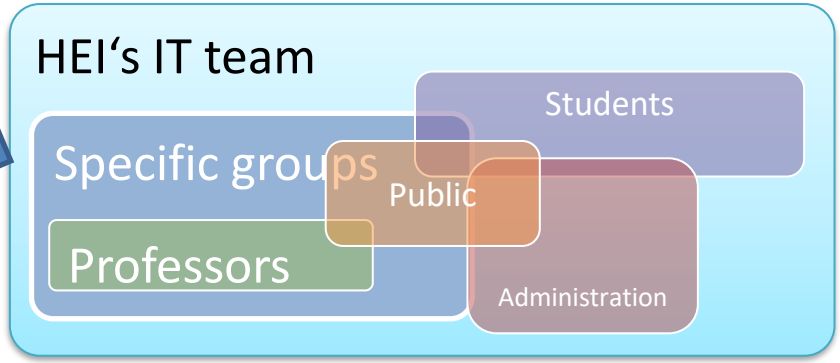
KREN LOGICAL infrastructure – DATA CENTER

KREN users logical structure



User groups:

- KREN staff
- HEIs' users - tenants
  - IT staff
  - Specific groups
  - Professors
  - Administration
  - Students



A tenant's logic of management users and access to resources

KREN Services – main categories

- **Azure Network Services** (with Data Center)

  IP address allocation, DNS hosting, access routers management, security, traffic monitoring…

- **FEDERATION** (**Azure Active Directory vs Local Active Directory**)

  The process of establishing identity management systems and sharing resources

- **Collaboration services (MS Teams as primary app)**

  Voice, video conferencing, multimedia and file sharing, event recording, cloud services, storage facilities, virtual machines, database services..

- **Connection to GÉANT**

  EduROAM, eduGAIN, FileSender, eduMEET, ..

- **Support Services**

  Security, trainings,

- **Hosting support services**

  Web hosting, database, LMS platforms…

AZURE SERVICES

- AI + machine learning
- Analytics
- Compute
- Containers
- Databases
- Developer tools
- DevOps
- Hybrid + multicloud
- Identity
- Integration
- Internet of Things
- Management and governance
- Media
- Migration
- Mixed reality
- Mobile
- Networking
- Security
- Storage
- Virtual desktop infrastructure
- Web

GEANT SERVICES

GÉANT Services

NETWORKS | SERVICES | PEOPLE | INNOVATION | PROJECTS

Connectivity & network management

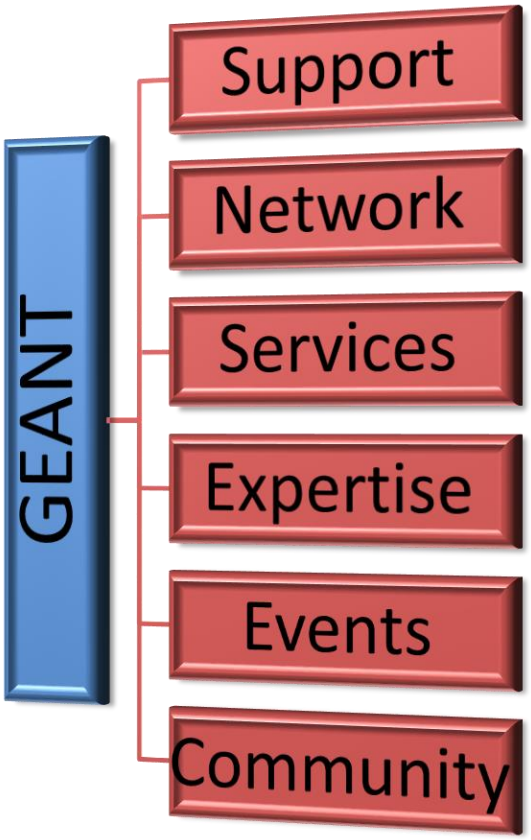
- GÉANT IP
- GÉANT point-to-point
- GÉANT Open
- GÉANT VPN Services
- GÉANT Testbeds Service
- eduroam
- perfSONAR
- Network Management as a Service
- Performance Management Platform
- WiFiMon

Trust, identity & security

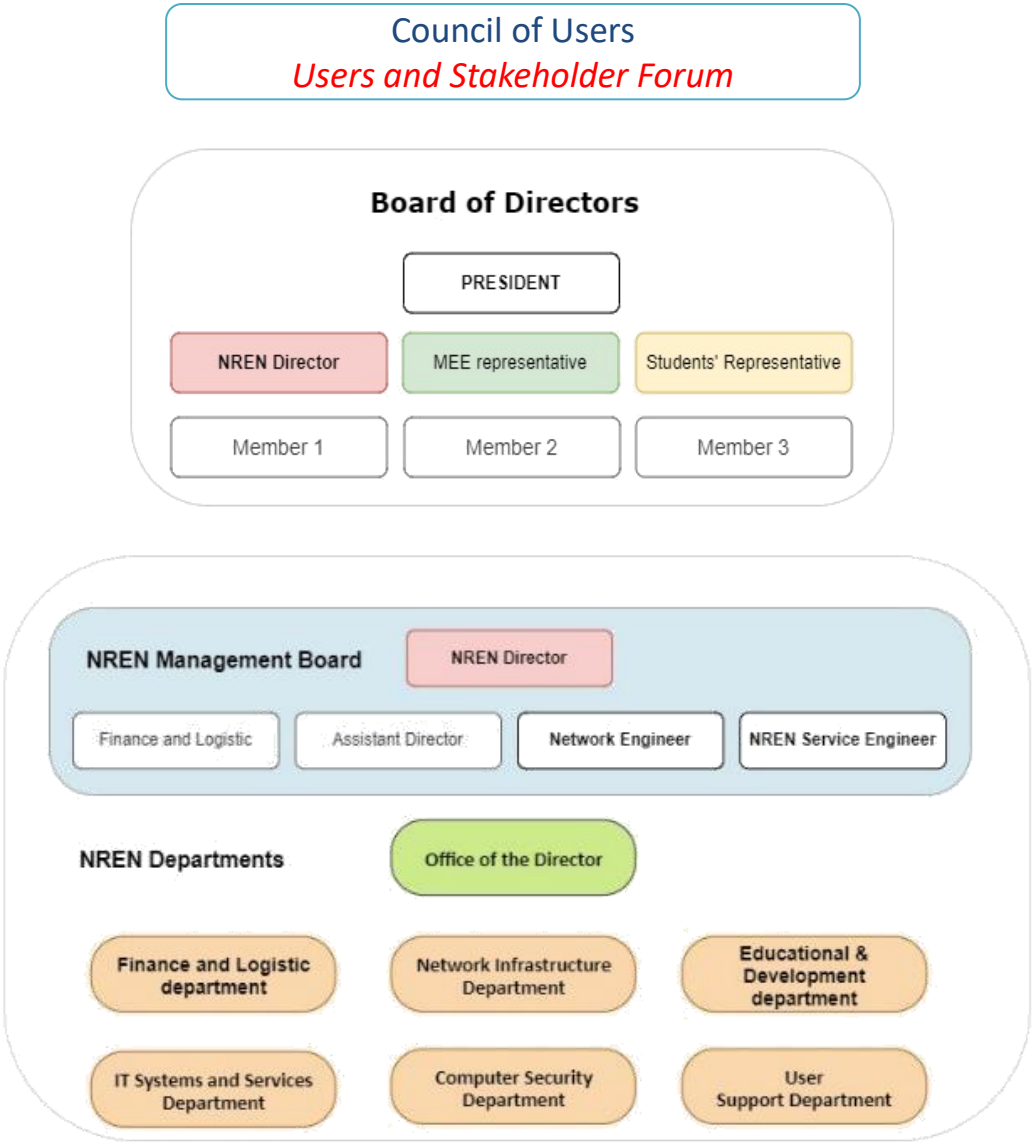
- eduroam
- eduGAIN
- eduTEAMS
- InAcademia
- eduVPN
- Trusted Certificate Service (TCS)
- TRANSITS
- Trusted Introducer Service
- DDoS - Cleansing and Alerting

Storage & clouds

- Cloud Services
- FileSender
- OpenCloudMesh



ORGANIZATIONAL model – DRAFT PLAN



KREN Legal status

Options:

- Within Ministry of Economy (Department)
- Independent Government Agency
- A non-governmental association of Research and Education Community

KREN Challenges

- KREN FEDERATION
  HEIs connection and EduGain
- Integration HEIs within KREN infrastructure
  different platforms, domains, …

KREN OPPORTUNITIES

- Strong support from Government for IT
- Strong support from WB through KODE
- Location within ITP Park Prizren
  - Digital Excellence Center
  - ITP Park for Inovative IT companies
- Azure Stack on Premise infrastructure cutting edge cloud technology

R&D National Database

KRIS- ***Kosovo Research Information System- a management information system*** that will serve as a national repository for offering information regarding:

- Researchers,
- National and international funded projects,
- Licensed research institutions and its research infrastructure.

KRIS as a regulatory mechanism in providing more standardized information in research.

KRIS will serve as a research ecosystem for gathering data systematically on research indicators that will generate research data outputs for all researchers, student, policy makers and other stakeholders

Future PLAN

CONTINUATION of:

- **Development Azure Services**
  for KREN and for HEIs
- **Connection with GÉANT services**
  for KREN and for HEIs
- Connection with primary and secondary schools
- Supplying of KREN with some of the equipment needed to create conditions, space and place for **the private sector and academia** to have opportunities for research and initial test phase product/service development.

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THANK YOU!

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Ministry of Economy