

**National Initiatives for Open Science in Europe –**  
*On-boarded services and activities in*  
*Montenegro*

**National End-Users NI4OS-Europe Training in**  
**Montenegro**

*Enis Kočan*

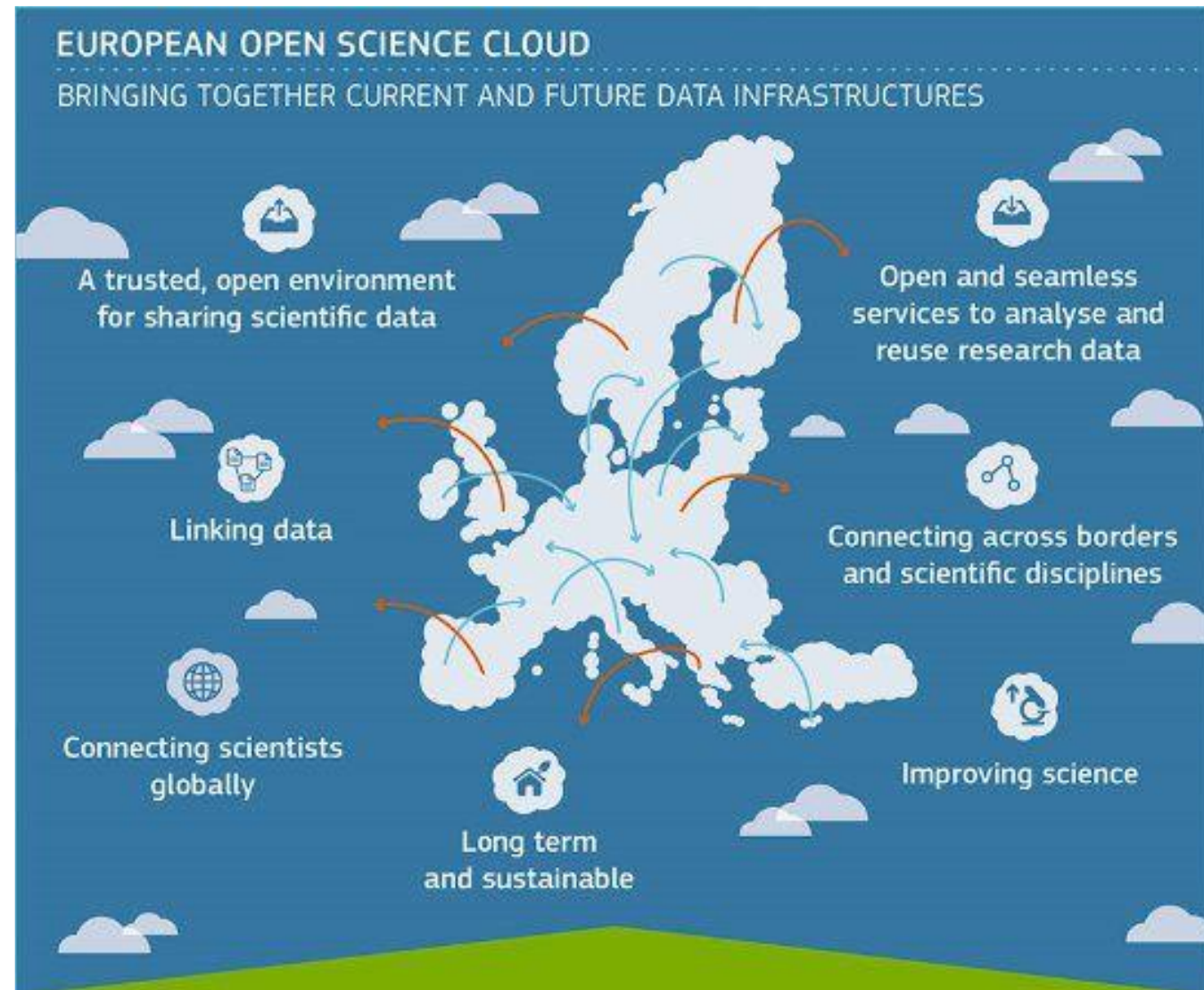
Faculty of Electrical Engineering  
University of Montenegro



- *NI4OS-Europe in brief*
- *NI4OS-Europe on-boarded services*
- *Activities and main NI4OS-Europe results in Montenegro*

- The role of the EOSC is to ensure that European scientists reap the full benefits of data-driven science, by offering:
- “1.7 million European researchers and 70 million professionals in science and technology a virtual environment with free at the point of use, open and seamless services for storage, management, analysis and re-use of research data, across borders and scientific disciplines”

2016 Communication on the “European Cloud Initiative”



# NI4OS-Europe

□ **15** EU Member States and Associated Countries | **22** Partners



Participating countries

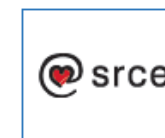
Greece	Hungary	Albania	Republic of Moldova
Cyprus	Romania	Bosnia-Herzegovina	Armenia
Bulgaria	Slovenia	North Macedonia	Georgia
Croatia	Serbia	Montenegro	



- GA no. 857645 (<https://ni4os.eu/>)
- Call: H2020-INFRAEOSC-2018-2020 (RIA)
- Project started in September 2019
- Project duration: 36+6 months
- Mission:
- **Support** the development and inclusion of the national Open Science Cloud (OSC) initiatives in 15 Member States and Associated Countries in the overall scheme of EOSC governance
- **Spread** the EOSC and FAIR principles in the community and train the community
- **Provide** technical and policy support in on-boarding of the existing and future service providers into EOSC

# Partnership

1	National Infrastructures for Research and Technology SA	GRNET	Greece
2	Athena Research & Innovation Center	ATHENA	Greece
3	The Cyprus Institute	CYI	Cyprus
4	University of Cyprus	UCY	Cyprus
5	Institute of Information and Communication Technologies	IICT	Bulgaria
6	SRCE - University of Zagreb, University Computing Centre	SRCE	Croatia
7	Ruđer Bošković Institute	RBI	Croatia
8	Governmental Agency for IT Development	KIFU	Hungary
9	University of Debrecen	UD	Hungary
10	National Institute for Research and Development	ICI	Romania
11	Executive Agency for Higher Education, Research, Development and Innovation Funding	UEFISCD I	Romania
12	Academic and Research Network of Slovenia	ARNES	Slovenia
13	University of Maribor Library	UMUKM	Slovenia
14	Institute of Physics Belgrade	IPB	Serbia
15	University of Belgrade	UOB	Serbia
16	Albanian Academic Network - Interinstitutional ICT Research Centre	RASH	Albania
17	University of Banja Luka	UNI BL	Bosnia-Herzegovina
18	Ss. Cyril and Methodius University in Skopje	UKIM	Northern Macedonia
19	University of Montenegro, Faculty of Electrical Engineering	UOM	Montenegro
20	Research and Educational Networking Association of Moldova	RENAM	Republic of Moldova
21	Institute for Informatics and Automation of the Academy of Sciences of Armenia	IIAP	Armenia
22	Georgian Research and Educational Networking Association	GRENA	Georgia



## Faculty of Electrical Engineering:

- Božo Krstajić – team coordinator
- Enis Kočan
- Milutin Radonjić
- Žarko Zečević
- Božidar Škrbić

## Centre of Information System:

- Lidija Milosavljević - EOSC promoter for Montenegro







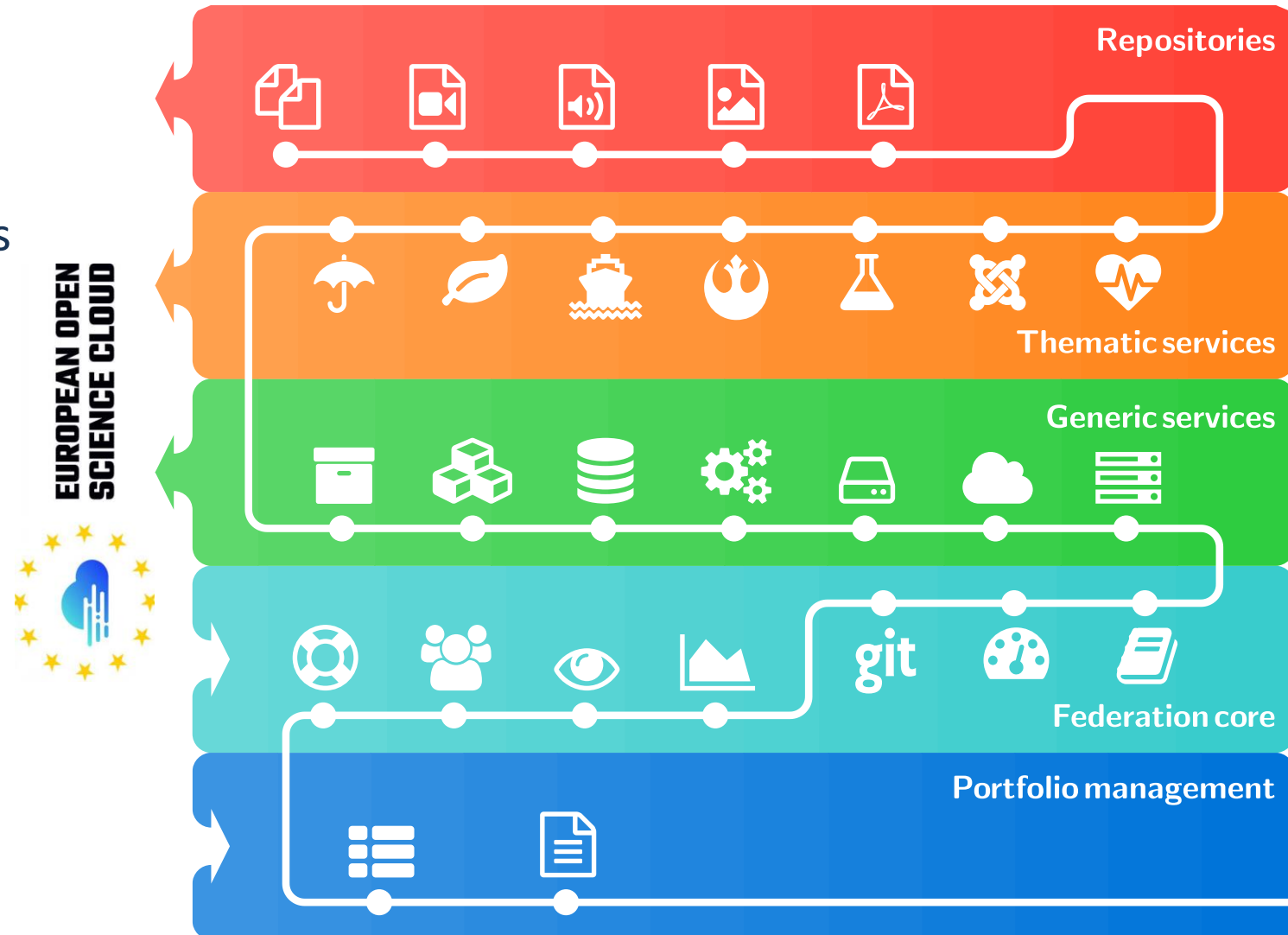
Strengthen the national Open Science ecosystems, enhance regional representation in the pan-EU initiatives, and support alignment of policies and practices for Open Science and FAIR data with the EOSC

- Support the EOSC Governance structure by forming **15 national OSC initiatives** in partner countries
- Support the building of sustainable **pan-European EOSC** governance by engaging the national initiatives
- Provide **support and interface** to other EOSC-relevant bodies
- Reduce **fragmentation** and promote federation on national level
- Prepare the ground for EOSC **on-boarding**

# Service integration and onboarding (WP3, WP5)

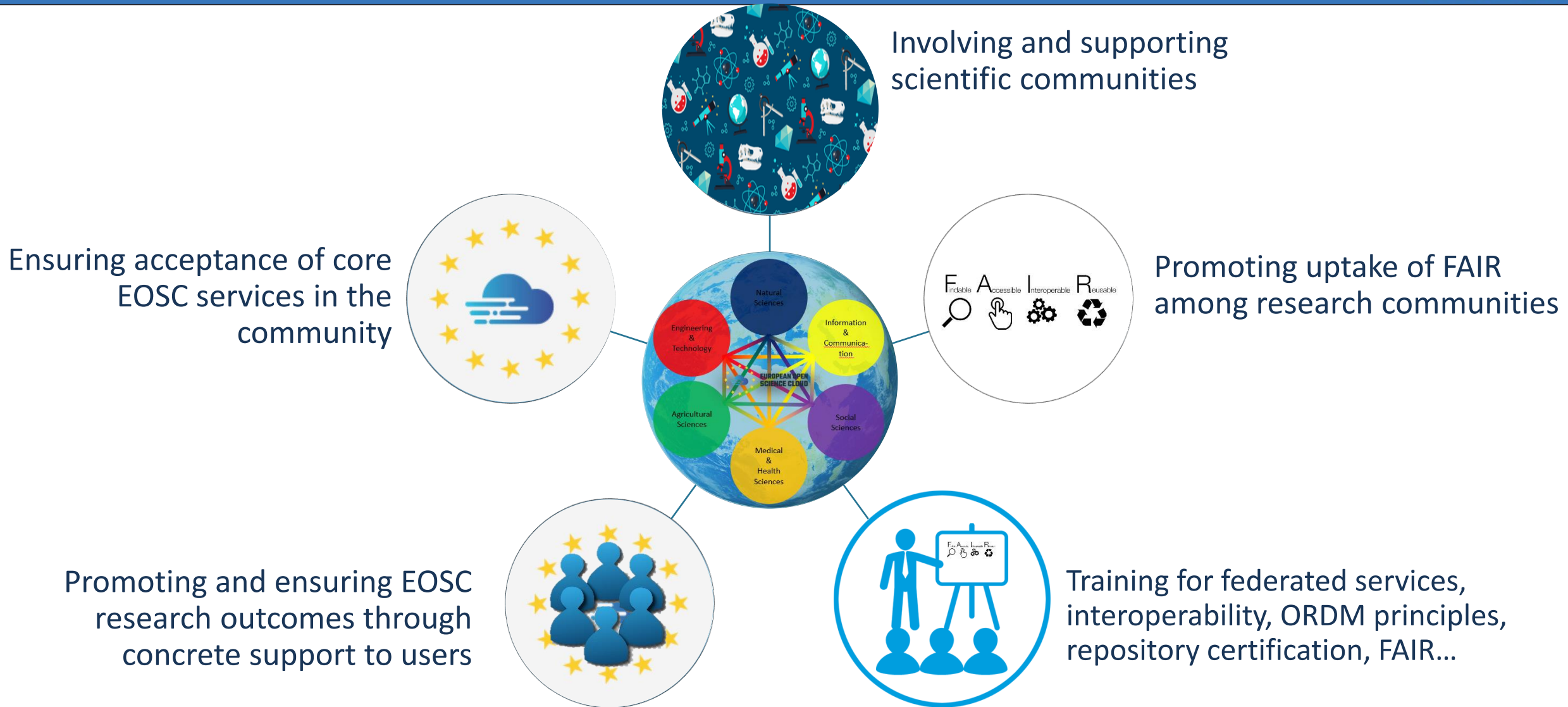
## NI4OS-Europe onboarding includes:

- Pre-production environment to prepare for the onboarding process (validating readiness and maturity level)
- Inclusion in the service and portfolio management system / service description template
- Integration with the federation core services (AAI, monitoring, accounting, etc.)
- Integration with generic services (HPC, HTC, cloud, storage, etc.)
- Usage of the thematic services
- Inclusion of repositories



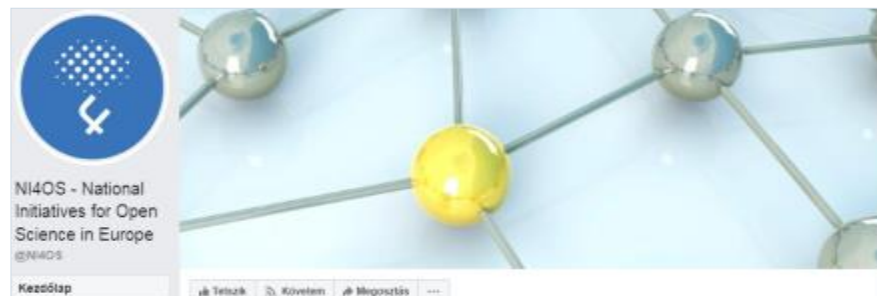


# User engagement, training and demonstrators (WP6)



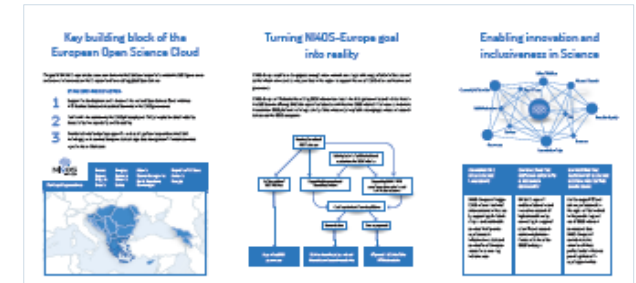
## Communication platform

Website: <https://ni4os.eu/>  
Calendar: <https://ni4os.eu/calendar>  
Agenda tool: <http://events.ni4os.eu/>  
Social media: [@NI4OS\\_eu](https://twitter.com/NI4OS_eu) [@NI4OS](https://facebook.com/NI4OS)



## Promotional material

Brochure, posters, presentation, roll up banners, web banners



## Dissemination events

30 national events  
(600 persons targeted)  
1 regional event  
(200 persons targeted)



## Sustainability and innovation

Find solutions for sustainable and long-term impact of project results  
Manage knowledge and results so as to create added value for different stakeholders

- ❑ 15 OSC initiatives / 10 established, 5 in set-up process
- ❑ 20 generic service instances / 15 on-boarded, 3 registered, 3 candidates
- ❑ 20 thematic services / 15 on-boarded, 6 registered, 10 candidates
- ❑ 15 repositories / 15 on-boarded, 5 registered, 15 candidates
- ❑ 30 national-level trainings (450 persons targeted) / 28 completed
- ❑ 5 train-the-trainer events / completed
- ❑ 30 national dissemination events (600 persons targeted) / 23 held with 1292 attendees
- ❑ 1 regional event (200 persons targeted) / planned for Sept. 28-29 in Budapest
- ❑ 3 sets of ORDM guidelines / completed
- ❑ 6 ORDM tools / 4 completed
- ❑ 1 pre-production environment / completed

- *NI4OS-Europe in brief*
- ***NI4OS-Europe on-boarded services***
- *Activities and main NI4OS-Europe results in Montenegro*

- All the services can be find at **NI4OS-Europe catalogue** ([https://catalogue.ni4os.eu/? =/resources](https://catalogue.ni4os.eu/?=/resources)), and are divided in 3 categories:
  - **Generic**
  - **Thematic**
  - **Repositories**
- Each on-boarded service has defined:

Readiness

TRL8

Domain

Generic

Subdomain

Generic

Category

Data Storage

Subcategory

Data Online

Target users

Research Groups Research Projects Researchers

Access type

Virtual

Access mode

Free Conditionally Peer reviewed



[User manual](#)



[Terms of use](#)



[Privacy policy](#)



[Access policy](#)



[Training](#)



[Helpdesk](#)








[Monitoring](#)

- ❑ **15 on-boarded** generic services include
  - ❑ **Cloud services** – 5 different cloud instances with 364 Virtual Machine (VM) cores
  - ❑ **Storage services** – 2 different storage services are offered (10TB of storage space per project or 100GB per registered user)
  - ❑ **High-performance computing**
    - ❑ HPC resources consist of clusters with low-latency interconnection or supercomputers. In total, 6.2 million CPU-core hours and 402,000 GPU-card hours are allocated
  - ❑ **Data processing services** - Data analysis service or PARADOX Hadoop cluster consists of a single name node that runs the YARN resource manager, and three additional data nodes.
  - ❑ **Other services**
    - ❑ Licence clearance tool – LCT (<https://lct.ni4os.eu>)
    - ❑ Repository policy generator – RePol (<https://repol.ni4os.eu/>)
    - ❑ EOSC RoP Legal & Ethics Compliance Tool – RoLECT (<https://rolect.ni4os.eu/>)



## FINKI cloud

Openstack cloud deployed at the Faculty of Computer Science and Engineering, UKIM.

 <a href="#">User manual</a>	 <a href="#">Terms of use</a>	 <a href="#">Privacy policy</a>	 <a href="#">Access policy</a>	 <a href="#">Training</a>	 <a href="#">Helodesk</a>	 <a href="#">Monitoring</a>
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Openstack cloud deployed at the Faculty of Computer Science and Engineering, UKIM. Cloud infrastructure based on Openstack and is hosted on 15 Huawei servers, each with 128GB RAM and 20 HT CPU cores, totaling in 300 vCPU cores and 37TB SSD and 32 TB SAS storage. The system is in production from 2017 as a National cloud system. The connectivity to Internet is 1Gbit through MARNET provided link to GEANT. Currently the system hosts templates for all popular Linux distributions, and Windows variations. The primary target communities are the ones from the long tail of science.

The infrastructure is fully integrated with the eduGAIN / NI4OS AAI, enabling seamless access to virtualized computing, network and storage resources.

## Resource organization



ON-BOARDED

University Ss. Cyril and Methodius, Faculty of Computer Science and Engineering

Rudjer Boskovic 16, 1000 Skopje, North Macedonia (MK)

[more](#)

## Resource providers



ON-BOARDED

University Ss. Cyril and Methodius, Faculty of Computer Science and Engineering

Rudjer Boskovic 16, 1000 Skopje, North Macedonia (MK)

[more](#)

GENERIC

ON-BOARDED



Website

<https://openstack.finki.ukim.mk/>

Readiness

TRL9

Domain

[Natural Sciences](#) [Engineering & Technology](#)

Subdomain

[Electrical, Electronic & Information Engineering](#)

[Other Engineering & Technology Sciences](#) [Computer & Information Sciences](#)

Category

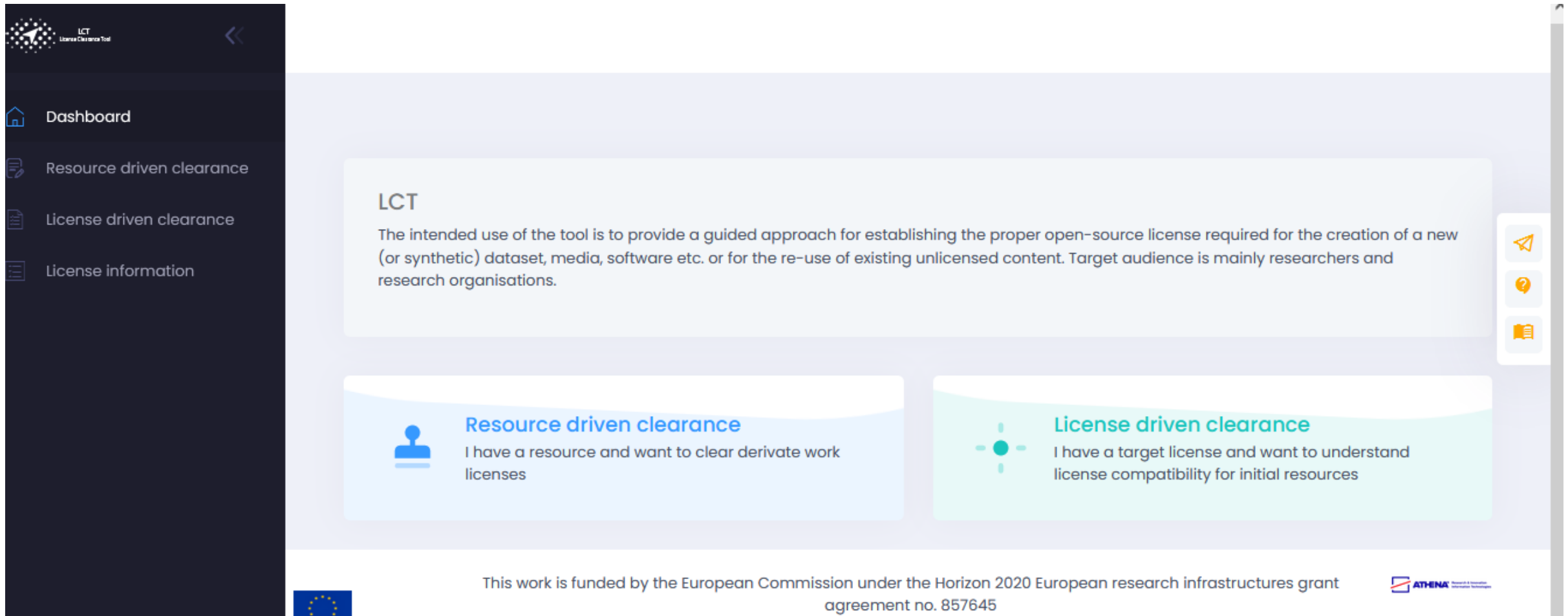
[Compute](#)

Subcategory

[Virtual Machine Management](#)

Target users

- **LCT** aims to facilitate and automate the clearance of rights (copyright) for datasets, media, software and other content before they are released under an open licence or stored at a publicly trusted FAIR repository.



**LCT**  
License Clearance Tool

Dashboard

Resource driven clearance

License driven clearance

License information


## LCT

The intended use of the tool is to provide a guided approach for establishing the proper open-source license required for the creation of a new (or synthetic) dataset, media, software etc. or for the re-use of existing unlicensed content. Target audience is mainly researchers and research organisations.

**Resource driven clearance**  
I have a resource and want to clear derivate work licenses

**License driven clearance**  
I have a target license and want to understand license compatibility for initial resources

This work is funded by the European Commission under the Horizon 2020 European research infrastructures grant agreement no. 857645

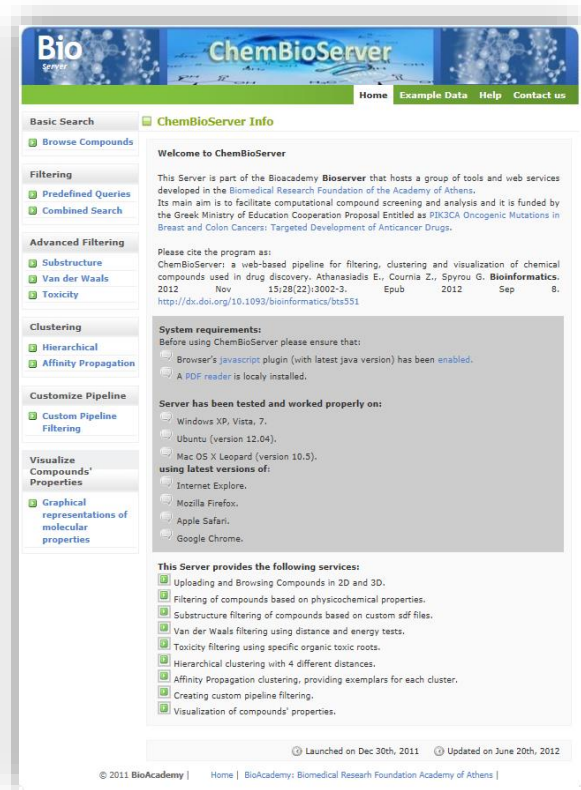


- ❑ **15 on-boarded** thematic services include
  - ❑ Application-specific services for **Climate**
  - ❑ Application-specific services for **Digital Cultural Heritage**
  - ❑ Application-specific services for **Life Science**
  - ❑ Application-specific services for **Computational Physics**
  - ❑ Application-specific services for **other sciences**

# Thematic services: examples

## ChemBioServer

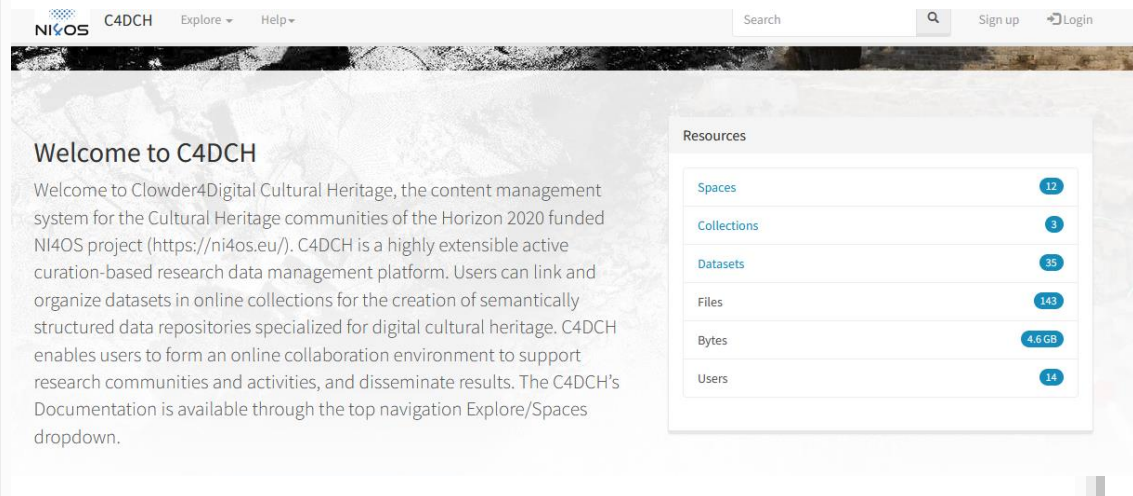
Service for filtering, clustering and visualization of chemical compounds used in drug discovery



The screenshot shows the ChemBioServer website interface. It features a navigation bar with 'Home', 'Example Data', 'Help', and 'Contact us'. The main content area includes sections for 'Basic Search', 'Filtering', 'Advanced Filtering', 'Clustering', 'Customize Pipeline', and 'Visualize Compounds' Properties. A 'Welcome to ChemBioServer' message is displayed, along with system requirements and a list of services provided by the server.

## Clowder4Digital Cultural Heritage

A Digital Culture Heritage repository which also offers integrated interactive visualization tools

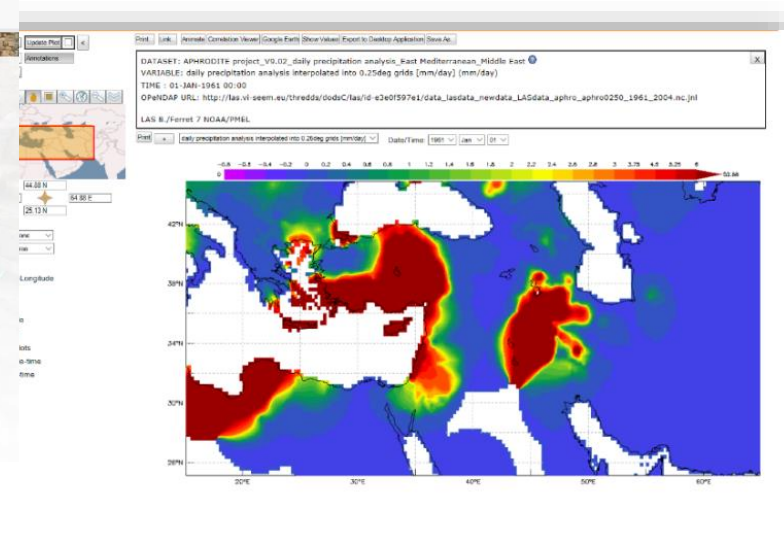


The screenshot shows the Clowder4Digital Cultural Heritage (C4DCH) website. It features a navigation bar with 'Explore' and 'Help'. The main content area includes a 'Welcome to C4DCH' message and a 'Resources' section with a table of statistics:

Resource Type	Count
Spaces	12
Collections	3
Datasets	35
Files	143
Bytes	4.6 GB
Users	14

## Live Access Server







A web server providing flexible access to geo-referenced scientific data, offering visualization & post-processing capabilities for climate data



The screenshot shows the Live Access Server website interface. It features a navigation bar with 'Home', 'Example Data', 'Help', and 'Contact us'. The main content area includes a 'Welcome to Live Access Server' message and a 'Resources' section with a table of statistics:


Resource Type	Count
Spaces	12
Collections	3
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Files	143
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# Repositories

REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED		
											
<b>CHERRY - CHEmistry Repository</b>		<b>CeR - Central Repository of the Institute of Chemistry, Technology and Metallurgy</b>		<b>DAIS - Digital Archive of the Serbian Academy of Sciences and Arts</b>		<b>Digital Library of University of Maribor</b>		<b>Georgian Integrated Library Information System Consortium 2017</b>		<b>HELIX Data</b>	
Institutional repository of the University of Belgrade - Faculty of Chemistry		Institutional digital repository of the Institute of Chemistry, Technology and Metallurgy, University of Belgrade		Open access to publications and other research outputs of the SASA and its institutes.		Institutional repository of the University of Maribor		National repository of scientific works		A data catalogue and repository, with a dual role in storing and preserving data that are self-deposited by researchers and in harvesting data records from other national data sources and catalogues, such as HARDMIN.	
CHERRY, ie CHEmistry Repository is a joint digital repository of the all departments in University of Belgrade - Faculty of Chemistry. CHERRY provides open access to the publications, as well as to other outputs of the research projects implemented in this institution. OpenD...		CeR – Central Repository is the institutional digital repository of the Institute of Chemistry, Technology and Metallurgy, University of Belgrade. The aim of the repository ...		DAIS - Digitalni arhiv izdanja SANU / Digital Archive of the Serbian Academy of Sciences and Arts is a joint digital repository of the Serbian Academy of Sciences and Arts (SASA) and the research institutes under the auspice...		The University of Maribor Digital Library (DKUM) is the institutional repository of the University of Maribor. It supports open access to scientific, research and professional works, and research data, which are results of research and education at the University. Publishing works in DKUM en...		Georgian Integrated Library Information System Consortium GILISC was founded in 2017 to assist educational institutions in their development. GILISC gives them access to the electronic databases of scientific journals, helps them to use modern electronic catalogs/integrated library sy...		HELIX Data is one of the services provided by the Hellenic Data Service. Hellenic Data Service, also known as HELIX, is a data ca...	
<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>	



# Repositories

REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED	REPOSITORY	ON-BOARDED
											
<b>NI4OS-Europe repository service</b>		<b>RADaR - Digital Repository of Archived Publications of the Institute for Biological Research</b>		<b>Repository of Faculty of Science, University of Zagreb</b>		<b>Repository of the Institute of Public Finance, Zagreb</b>		<b>SZTE repository of publications</b>		<b>Social Scientific Research Documentation Centre Repository</b>	
NI4OS-Europe general-purpose data repository.		Institutional digital repository of the Institute for Biological Research "Siniša Stanković" – National Institute of Republic of Serbia, University of Belgrade		Institutional repository		Institutional repository		This is the institutional repository of the University of Szeged which contains the work of staff and students.		You can browse through researches conducted at the four institutes (Institute for Legal Studies, Institute for Minority Studies, Institute for Political Science, Institute for Sociology) of the Centre for Social Sciences and download research collections.	
NI4OS Repository Service (NRS) is the main storage service of a community that holds "Regional Community Datasets". The NRS is also the platform to host all kinds of additional data such as publications (and their associated data), software (or references to software), workflow descriptions (e.g. how to genera...		RADaR - Digital Repository of Archived Publications of the Institute for Biological Research "Sini...		The repository provides access to publications and research data produced by the employees and the students of the faculty. Content of repository is open to all users for searching and downloading with clearly stated usage rights. OpenDOAR OpenAIRE...		Repository provides access to publications and research data produced by the employees of the institute, papers published in scientific journals, conference proceedings, dissertations, books, manuals, guides and complete documentation related to the Institute's activities. Content of repository is open to all...		The intention of the SZTE Repository of Publications is to make the full text of scientific and artistic activities at the University available for the widest possible academic audience. Depositin...		The Research Documentation Cen...	
<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>		<a href="#">more</a>	



# Repositories

REPOSITORY

ON-BOARDED



University of Zadar Institutional Repository of evaluation works

Institutional repository

The repository provides access to publications and research data produced by the employees and the students of the faculty. Content of repository is open to all users for searching and downloading with clearly stated usage rights. OpenDOAR OpenAIRE...

[more](#)

REPOSITORY

ON-BOARDED



VideoLectures.Net

exchange ideas & share knowledge

VideoLectures.NET is an award-winning free and open access educational video lectures repository. The lectures are given by distinguished scholars and scientists at the most important and prominent events like conferences, summer schools, workshops and science promotional events from many fields of Science. The portal is aimed at promoting ...

[more](#)

REPOSITORY

ON-BOARDED



VinaR - Repository of the Vinča Institute of Nuclear Sciences

Institutional digital repository of the Vinča Institute of Nuclear Sciences, University of Belgrade

VinaR - Repository of the Vinča Institute of Nuclear Sciences is the institutional digital repository of the Vinča Institute of Nuclear Sciences, University of Belgrade. The aim of the repository is to provid...

[more](#)

REPOSITORY

CANDIDATE



FarFar - Repository of the Faculty of Pharmacy

Digital repository of the University of Belgrade - Faculty of Pharmacy

FarFar - Repository of the Faculty of Pharmacy is the joint digital repository of all departments of the University of Belgrade, Faculty of Pharmacy. The aim of the repository is to provide open access to publications and other research outputs resulting from the p...

[more](#)

REPOSITORY

CANDIDATE



GraFar - Repository of the Faculty of Civil Engineering

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[more](#)

REPOSITORY

CANDIDATE



Jakov - Repository of the University of Criminal Investigation and Police Studies

Institutional digital repository of the University of Criminal Investigation and Police Studies in Belgrade

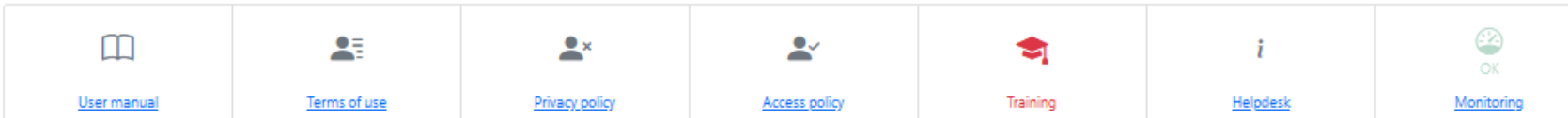
Jakov - Repository of the University of Criminal Investigation and Police Studies in Belgrade is the institutional digital repository of the University of Criminal Investigation and ...

[more](#)

# Repositories

## VideoLectures.Net

exchange ideas & share knowledge



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**Videolectures**

**AWARD WINNING** | **FREE & OPEN ACCESS**  
educational video repository

**OUR SERVICES:**

- Event recording
- LIVE** broadcast
- Postproduction
- Synchronization
- Promotional video
- Short films for social media

**MORE THAN:**

- 1200 events,
- 17400 authors,
- 24100 lectures,
- 27600 videos
- and counting...

GET IT ON Google Play | Download on the App Store

## CATEGORIES

- Architecture (394)
- Arts (548)
- Astronomy (80)
- Biology (599)
- Business (1262)
- Chemistry (262)
- Computers (674)
- Computer Science (14416)
- Data Science (730)
- Earth Sciences (56)
- Environment (208)
- Events (439)
- Health Sciences (33)
- Humanities (704)
- Life Sciences (34)
- Mathematics (679)
- Medicine (661)
- Military (36)
- Philosophy (184)
- Physics (433)
- Psychoanalysis (1)
- Regional (160)
- Science (755)
- Social Sciences (2870)
- Sports (39)
- Technology (1394)

## TOP AUTHORS

- *NI4OS-Europe in brief*
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- ***Activities and main NI4OS-Europe results in Montenegro***

# UoM activities

- ❑ **Participating in 5 out of 7 Work Packages**
  - ❑ **WP1 – Management**
    - ❑ T1.4 -Prepare 3-monthly, yearly and final progress report
    - ❑ T1.6 -Assess the project deliverables and conformance to requirements
  - ❑ **WP2 – EOSC national initiatives and policy support**
    - ❑ T2.1 -Stakeholder analysis & mapping
    - ❑ T2.3 - Set up of national OSC initiatives
    - ❑ T2.5 - EOSC governance liaison
  - ❑ **WP5 – Service provider integration, on-boarding and service maintenance**
    - ❑ T5.1 - Detailed analysis of provider landscape
    - ❑ T5.2 - Support to generic service providers
    - ❑ T5.3 - Support to thematic service providers
    - ❑ T5.4 - Support to integration of national repositories
  - ❑ **WP6 – User engagement, training and demonstrators**
    - ❑ T6.3 - EOSC service uptake and FAIR uptake in communities
    - ❑ T6.4 - Training
  - ❑ **WP7 – Communication, marketing, sustainability and innovation**
    - ❑ T7.2 - Dissemination events

# UoM activities

- ❑ Main realized activities:
  - ❑ Stakeholder and service provider mapping
  - ❑ **1<sup>st</sup> national dissemination event** in the frame of 24<sup>th</sup> Information Technology (IT 2020) conference, Žabljak, Montenegro, on February 18, 2020 (34 participants)
  - ❑ **1<sup>st</sup> Training event - capacity building**
    - ❑ Online event, organized on October 27, 2020 (more than 30 attendees)
  - ❑ **Two thematic services** (OpenMApp and IoT Cloud) registered at Agora catalogue, (OpenMApp on-boarded)
  - ❑ Nomination of national **EOSC promoter** (Ms. **Lidija Milosavljević**)
  - ❑ Membership in **EOSC Association**, as an observer since 2021
  - ❑ NOSCI established. MoU has been signed by 9 institutions and official kick-off meeting was held on January 26, 2022

# UoM activities

- ❑ Besides project planned activities:
  - ❑ Inclusion of UoM in [OpenAire AMKE](#) legal entity, on June 01, 2020
  - ❑ Creation of a strategic document entitled “[Programme of Implementation of Open Science Principles in Montenegro with the Action Plan \(2020–2022\)](#)”, adopted by Government of Montenegro in June 2020
  - ❑ [Regional OS initiative](#), realized through RCC (Regional Cooperation Council)
  - ❑ Creation of “[Feasibility study of national Open Science repository](#)”, March 2022
- ❑ Ongoing work
  - ❑ Work on generic cloud service with 1Gbps bandwidth to the Internet
    - ❑ Total number of nodes: 4 nodes, with 12 physical (24 logical) cores per node
    - ❑ RAM per core: 10 GB
    - ❑ Max number of VMs: 100 with Min/Max amount of RAM per VM: 512 MB/24 GB
    - ❑ Total storage: 20 TB
    - ❑ Cloud environment type: Linux VM (ESXi virtualization)
    - ❑ Access interfaces: SSH client, Remote Desktop client



- ❑ Options for building national Open Science infrastructure for long term archiving scientific publications, scientific data, creating CRIS system, ...
- ❑ To establish interoperable repository, capable for inclusion in EOSC
- ❑ Proposal of optimal technical solution and cost analysis
- ❑ Content
  - ❑ Comparison of the existing open code software solutions for repositories
  - ❑ State-of-the art analysis and estimation of the capacity needs for national repository
  - ❑ Proposal of optimal model for technical solution of national repository
  - ❑ Budget estimation for establishing national repository
  - ❑ Defining steps in process of establishing national repository

- ❑ DSpace open source software platform with CRIS functionality
- ❑ Interoperable (OAI-PMH - Open Archive Initiative Protocol for Metadata Harvesting)
- ❑ Metadata structured in accordance with Dublin Core standard

