

**Moldova State University**

# **Project Requirement Document**

**for**

**Integrate Solution for Hybrid Cloud platform implementation**

**for public institution**

**Moldova State University**

- **Cod CPV – 00000000-0 – Configuration and consulting services**
- **Cod CPV – 00000000-0 – IT platforms**
- **Cod CPV – 48820000-2 – Servers**
- **Cod CPV – 48900000-7 – Various software packages and computer systems**

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## I General information

This project requirement document contains the general requirements of the State University of Moldova regarding the award contract for the acquisition of an IT system, consisting of hardware and software products, structured cabling services and informatic system installation / configuration services, in order to achieve its strategic objectives, provided in the Digital Development Strategy of the State University of Moldova, approved at the USM Senate meeting on 10.10.2021.

## II Organizational structure and digital infrastructure

The Moldova State University (MSU) is a public institution with juridical personality, in the subordination of the Ministry of Education and Research, financed from the state budget through the budget of the Ministry of Education and Research.

Founded in 1946, MSU currently has 11 faculties, about 10,500 students, 1,000 teachers and 1,000 employees in auxiliary structures.

MSU's digital infrastructure was actively developed between 2003 and 2005, according to the standards and models for that period. The star topology of the data transport network, technical parameters of the network equipment have been primarily selected to facilitate access to information from the internet at a data transfer rate of up to 100 mbps for the entire university campus. Currently, the existing informatic system connects decentralized the administrative offices, library, departments, and instructive and research laboratories of the University faculties, providing local access to computing resources for study and research, in strictly delimited locations. The authorization mode of the users does not allow the centralized access to the university information system.

The modernization of the informatic system is also motivated by the structural transformations of the university campus – the launch of laboratories for the creation and editing of digital contents, the analysis of large volumes of data, the construction of the MediaCor media hub, the development of student television – all entities being increasingly dependent on the university information system because they generate data traffic that far exceeds the capacities of the existing information system.

The transformation of the educational process in the last two years through the massive inclusion of distance training activities and the development of institutional rapids has further

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aggravated the situation in terms of accessibility to infrastructure and digital technological resources. In addition to the insufficient flow and bandwidth of the university network (Campus Area Network, short CAN), the problem of the centralized data calculation and storage capabilities was added, or, in the current model, both a dedicated university data center and the basic infrastructure to ensure its continuous operation in critical situations (lack of electricity, fires, weather, etc.)

### III Objectives

Based on the previous section, it is necessary to develop a new digital educational ecosystem of MSU by creating a high-performance digital educational environment, respecting digital ethics, personal data protection, online safety, cybersecurity through real-time data analysis, etc., centered on the following key concepts:

- **Accessibility** - ensuring digital infrastructure and emerging technologies for access to inclusive and quality education.
- **Connectivity** – developing the digital skills of students and teachers for the digital transition to a competitive society, centered on sustainable development, social equity and resilience; digital literacy and tackling disinformation, using open educational resources.
- **Community** – involvement of "stakeholders".
- **Innovation** – using all emerging digital resources and technologies, stimulating creativity and entrepreneurship.
- **Sustainability** – ensuring predictability in the medium and long term, through international cooperation, for quality, greener and more efficient education.

The premises for implementation are an informatic system that must:

- ensure a robust and scalable network infrastructure for the next 7 to 10 years with bidirectional data transmission capacity through CAN, from 1 Gbps (initially) to 10 Gbps (in the field) for end-users (end-point) for the entire university community (teachers, researchers, students, administration, etc.);
- form a unique continuous digital educational environment throughout the perimeter of the university campus, primarily oriented towards the use of wireless mesh technologies in broadband with the guarantee of the level of performance for the data flow (Quality of Service, short QoS), to automatically improve jamming and instantly reduce packet losses, to provide priority with a

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low delay rate to transport at the same time data, voice, streaming and other video channels, storage with continuously updated content, access to institutional digital applications and resources in the space delimited by the Central block and block #4 of USM, with the possibility of extending throughout the university campus, including affiliated ones, as well as from the student dormitories;

- ensure secure access from anywhere and seamlessly with single sign-on feature (Single sign-on, short SSO) for the entire university community to university digital educational resources, as well as to SaaS (Software as a Service Model) services of third parties (3rd-party service provider) interconnected with the Hybrid University Cloud;
- ensure secure internet access using multifactor authentication (short MFA) to university digital educational resources for the entire university community;
- maintain its functionality under conditions of risks or technological attacks, cybernetics, climates maintain its functionality under conditions of risks or technological, cyber, climate attacks.
- has a modular, flexible and scalable structure that allows for further upgrades without disassembly and full replacement.

### All this can be realized by:

- Creating within USM a software-defined IT infrastructure for the purpose of implementing next generation HCI technologies for a hyperconverged hybrid university cloud infrastructure for software-defined data center (SDDC) that will become the functional pillar of the university IT modernization.

SDDC, will form a combination of software-defined computing (virtualization), software-defined network collaboration (SDN), software-defined storage (SDS) and a common management layer, as it will provide a flexible, efficient and iterated infrastructure.

- The Hybrid University Cloud will provide integrated Cloud services that will use both private and public cloud systems to perform distinct functions within the university.

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For both the university and public clouds, simplified access to resources from anywhere will be ensured, with single sign-on (SSO) - seamless identity solution.

### IV. The object of the purchase

**It represents an integrated solution, which consists in the implementation of an efficient informatic system, in which the aggregation of the University's resources will take place.** From the moment of launching, the system will perform the verification and validation of institutional and external information resources depending on the availability of services, their capacity, performance, and the cost related to their use on demand, as well as the quantification of services according to consumption.

#### Key factors:

- Upgrading data transport infrastructure via a software-defined network (SDN) and creating the Hybrid University Cloud combination of software-defined computing (virtualization) and software-defined storage (SDS) for a hyperconverged infrastructure.
- improving the level of IT services and applications, and optimizing the use of IT systems;
- providing easy access to University services, elasticity of services offered, which can be accessed;
- implementing European practices regarding university services;
- ensuring the efficient use of IT resources;
- eliminating cases of unavailability of IT services;
- executing critical applications in the virtual environment in conditions of maximum performance;
- implementing solutions to automate repetitive maintenance tasks, including application installation and system administration processes;

## V Security requirements

### Data Security

Before outsourcing data or information to the cloud, it is necessary to make sure that all data security, integrity, and consistency measures have been taken. In this regard, the provider must ensure the safety and security of information at every level in the built-in Cloud, from the infrastructure level to the software services level.

The measures at the Cloud Computing levels are as follows:

#### Cloud infrastructure security

As the processing power is composed of the infrastructure resources of one or more data centers, it is important to ensure the security of the services, components and communication channels through which the data is transmitted.

#### Cloud platform security

In order to ensure platform-wide data security, it is essential that data management and processing systems be maintained to the current version and that suspicious data traffic be stopped immediately. Various data security policies and regulations are defined here at the organizational level.

#### Software security in the Cloud

The provider must protect the entire portfolio of applications against internal and external threats, from the design phase until the applications are launched. Security must be ensured throughout the life cycle. It is also important that security policies and defined processes do not become an obstacle to the university's functionality and do not introduce other risks or difficulties for those who will use the Hybrid Cloud - based university platform.

**VI Minimum requirements and technical specifications for information and communication systems**

Necessary equipment for the modernization of university data transport networks for MSU Central Building and Building No. 4 (A. Mateevici 60 str.) central campus.

| Name  | The requested technical specification   | Quantity |
|---|---|----------|
| <p><b>Hardware equipment and Software for the Software Defined Data Center (SDDC)</b></p> | <p><b>HCI nodes - Computing infrastructure that allows delivery of storage and network functions through software.</b> The base architectural component for the implemented HCI must provide Software Defined Storage with the virtualization technology provided by Microsoft Storage Spaces Direct (hereinafter S2D) or similar technologies, which will guarantee full compatibility with the Microsoft Azure Cloud that functions on RoCE v2 (RDMA over Converged Ethernet) and correct alignment between the Azure Public Cloud and the University’s academic Hybrid Cloud. The implemented infrastructure must be transparent integrable to Azure Disaster Recovery, in order to recovery in case of disaster of Hyper-V virtual machines, without using any Third-Party Software.</p> <p><b>Minimum characteristics per HCI node:</b><br/> <b>Chassis:</b> <b>minim</b> 19” 2U Rack mount;<br/> <b>CPU:</b> <b>minim</b> Four (4x) Intel Xeon Gold 6226, 2.7 GHz base frequency, 12 cores, 24 threads, Hyper-Threading Technology, Virtualization Technology (VT-x), Intel EPT, <b>or equivalent</b>;<br/> <b>RAM:</b> <b>minim</b> 512 GB DDR4 ECC Registered Memory, <b>min.</b>3200MHz<br/> <b>RAID Controller for Boot drives:</b> <b>min.</b> hardware RAID 0/1 Controller, <b>min</b> 2 GB Flash-Backed Write Cache, compatible with Microsoft Windows Server 2022;<br/> <b>Boot drives:</b> <b>minim</b> Two (2x) 240GB SSD or M2 Drives configured in RAID1;<br/> <b>RAID Controller Card for Storage Capacity:</b> Mixed mode support (RAID &amp; HBA), in Host-bus Adapter (HBA) mode must implement the simple pass mode for any storage device used for Storage Spaces Direct (S2D).<br/> <b>Storage for capacity:</b> <b>min.</b> 24 x 960GB SSD SAS 12Gbps Mix Use (3 DWPD), FIPS-140, Hot-plug;<br/> <b>Storage for Caching:</b> two (2) x PCIe 1.6TB Enterprise NVMe Mixed Use Storage Card, totally functional within the software managed storage solution, proposed;<br/> <b>Network interface card:</b> two (2) x PCIe 3.0 x16 100GbE single-port, Tall bracket &amp; 100G QSFP to 4xSFP25G Passive Copper Splitter Cable included;<br/> <b>Cooling system:</b> Full Redundant hot plug fans<br/> <b>PSU:</b> Dual, Hot-Plug, Redundant power supplies <b>min.</b> 1600W, Platinum, <b>or equivalent</b>, Certified.</p> | <p>2</p> |



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|  | <p><b>Network interfaces:</b></p> <ul style="list-style-type: none"> <li>• minim two (2x) – 10 GbE SFP+;</li> <li>• minim two (2x) – 1 GbE Ethernet port;</li> <li>• One (1x) – 1 Ethernet Dedicated Management port;</li> </ul> <p><b>Server management:</b> Local and remote control of system resources (management, diagnostics and monitoring); Control remote for power connection, remote update firmware, remote captures of OS drop screens (BSOD) via web interface, virtual media attachment (USB drive, CD/DVD drive) to server; LDAP authentication; full control administration via remote host server's display, keyboard, and mouse, GUI OS; Virtual media option (virtual CD, remote image mounting);</p> <p><b>Operating Systems and Virtualization Software:</b> included perpetual license Windows Server 2022 Datacenter Edition;</p> <p><b>Rack mounting rails:</b> complete extraction rails;</p> <p><b>Accessories:</b> All cables necessary for installation, connection and operation with the offered HCI infrastructure.</p> <p>Note: if, in the process of installing and configuring the solution, some connection cables or modules are missing, they will be delivered from the supplier's own account.</p> <p><b>Hardware Warranty: warranty covered by the manufacturer at least 3 years after delivery to remedy manufacturing defects,</b> including access to updates and support on the manufacturer's support portal.</p> <p>The bidder shall guarantee technical assistance and on-site or remote diagnosis with a reaction time of max. 4 hours from the complaint, the rectification of defects shall not exceed 7 working days. All expenses related to the removal of defects or problems (including logistics with the manufacturer of the defective parts, etc.) will be made by the solution provider on their own account.</p> |   |
|  | <p><b>Installation and configuration of the SDDC:</b></p> <p><b>Installation, connection and configuration of HCI physical nodes</b></p> <ul style="list-style-type: none"> <li>- Installing, updating and checking servers firmware, BIOS, IPMI</li> <li>- Interconnection of servers in full-mesh network</li> <li>- Installing and checking host OS</li> <li>- Installing and checking Hypervisors;</li> <li>- Creation of failover cluster</li> <li>- <b>Configure S2D storage in Six-levels with Resiliency 3-Way Mirror mode:</b></li> <li>- The level of network connected servers by the network application protocol SMB 3.0 (Server Message Block).</li> <li>- Software Storage Bus active on all servers that make up the HCI cluster, where each server can "access" all discs on all</li> </ul>   | 1 |

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|  | <p>servers in the cluster, offering a completely full mesh network topology.</p> <ul style="list-style-type: none"> <li>- Storage Pool - the set of physical disks, which can include different disks in terms of volume, performance and connection interface.</li> <li>- ReFS (Resilient file system) - file system, designed to maximize data availability, scale efficiently to large data sets for various workloads, and provide data integrity with resistance to corruption.</li> <li>- Storage spaces - virtual disk volumes.</li> <li>- Virtual Machines. The sixth layer is present only if a hyper converged architecture is implemented.</li> <li>- <b>Installation and configuration of the management components of the implemented solution, based on Microsoft System Center :</b> <ul style="list-style-type: none"> <li>○ <b>Operations Manager</b></li> <li>○ <b>Configuration Manager</b></li> <li>○ <b>Data Protection Manager</b></li> <li>○ <b>Endpoint Protection</b></li> <li>○ <b>Service Manager</b> (consolidated into the data warehouse, cubes are stored in SQL Server Analysis Services (SSAS) need SQL Server perpetual license!);</li> <li>○ <b>Virtual Machine Manager</b></li> </ul> </li> <li>- <b>SDDC Management Software:</b> need perpetual license for System Center 2022 and CAL's for configured VMs after deployment.</li> <li>- Deployment testing, which will include the verification of the basic function of the solution delivered.</li> <li>- Transfer of knowledge to the beneficiary for all components of the solution, including: <ul style="list-style-type: none"> <li>○ Low Level Design Documentation with a thorough description of solution settings</li> <li>○ Administration guide</li> </ul> </li> </ul> |                                      |
| <p style="text-align: center;"><b>Hardware and Software equipment for the Software Defined Network (SDN)</b></p> | <p><b>SDN Controller</b><br/> <b>General requirements</b><br/> SDN Controller – solution for network management tasks, which form a single control plane for all managed network devices (switches, routers, wireless controllers, wireless access points, and controllers compatible with other network devices). It must allow the design of workflows in the network, the granular definition of secure access policies, the segmentation of the network based on AD profiles or authorization groups, policy-based automation, management of devices and firmware, allowing transparent network</p>  | <p style="text-align: center;">3</p> |

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|  | <p>traffic control. The controller must be compatible with the open platform for data exchange with third-party applications.</p> <p><b>Minimum characteristics:</b><br/>Type: hardware appliance, rackmount with at least 2 x CPU, storage controller that supports RAID 0/1/5/10 with min. 2GB Cache, 2 x SSDs for SO configured in RAID1, min. 8 x SSDs for system storing configured in RAID5 or RAID10, min. 4 x 10GbE SFP+ ports, redundant fans and power supplies.</p> <p><b>Performance and scalability:</b></p> <ul style="list-style-type: none"><li>- <b>min.</b> 900 devices supported (switches, routers, wireless controllers, Wireless Access Points and other network devices compatible with controllers).</li><li>- <b>min.</b> 3850 WAP and min. 450 WAP controllers</li><li>- <b>min.</b> 23000 concurrent wired/wireless endpoints</li><li>- <b>min.</b> 45000 managed physical ports</li></ul> <p><b>Functional specifications required:</b></p> <ul style="list-style-type: none"><li>- Single pane for administration, automation, monitoring and analysis.</li><li>- Network discovery using LLDP/LLDP-MED, SNMP, ARP, CDP.</li><li>- Initial network devices configuration with at least:<ul style="list-style-type: none"><li>o IP configuration,</li><li>o routing,</li><li>o management/monitoring settings (AAA, DNS, NTP, NetFlow, Syslog, SNMP)</li></ul></li><li>- Apply network configuration and software images updates on new devices after replacement of failed or outdated components from a single console by network administrator, scheduled or immediately.</li><li>- Define network domains and sites</li><li>- Collect network telemetry data from network devices, monitor network device characteristics</li><li>- Provide diagnosis data (disconnection, delays, traffic loss, bandwidth issues, increased IP lease time, ) for wired and wireless networks and “how-to” guides to remediate problems</li><li>- create and apply policies to applications (ex. Office365, Skype, conferencing applications) to ensure traffic prioritization, quality user experience and secure network.</li><li>- ensuring the ability to move a user or device between domain, sites or application structure without changing its IP address and other network connection parameters;</li></ul> |  |
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|  | <p><b>High Availability support:</b> switchover cluster mode, comprising minimum 3 nodes.</p> <p><b>Accessories:</b> All installation components, on-site mounting components must be included in the offer.</p> <p><b>Compatibility:</b> The system must be compatible with all network equipment offered in the project.</p> <p><b>Service/Support:</b> For the offered SDN solution, all software functionalities (including later developed) must be covered by the legal right (software entitlement) and use for a term of min. 1 year after the commissioning of the implemented information system, with the possibility of automatic extension for a fee after its expiration (the price for 1 year of Software Service &amp; Support will be indicated as separately noted in the offer) <b>provided that the extension (End of Service/Support, short EOSL) at least 5 years</b></p> <p><b>Hardware Warranty:</b> warranty covered by the manufacturer at least 1 year after delivery to remedy manufacturing defects, including access to updates and support on the manufacturer's support portal.</p> <p>The bidder shall guarantee technical assistance and on-site or remote diagnosis with a reaction time of max. 4 hours from the complaint, the rectification of defects shall not exceed 7 working days. All expenses related to the removal of defects or problems (including logistics with the manufacturer of defective and new parts, etc.) will be made by the bidder on his own account.</p> |   |
|  | <p><b>Identity management and access policy management platform</b></p> <p><b>General requirements:</b> Solution that ensures and simplifies the management of network access and its resources, by centralizing, unifying authentication and authorization methods, as well as defining and subsequently applying network access policies based on the categories of roles and rights regardless of network type (wired, wireless, VPN). The solution must manage the devices that access the network, providing or not access according to the equipment compliance policies and configured security requirements. Also, to facilitate and secure the access of external Guest users and mobility within the organization. The product offered must be from the same manufacturer as the SDN Controller.</p> <p><b>Minimum characteristics:</b><br/> <b>Type:</b> hardware or virtual appliance.<br/> <b>Form factor for hardware appliance:</b> 19" 1U rack-mount. Rack mounting KIT to be included in the proposal.<br/> <b>Functional specifications required:</b></p>  | 2 |

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- Centralized configuration of profiles, policies, guest portal, authentication, authorization and profiling.
- Access control options, URL redirection, virtual LAN assignments, ACLs
- AAA services with support of at least RADIUS, PAP, MS-CHAP, FAST, EAP-TLS, EAP-MD5.
- Device access control with support of TACACS+, access at least by credential, group, commands.
- Built-in CA
- Templates for endpoints (Phones, smartphones, tablets, Cameras). Possibility to create custom templates and associate authorization policies.
- Active Directory support including multi forest domains.
- Self-service device onboarding and secure logins
- Identity sources supported at least Certificate Authentication Profiles, Microsoft Active Directory, LDAP, RADIUS Token Identity Sources, RSA Identity Sources
- Authentication and authorization exchange ability with other security devices.

**High Availability support:** switchover Cluster mode.

**Management and scalability:** Web-based.

**Accessories:** All installation components, on-site mounting components must be included in the offer.

**Compatibility:** The solution must be compatible, at least with all the equipment, and be the same manufacturer as the SDN Controller offered.

**Service/Support:** For the offered SDN solution, all software functionalities (including later developed) must be covered by the legal right (software entitlement) and use for a term of min. 1 year after the commissioning of the implemented information system, with the possibility of automatic extension for a fee after its expiration (the price for 1 year of Software Service & Support will be indicated as separately noted in the offer) **provided that the extension (End of Service/Support, short EOSL) at least 5 years**

**Hardware Warranty:** warranty covered by the manufacturer at least 1 year after delivery to remedy manufacturing defects, including access to updates and support on the manufacturer's support portal.

The bidder shall guarantee technical assistance and on-site or remote diagnosis with a reaction time of max. 4 hours from the complaint, the rectification of defects shall not exceed 7 working days. All expenses related to the removal of defects or problems (including logistics with the manufacturer of defective and new

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|  | <p>parts, etc.) will be made by the bidder on his own account.</p> <p><u>Comutatoare Core si Aggregation (Edge)</u><br/> <b>Caracteristici minimale:</b><br/>         Form factor: 19" 1U rack-mount. KIT de montare în rack să fie inclus în ofertă.<br/>         Ports: <b>min.</b> 48x porturi 1/10/25 Gigabit, 4x porturi 100 Gigabit Uplinks<br/>         Power supply: 2x surse de alimentare hot swappable<br/>         Fans: Redundant, hot-swappable fans.<br/>         Stacking: posibilitatea să fie unite în „stack” cu echipamente de același tip, kit de conectare în „stack” trebuie să fie inclus în ofertă.<br/>         Switch Performance:         <ul style="list-style-type: none"> <li>• Switching capacity <b>min.</b> 3Tbps</li> <li>• Forward rate <b>min.</b> 980 Mpps</li> </ul>         Management ports: <b>min.</b> 1 RJ-45 și USB mini-Type B Console port<br/>         Functional specifications required: <b>min.</b> 4000 VLAN-uri ; IEEE 802.1Q VLAN; Jumbo Frame <b>min.</b> 9000 bytes; Link Aggregation Control Protocol, IEEE 802.3ad; <b>min.</b> 200k MAC adrese; up to 1.9M routes<br/>         Authentication requirements: Radius, TACACS, Secure Shell<br/>         Additional requirements:<br/>         Port-based/MAC-based/Voice VLAN; Per-VLAN Spanning Tree Plus (PVST+); Virtual Switch interface; Persistent MAC (sticky MAC); 802.1x authentication, ARP inspection, ACL, DHCP Snooping, BPDU Guard, IP Source Guard; Remote Switch Port Analyzer (RSPAN), Uni-Directional Link Detection (UDLD), Voice VLAN, Per-port broadcast, multicast, unicast storm control.<br/>         Management and configuration option: prin CLI, GUI, SNMP v2c, SNMP v3<br/> <b>Protocols support, minimum: RIP, OSPF, RSPAN, MACsec-128, 802.1X</b><br/> <b>Compatibility:</b> trebuie să fie de la același producător ca și controllerul de rețea SDN.<br/>         Service/Support: Pentru soluția SDN oferată toate funcționalitățile software (inclusiv ulterior dezvoltate) trebuie să fie acoperite de dreptul legal (eng: software entitlement) și de utilizare pe un termen de min. 1 an după darea în exploatare a sistemului informatic implementat, și posibilitatea de prelungire automată contra-cost după expirarea acesteia (prețul pentru 1 an de Software Service &amp; Support se va indica ca remarcă separat in ofertă) <b>cu condiția de prelungire (eng: End of Service/Support, scurt EOSL) cel puțin 5 ani!</b><br/> <b>Hardware Warranty: garanție acoperită de producător minim 1 an după livrare pentru a remedia defectele de fabricație</b>, inclusiv acces la actualizări și asistență pe portalul de suport al producătorului.<br/>         Ofertantul va garanta asistență tehnică și diagnosticarea on-site sau distant cu timp de reacție max. 4 ore de la reclamare, remediarea</p> | 2 |
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|  | <p>defectelor nu va depăși 7 zile lucrătoare. Toate cheltuielile legate de înlăturarea defectelor sau problemelor (inclusiv logistica cu producătorul a pieselor defectate și noi, etc.) vor fi efectuate de către ofertant din contul propriu.</p>  |    |
|  | <p><b><u>Comutatoare de Access cu Power over Ethernet (PoE)</u></b><br/> <b>Caracteristici minimale:</b><br/>         Form factor: 19" 1U rack-mount. KIT de montare în rack să fie inclus în ofertă.<br/>         Ports: <b>min.</b> 48x porturi 1 Gigabit Ethernet PoE+ și 4x porturi 10 Gigabit (SFP+) Uplinks<br/>         PoE Budget: <b>min</b> 500W PoE buget, upgradable to min. 1400W<br/>         Power supply support: 2x surse de alimentare hot swappable<br/>         Stacking: posibilitatea să fie unite în „stack” cu echipamente de același tip, kit de conectare în „stack” trebuie să fie inclus în ofertă.<br/>         Switch Performance:</p> <ul style="list-style-type: none"> <li>• Switching capacity <b>min.</b> 170 Gbps</li> <li>• Stacking capacity <b>min.</b> 450 Gbps</li> <li>• Forward rate min. 120 Mpps</li> <li>• Forwarding rate in stack <b>min.</b> 350 Mpps</li> </ul> <p>Management ports: <b>min.</b> 1 RJ-45 și USB mini-Type B Console port<br/>         Functional specifications required: min. 4000 VLAN-uri ; IEEE 802.1Q VLAN; Jumbo Frame <b>min.</b> 9000 bytes; Link Aggregation Control Protocol, IEEE 802.3ad; <b>min.</b> 16000 MAC adrese;<br/>         Authentication requirements: Radius, TACACS, Secure Shell<br/>         Additional requirements:<br/>         Port-based/ MAC-based/Voice VLAN; Per-VLAN Spanning Tree Plus (PVST+); Virtual Switch interface; Persistent MAC (sticky MAC); 802.1x authentication, ARP inspection, ACL, DHCP Snooping, BPDU Guard, IP Source Guard; Remote Switch Port Analyzer (RSPAN), Uni-Directional Link Detection (UDLD), Voice VLAN, Per-port broadcast, multicast, unicast storm control.<br/>         Management and configuration option: prin CLI, GUI, SNMP v2c, SNMP v3, RestCONF<br/> <b>Protocols support: minimum RIP, OSPF, RSPAN, MACsec-128, 802.1X</b><br/> <b>Compatibility:</b> trebuie să fie de la același producător ca și controllerul de rețea SDN.<br/>         Service/Support: Pentru soluția SDN oferată toate funcționalitățile software (inclusiv ulterior dezvoltate) trebuie să fie acoperite de dreptul legal (eng: software entitlement) și de utilizare pe un termen de min. 1 an după darea în exploatare a sistemului informatic implementat, și posibilitatea de prelungire automată contra-cost după expirarea acesteia (prețul pentru 1 an de Software Service &amp; Support se va indica ca remarcă separat in ofertă) <b>cu condiția de prelungire (eng: End of Service/Support, scurt EOSL) cel puțin 5 ani!</b><br/> <b>Hardware Warranty: garanție acoperită de producător minim 1 an după livrare pentru a remedia defectele de fabricație, inclusiv acces la actualizări și asistență pe portalul de suport al</b></p> | 17 |

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|  | <p>producătorului.<br/>Ofertantul va garanta asistență tehnică și diagnosticarea on-site sau distant cu timp de reacție max. 4 ore de la reclamare, remedierea defectelor nu va depăși 7 zile lucrătoare. Toate cheltuielile legate de înlăturarea defectelor sau problemelor (inclusiv logistica cu producătorul a pieselor defectate și noi, etc.) vor fi efectuate de către ofertant din contul propriu.</p>   |   |
|  | <p><b>Controller wireless</b><br/><b>Minimum characteristics:</b><br/><b>Form factor:</b> rackmount, max. 1U, with redundant power supplies.<br/><b>Interfaces:</b> min. 4 x 10Gb SFP+, 1x 1G SFP+/SFP, redundant management ports, console port, min. 2xUSB port, with external memory support.<br/><b>Performance:</b><br/>- Min. 2000 access point support<br/>- Min. 32000 clients<br/>- Min. 4000 VLANs<br/>- Min. 40Gbps throughput<br/><b>Functional specifications required:</b> Wi-Fi 6 (802.11ax), WPA3, Open standards APIs, client management policies and segmentation.<br/><b>Security:</b> wireless firewall and intrusion prevention system, application visibility and control, application QoS policies.<br/>Wireless standards: IEEE 802.11a/b/g/d, 802.11w, 802.11ac, WMM/802.11e, 802.11h, 802.11n, 802.11k/r/u, 802.11ax.<br/><b>High Availability support:</b> software upgrade without downtime, Stateful switchover Cluster, N+1 redundancy mode.<br/><b>Management:</b> web-based, SSH, Serial, SNMP, Netconf.<br/><b>Accessories:</b> All installation components, on-site mounting components must be included in the offer.<br/><b>Compatibility:</b> It must be from the same manufacturer as the SDN Controller<br/><b>Service/Support:</b> For the offered SDN solution, all software functionalities (including later developed) must be covered by the legal right (software entitlement) and use for a term of min. 1 year after the commissioning of the implemented information system, with the possibility of automatic extension for a fee after its expiration (the price for 1 year of Software Service &amp; Support will be indicated as separately noted in the offer) <b>provided that the extension (End of Service/Support, short EOSL) at least 5 years</b><br/><br/><b>Hardware Warranty:</b> warranty covered by the manufacturer at least 1 year after delivery to remedy manufacturing defects, including access to updates and support on the manufacturer's support portal.<br/>The bidder shall guarantee technical assistance and on-site or</p> | 2 |



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|  | <p>remote diagnosis with a reaction time of max. 4 hours from the complaint, the rectification of defects shall not exceed 7 working days. All expenses related to the removal of defects or problems (including logistics with the manufacturer of defective and new parts, etc.) will be made by the bidder on his own account.</p>   |           |
|  | <p><b>Wireless access points</b><br/> <b>Minimum characteristics:</b><br/> <b>Form factor:</b> Indoor WAP, min. 4 external antennas 2.4 GHz/5 GHz min. 5 dBi.<br/> <b>Interfaces:</b> min. 1Gb Ethernet RJ-45, management console, USB port.<br/> <b>Wireless:</b> 4x4 MIMO with four spatial streams, beamforming, A-MPDU/ A-MSDU, MRC, BSS-coloring, TWT, channel bandwidth 20-, 40-, 80-, and 160-MHz.<br/> <b>Functional specifications required:</b> OFDMA and MU-MIMO support, Wi-Fi 6, flexible radio assignments; roaming service.<br/> <b>Security:</b> built-in AVC capabilities (inspect traffic, application flows according to access policies configured in Software Define Access controllers), Zero Trust access; WPA3.<br/> <b>Accessories:</b> All installation components, on-site mounting components must be included in the offer.<br/> <b>Compatibility:</b> It must be from the same manufacturer as the SDN Controller</p> <p><b>Service/Support:</b> For the offered SDN solution, all software functionalities (including later developed) must be covered by the legal right (software entitlement) and use for a term of min. 1 year after the commissioning of the implemented information system, with the possibility of automatic extension for a fee after its expiration (the price for 1 year of Software Service &amp; Support will be indicated as separately noted in the offer) <b>provided that the extension (End of Service/Support, short EOSL) at least 5 years</b></p> <p><b>Hardware Warranty: warranty covered by the manufacturer at least 1 year after delivery to remedy manufacturing defects,</b> including access to updates and support on the manufacturer's support portal.</p> <p>The bidder shall guarantee technical assistance and on-site or remote diagnosis with a reaction time of max. 4 hours from the complaint, the rectification of defects shall not exceed 7 working days. All expenses related to the removal of defects or problems (including logistics with the manufacturer of defective and new parts, etc.) will be made by the bidder on his own account.</p> | <p>91</p> |
|  | <p><b>Installation and configuration of the SDN:</b></p>  | <p>1</p>  |

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|                                  | <p><b>Creating HLD project documentation with subsequent approval:</b><br/>Collecting information on the up-to-date situation of the existing infrastructure (DNS, SSO, AAA, DHCP, NTP... ) and creating HLD design documentation.</p> <p><b>Installation, connection, and configuration of the SDN Controllers</b></p> <p><b>Configuring controllers connectivity</b></p> <ul style="list-style-type: none"> <li>- Installation and verification of SDN controllers updates</li> <li>- Connecting and configuring Aggregation and Access switches to the SDN controllers</li> <li>- Connecting and configuring Wireless Controllers and Wireless Access Points</li> <li>- Applying update images via Controllers</li> <li>- Create and set global configurations for the solution (locations, DHCP, DNS, IP Pools, etc.)</li> <li>- Creating user groups (e.g. contributors, students, printers, guest users, etc.)</li> <li>- Creating virtual networks and assigning users to these networks</li> <li>- Creating and assigning control and access policies</li> </ul> <p><b>Installation and configuration of identity and access-policy Management Platform</b></p> <ul style="list-style-type: none"> <li>- Integration with Active Directory and existing infrastructure SSO</li> <li>- Configuring Administrative Access Policies (Identification and Authentication)</li> <li>- Configuring CA options</li> <li>- Creating users and users groups.</li> <li>- Integration with SDN Controllers</li> <li>- Checking and testing the access to the network according to the access policies settings.</li> </ul> <p><b>Acceptance testing, which will include checking the basic function of the solution delivered.</b></p> <p><b>The transfer of knowledge to the beneficiary for all the components of the solution, including:</b></p> <ul style="list-style-type: none"> <li>- Low Level Design Documentation with a thorough description of solution settings</li> <li>- Administration guide</li> </ul> <p><b>Migration of existing services on the newly implemented platform</b></p> <ul style="list-style-type: none"> <li>- Migration of Services to the computing Hyper-Converged Infrastructure</li> <li>- Migration of services to the Software Defined Network</li> </ul> |          |
| <p>Structured cabling system</p> | <p><b>Passive Network Equipment</b></p> <ul style="list-style-type: none"> <li>• 2x 42U 800mmx1200mm Rack black or gray equipped with:</li> </ul>  | <p>1</p> |

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|  | <ul style="list-style-type: none"> <li>- Metal front/rear metal, perforated and secured - key closure</li> <li>- Removable metal side panels;</li> <li>- Vertical PDU mount &amp; Cable organizer – <b>2x</b> units installed for each Rack;</li> <li>- Zero-U Single Phase PDU, 32A, 230V, 20xC13 &amp; 4xC19 – <b>2x</b> units installed for each Rack;</li> <li>- Grounding and assembly kit included.</li> </ul> <ul style="list-style-type: none"> <li>• <b>14x</b> 10G SFP+ to SFP+ 7m DAC Cable;</li> <li>• <b>4x</b> QSFP to QSFP copper direct-attach 100GBASE-CR4 DAC Cable;</li> <li>• <b>34x</b> 10G SFP+ to SFP+ 1m DAC Cable;</li> <li>• <b>4x</b> 19" 1U 24 Port, rack mount patch panel, with 24x SC/SM adapters and 24x SC/SM 1m 9/125 pigtail;</li> <li>• <b>96x</b> Fiber Optic Patchcord SC/APC – SC/UPC, SM, 9/125, L=1m;</li> <li>• <b>34x</b> WDM SFP+ Optic Transceiver, 2km /pair for Access Switches;</li> <li>• <b>13x</b> 19" 9U 600x600mm Cabinet rack de perete, ușă din față sticlă (securizat - închidere cu cheie), spate și laterale metal plin detașabile, kit montaj inclus;</li> <li>• <b>13x</b> 19" 1U Rack orizontal PDU la 16A, cu 8 prize Schuko, profil de aluminiu, include cablu de alimentare C14 min 1.8m;</li> <li>• <b>6x</b> 19" 1U Organizator cablu cu capac, aceeași culoare ca și dulapul;</li> <li>• <b>20x</b> 19" 2U Organizator cablu cu capac, aceeași culoare ca și dulapul;</li> <li>• <b>13x</b> 19" 1U panou de patch-uri ecranat Cat.6A STP 48x porturi cu organizator de cablu;</li> <li>• <b>2x km</b> Cablu de fibra optică (FTTH) 4 fire Single Mode, tip: ADSS, Amplasare: aerian, tip: mono tube;</li> <li>• <b>45x</b> Cablu F/FTP Cat.6A 4x2xAWG23 (500 MHz), pentru garnitura interioara, 500m în rolă;</li> <li>• <b>816x</b> Cablu rețea ecranat 0.5m, S/FTP (SSTP) Cat.6a LSZH (500 MHz);</li> <li>• <b>24x</b> Cablu rețea ecranat 7m, S/FTP (SSTP) Cat.6a LSZH (500 MHz);</li> </ul> |   |
|  | <p><b><u>Structured cabling services</u></b></p> <p>The service involves the design based on the attached cadastral plans for the 4th and central block of the USM on 60 Alexei Mateevici Street, the preparation of the documentation and the elaboration of the technical project, the realization of the structured cabling system for the hybrid SDN topology. The project will provide all the materials, the workforce necessary for the installation and</p>  | 1 |

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|  | <p>"turnkey" realization of the structured cabling solution for the offered SDN solution. All norms, technical prescriptions, specialized standards, specific rules of the work will be respected, even if they are not explicitly described.</p> <p>The final system must represent a clear architecture of horizontal and vertical wiring.</p> <p>Horizontal cabling must be carried out with the use of routes installed on metal supports for cables (gutter) with the guarantee of 20% reserve for future installations, metal embossed tubes, fast-fastening gutter systems (PVC).</p> <p>For each cable consolidation point, a wall-mounted telecommunication cabinet must be installed. The cabinet will contain at least: copper/fiber optic cords, copper/optical circuit connection panels (patch-panel), horizontal cable organizer(cable organiser), switch, 1U PDU. Telecommunication wall cabinets must be interconnected strictly by fiber optics directly and redundancy! with the Data Center of USM.</p> <p>For each consolidation point of the cables, a switching cabinet must be installed which will contain at least: copper/optical circuit connections, cable organizer, copper cords, UPS. The switching cabinets must be connected by optical cable to the university data center.</p> <p>The execution of the works will contain the documentation regarding the system of identification, numbering and labeling of each element of the system, so each cable, terminal point, RJ45 mode, port in the connections panel, etc. be easily identified.</p> <p>As a result, the following identifiers will be used:</p> <ul style="list-style-type: none"><li>• Patch Cord encoding system by color</li><li>• Tags at each end of each network cable</li><li>• Tags for each outlet, indicating the floor, room and socket number in the room</li><li>• Diagram for connection panel, with cable identifier, source-destination, type and use</li><li>• Wiring diagram for connection cabinets</li><li>• Full set of wiring plans in the building.</li></ul> <p>At the reception of the works, the executor will hand over to the beneficiary the documentation with the record of the works executed in order to administer the network.</p> <p>The order of execution of the works must be coordinated with the beneficiary and will contain:</p> <ul style="list-style-type: none"><li>• Identification, marking, and approval of route of the metal gutters</li></ul> |  |
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|                                 | <ul style="list-style-type: none"> <li>• Execution of pierces in walls and floors</li> <li>• Mounting metal gutters for cables;</li> <li>• Mounting the system of rapid mounting gutters on the auditorium walls</li> <li>• Installing horizontal cables through gutters</li> <li>• Connecting horizontal cables to work sockets and installing them in gutters</li> <li>• Installing connections panels in floor distribution cabinets</li> <li>• Striping and crimping horizontal cables to connections panels in floor distribution cabinets</li> <li>• Installation of Access Switches with PoE and Wireless Access Points, connecting them to patch panels through Cable Organizer.</li> <li>• Connecting fiber optic cables to OFDs from distribution cabinets and switches</li> <li>• Testing the bonding performances of structured cabling with a profile device, which will deliver the performance indicators for each port/link that will be included in the system passport.</li> </ul> <p>Launching the system in production.<br/>         Within the works, at least the materials indicated in the "Passive network equipment" compartment will be used. If additional materials are required, they will be included in the offer.</p> <p><b>Guarantee for the works executed: min. 5 years</b></p> |                 |
| <p><b>SCCD power system</b></p> | <p><b>Uninterruptible Power Source (UPS)</b></p> <p><b>Type:</b> 19" max. 6U Rackmount with Battery Pack<br/> <b>Topology:</b> On-line double conversion with PFC (Power Factor Correction)<br/> <b>Rated power (VA/Watts): min.</b> 8kVA (7.2kW)<br/> <b>Communications:</b> Serial Ports RS232 and USB with communication cables, Supports Network Management Module: as a standard feature, LCD Display and Button Interface on front panel;<br/>         Provides virtualization-ready support for Power Manager software (free download).<br/> <b>Electrical Input:</b><br/>         Input 3 phases, voltage range 305V-480V without derating (up to 175V-480V with derating)<br/>         Input Connection: Terminal Block (Hardwire)<br/>         Nominal Voltage: 380/400/415V<br/>         Frequency: 50/60 Hz autoselection<br/>         Frequency Range: 40-70 Hz<br/>         Short Circuit Current: 120 A<br/> <b>Power output:</b><br/> <b>Output 1 phase</b></p>   | <p><b>3</b></p> |

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|  | <p><b>Voltages 200/208/220/230/240/250V (+/-1%)</b><br/><b>Efficiency (Normal Mode): Up to 95% in Online mode, 98% in Hi-Efficiency mode</b><br/><b>Output Frequency 50/60 Hz autoselect, frequency converter as standard</b><br/><b>Power distribution:</b><br/>Electrical Output: On battery Regulation -10% to +6% of nominal voltage, Voltage Wave Form Sinusoidal, Output protection: Firmware overload sensing and control<br/>Output Connection: <b>min.</b>6x C-19, 2x IEC 32A<br/>Breaker Amp Rating/ Single of Double Pole 16A/1pole for 6x C19 32A/1pole for 2x IEC 32A<br/>UPS Battery type: Maintenance-free, rechargeable, valve regulated lead-acid batteries<br/>Backup runtime: Internal Battery at 100% load not less than 3.5 Minutes<br/>Supports Extended Runtime Modules: min. 4 per UPS</p> <p><b>Hardware Warranty: warranty covered by the manufacturer at least 2 years after delivery to remedy manufacturing defects, including access to updates and support on the manufacturer's support portal.</b></p> <p><b>The bidder will</b> guarantee on-site or remote diagnostic assistance and diagnosis (with max. reaction time of 4 hours, remediation of malfunctions will not exceed 7 working days). All expenses related to the removal of defects or problems (including logistics with the manufacturer of the defective parts, etc.) will be made by the solution provider on their own account.</p> |  |
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## **VII. Requirements and conditions for "turnkey" installation / configuration**

- The bidder will minimize the downtime risks for the proposed **turnkey** solution to guarantee an Uptime of 99.9%. The SLA describes the qualitative and quantitative terms of the service level to be reached for the services offered by the Hybrid University Cloud implemented on the SDDC technology. These SLA terms do not have an expiration date and will be valid until a new version of them is implemented. These SLA terms may be updated from time to time to capture any new circumstances arising in this document that were not known or available at the time of publication of the previous version of the SLA terms;
- The solution provider must install and configure all the equipment offered "turnkey" exclusively from the local network of the Moldova State University;
- The proposed hardware equipment must be new, by an international vendor, with guaranteed compatibility between active network equipment, servers, software solutions used, storage equipment, and power sources.
- The hardware offered/ delivered must be new, of international brand and certified, compatible with the SDDC and SDN solution offered.

The functionality obtained from the implementation of the Software Defined Data Center and Software Defined Network must allow, at least the following use scenarios:

- Secure multifactor authentication (MFA) and seamless access with single sign-on feature (single sign-on, short SSO) for authorized users (USM domain-joined) via the CAN (via wired/wireless over SDN) or Internet (via DirectAccess for remote users) network to integrated services in the Hybrid University Cloud and/or existing Microsoft Office 365 online services.
- Simple access of Guest type users, through network connections (wired, wireless over SDN) only to public USM resources and applications, defined by the SDN network security policies.
- All security groups for users and network equipment must be integrated with core University services (AD, CA, DNS, DHCP, NTP, NPS, etc.) and synchronized with Microsoft Azure Cloud AD.

### **VIII. Requirements for the installation, configuration and restoration documentation**

- The solution provider must create diagrams of the implemented hyperconvergent network infrastructure topology (OSI Layer 1-7), diagrams of the physical / logical interconnection, the interconnection of the MSU Hybrid Cloud entities with the Public ones (Microsoft Azure) and the logical communication of the applications from entities and update it for the entire period of guaranteed assistance;
- Operation rules of the proposed system

### **IX. Training requirements for university staff who will manage the implemented platform**

- The solution provider must provide training services to MSU specialists, who will serve the implemented solution, by modules (SDDC and SDN), for each of the components of the solution.
- The solution provider will develop internal certification mechanisms, or will use external certification mechanisms for at least 2 university specialists for the implemented technologies;

### **X. Guaranteed assistance and maintenance requirements**

- The solution provider will offer at least 3 years of guaranteed technical assistance (from the date of starting service, same to the day of signing of the acceptance acts) for the implemented informatic system. Guaranteed technical assistance will cover fixing of the errors, detected during exploitation period.