TECHNICAL PROPOSAL TO IMPLEMENT INFORMATION TECHNOLOGY INFRASTRUCTURE

Rawalpindi Medical University Rawalpindi

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DOCUMENT INFORMATION	
Document Title	IT Infrastructure
Owner	Director IT
Version	1.0
Status	Approved
Prepared by	Muhammad Iftikhar (Manager IT System)
Approved by	Vice Chancellor
Date released	May 05, 2021
Classification	Rawalpindi Medical University

TECHNICAL PROPOSAL	
Problem Statement	Rawalpindi Medical University (RMU) provides high-quality medical education and research. As the university expands, a robust and reliable Local Area Network (LAN) and W-LAN infrastructure has become crucial. The current network is outdated, lacks scalability, has limited coverage, inadequate bandwidth, insufficient security, poor network management, and cannot meet the growing demands of students, faculty, and staff. Additionally, the implementation of EDUROAM by the Higher Education Commission (HEC) requires a secure and efficient WLAN infrastructure to provide seamless network access.
Scope of Work	The proposed system involves assessing the current network, designing a robust and scalable LAN and WLAN(EDUROAM) architecture, procuring and installing necessary hardware, and configuring the network for optimal performance and security. The project will conclude with deployment and ongoing support to meet the university's current and future needs.
Objectives	**Network Reliability and Coverage:** Ensure network reliability and network coverage of the entire campus. **Network Performance:** High-speed connectivity to support administrative, academic, and research activities. **Increase Security:** Security measures to protect the network from threats, unauthorized access, and data breaches **Scalability:** Scalable network infrastructure that can accommodate future growth and new technological advancements. **Network Management:** Network management tools for efficient monitoring, troubleshooting, and maintenance of the network. **Support Advanced Applications and Services:** Use of high-bandwidth applications, like video conferencing, online lectures, digital experience for users, and access to cloud resources. **Provide Training and Documentation:** Provide training to IT staff on managing the network and provide documentation. **Future Expansion:** Provisions for easy integration of new buildings and facilities in future expansions. **Cost Efficiency:** Ensure deployment is cost-effective, balancing high-quality performance with budget constraints.
Technical Specifications	**1. Network Infrastructure** • **Network Topology**: Star topology with core, distribution, and access layers • **Cabling**: Cat6 for internal connections, fiber optics for backbone links **2. Core Network** • **Core Switches**: Huawei S7706 **Series**

- **Ports**: 48 x 10 GE SFP+ ports
  96 x 1G ports
  48 x 10 GE SFP+ ports
  Features: High performance,scalability,high scalability,hot-swappable,Mpls,QoS,acl, STP,Security,VLAN,layer2/layer3
- **Core Switches**: H3C S6520-24
  - Ports: 24 x 10G SFP+ ports
  - **Features**: VLAN,Link Aggregation, high performance,Security, layer2/layer3

3. Distribution Layer

- **Core Switches**: Huawei S7706 **Series**
  - **Ports**: 48 x 10 GE SFP+ ports
    96 x 1G ports
    48 x 10 GE SFP+ port
  - **Features**: high performance, scalability, high scailability, hot-swappable,Mpls,QoS,acl, STP,Security

4. Access Layer

- **Access Switches**: H3C S5130 Series
  - **Ports**: 24 1G port,4 SFP+ ports
  - **Features**: Access control lists (ACLs), Quality of Service (QoS), VLAN
- Huawei S5720
  Ports: 28 1G POE ports
  12 1G POE ports
  - **Features**: Access control lists (ACLs), Quality of Service (QoS), VLAN

5. WLAN (EDUROAM)

- **Access Points**: Huawei AP5761
  - **Frequency Bands**: Dual-band 2.4 GHz and 5 GHz
  - **Speed**: Up to 1.2Gbps
  - **Coverage**: 122 meters (400 feet) range
  - **Wireless Standards**: 802.11a/b/g/n/ac/ac Wave 2
  - **Maximum Data Rate**: Up to 1.267 Gbps
  - **Features**: MIMO technology, seamless roaming, guest network capabilities
  - **Mounting Options**: Ceiling, wall, or pole mountable
- **Wireless Controllers**: Huawei AirEngine9700-M1
  - **Support**: Up to 10,000 Aps
  - **Maximum Number of Clients Supported**: Up to 100,000 clients
  - **Features**: Centralized management, advanced security, load balancing
  - **Encryption Throughput**: 40 Gbps
  - **Wi-Fi Standards Supported**: 802.11a/b/g/n/ac/ac Wave 2/ax (Wi-Fi 6)
- **Authentication and Access**: RADIUS server for EDUROAM authentication
  - **Encryption**: WPA2/WPA3 Enterprise

- **Certificates**: 802.1X authentication

6. Routers

- **Routers**: Huawei Net Engine 8000
  - **Interfaces**: Multiple Gigabit Ethernet ports, WAN interfaces
  - **Features**: Advanced routing protocols, VPN support, integrated security, routing protocol support,

7. Firewalls

- **Firewalls**: Huawei USG 6000E
  - **Throughput**: Up to 10 Gbps
  - **Interfaces**: Multiple Gigabit Ethernet ports
  - **Features**: IPS, application control, SSL inspection, VPN support, security features, routing protocols, anti-malware, content filtering,
- **Firewalls**: Hill Stone SG-6000 E5268P
  - **Throughput**: Up to 10 Gbps
  - **Interfaces**: Multiple Gigabit Ethernet ports
  - **Features**: IPS, application control, SSL inspection, VPN support, security features, routing protocols, anti-malware, content filtering

8. Data Center Specifications

- **Servers**:
  - **No of Server**:06 **(DELL,H3C,HUAWEI)**
  - **Type**: Rack-mounted, enterprise servers
  - **CPU**: Multi-core processors (e.g., Intel Xeon)
  - **RAM**: Minimum 256 per server, scalable based on application requirements
  - **Storage**: RAID-configured SSD and HDD for high performance and redundancy
- **Network**:
  - **Switches**: Huawei S7706, S5720, H3c S6520,5130
  - **Features**: High port density, low latency, advanced security features
  - **Speed**: 1/10/40/Gbps
- **Virtualization**: VMware vSphere for server virtualization
- **Cooling**: Precision air conditioning units, hot/cold aisle containment
- **Power**: Redundant power supplies, UPS systems, diesel generators for backup
- **Security**: Physical security (access control, surveillance), network security (firewalls, intrusion detection systems)

9. Fire Alarm System

- **Controllers**: Context plus M146sg
  - **Features**: Addressable, networkable, scalable
- **Detectors**: Smoke, heat, and multi-sensor detectors
  - **Connectivity**: Wired/Wireless options
  - **Features**: Early warning, self-diagnostic
- **Notification Devices**: Horns

- **Placement**: Strategically located throughout the data center and campus buildings
- **Monitoring**: Centralized monitoring and control panel
  - **Integration**: Interface with building management systems

10. CCTV System

- **Cameras**: IPC6325-WD-VR_Fixed dome camera indoor/ IPC6625-Z30-P_PTZ camera/ IPC6225-VRZ_Bullet camera
  - **Type**: Dome, bullet, PTZ cameras
  - **Resolution**: 2/4 MP
  - **Features**: Night vision, motion detection, weatherproof
- **Network Video Recorders (NVRs)**:
  - **Channels**: 16/32 channels
  - **Storage**: Up to 10 TB HDD, RAID support
  - **Features**: Remote viewing, motion alerts, advanced analytics
- **Monitoring Stations**: Centralized monitoring with multiple screens
  - **Software**: Video management software (IVS) for live viewing and playback
- **Integration**: Integration with access control and alarm systems

11. Servers and Applications

- **Web Server**:
  - **Software**: Apache or Nginx
  - **OS**: Ubuntu Server
  - **Domain**: rmur.edu.pk
- **Active Directory**:
  - **Software**: Microsoft Active Directory
  - **OS**: Windows Server
  - **Features**: User authentication, policy enforcement, centralized management
- **Print Server**:
  - **Software**: PaperCutMF
  - **OS**: Windows Server
- **File Server**:
  - **Software**: SMB
  - **OS**: Windows Server
  - **Features**: File sharing, access control, network storage
- **Content Management System (CMS)**:
  - **Domain**: cms.rmur.edu.pk
  - **Software**: PHP, Joomla,
  - **OS**: Ubuntu Server
- **Class Learning Management System (CLMS)**:
  - **Domain**: clms.rmur.edu.pk
  - **Software**: Moodle
  - **OS**: Ubuntu Server
- **Job Portal** :
  - URL: https://172.20.0.65:3000/
  - **Software**: Node JS,docker
  - **OS**: Ubuntu Server
- **Library Portal** :
  - URL: https://172.20.0.63/
  - **Software**: Pearl
  - **OS**: Ubuntu Server

	• **QR Generator:**
	  o URL: http://172.20.0.62:3000/
	  o **Software**: Python
	  o **OS**: Ubuntu Server
	• **Antivirus:**
	  o **Software**: Kaspersky Endpoint Security Management
	  o **OS**: Windows Server
	• **DHCP Server:**
	  o **Software**: DHCP
	  o **OS**: Windows Server
	• **Backup Server:**
	  o **Software**: VEEAM
	  o **OS**: Windows Server
	• **Attendance Machine**:
	  o **Devices**: Biometric/Face attendance machines ZKT
	  o **Integration**: Networked to a central server for data collection and processing
	  o **Software**: Attendance management software compatible with devices
	
	By implementing these technical specifications, Rawalpindi Medical University will establish a comprehensive, robust, and secure network infrastructure, data center, and security systems, ensuring the institution is well-equipped to support its educational and administrative operations.

Implementation Plan	**1. Project Planning and Management**
	
	• **Project Team**: Form a dedicated project team including network engineers, IT staff, admin staff and vendors.
	• **Timeline**: Develop a detailed project timeline with milestones and deadlines.
	• **Budget**: Define and allocate a budget for each component of the project.
	
	2. Assessment and Requirements Gathering
	
	• **Site Survey**: Conduct a comprehensive site survey of the existing network, data center, and facilities.
	• **Requirements**: Gather detailed requirements from stakeholders, including students, faculty, staff, and administration.
	
	3. Design and Architecture
	
	• **Network Design**: Develop detailed designs for LAN, WLAN (EDUROAM), and the data center network architecture.
	  o **Topology**: Define the network topology, VLANs, IP addressing scheme (10.82.0.0/172.20.0.0), and redundancy plans.
	  o **Security**: Plan for network security, including firewalls, encryption, and access control.
	• **Data Center Design**: Create a layout for the data center, including server placement, cooling systems, power supply, and network infrastructure.

- **Fire Alarm and CCTV Design**: Plan the placement and integration of fire alarm detectors and CCTV cameras.

4. Procurement

- **Hardware**: Procure the necessary hardware including switches, routers, access points, servers, firewalls, and CCTV cameras.
- **Software**: Obtain licenses for network management, virtualization, and security software.
- **Services**: Contract with vendors for installation and support services.

5. Installation and Configuration

- **Network Installation**:
  - Install core, distribution, and access switches.
  - Deploy and configure access points for WLAN (EDUROAM).
  - Install routers, firewalls, and other network devices.
- **Data Center Setup**:
  - Install and configure servers, storage systems, and network switches.
  - Set up virtualization environments and storage solutions.
  - Implement cooling and power systems.
- **Fire Alarm and CCTV Installation**:
  - Install fire alarm controllers, detectors, and notification devices.
  - Install CCTV cameras and network video recorders (NVRs).
  - Ensure integration with the network and monitoring systems.

6. Testing and Quality Assurance

- **Network Testing**:
  - Perform comprehensive testing of LAN and WLAN connectivity, performance, and security.
  - Conduct penetration testing and vulnerability assessments.
- **Data Center Testing**:
  - Test server performance, storage reliability, and network throughput.
  - Validate redundancy and failover mechanisms.
- **Fire Alarm and CCTV Testing**:
  - Test fire alarm sensors and notification systems.
  - Validate CCTV camera feeds, recording, and remote access.

7. Training and Documentation

- **Training**: Provide training sessions for IT staff on network management, data center operations, and security protocols.
- **Documentation**: Develop detailed documentation for network configurations, data center layouts, fire alarm systems, and CCTV setups.

8. Deployment

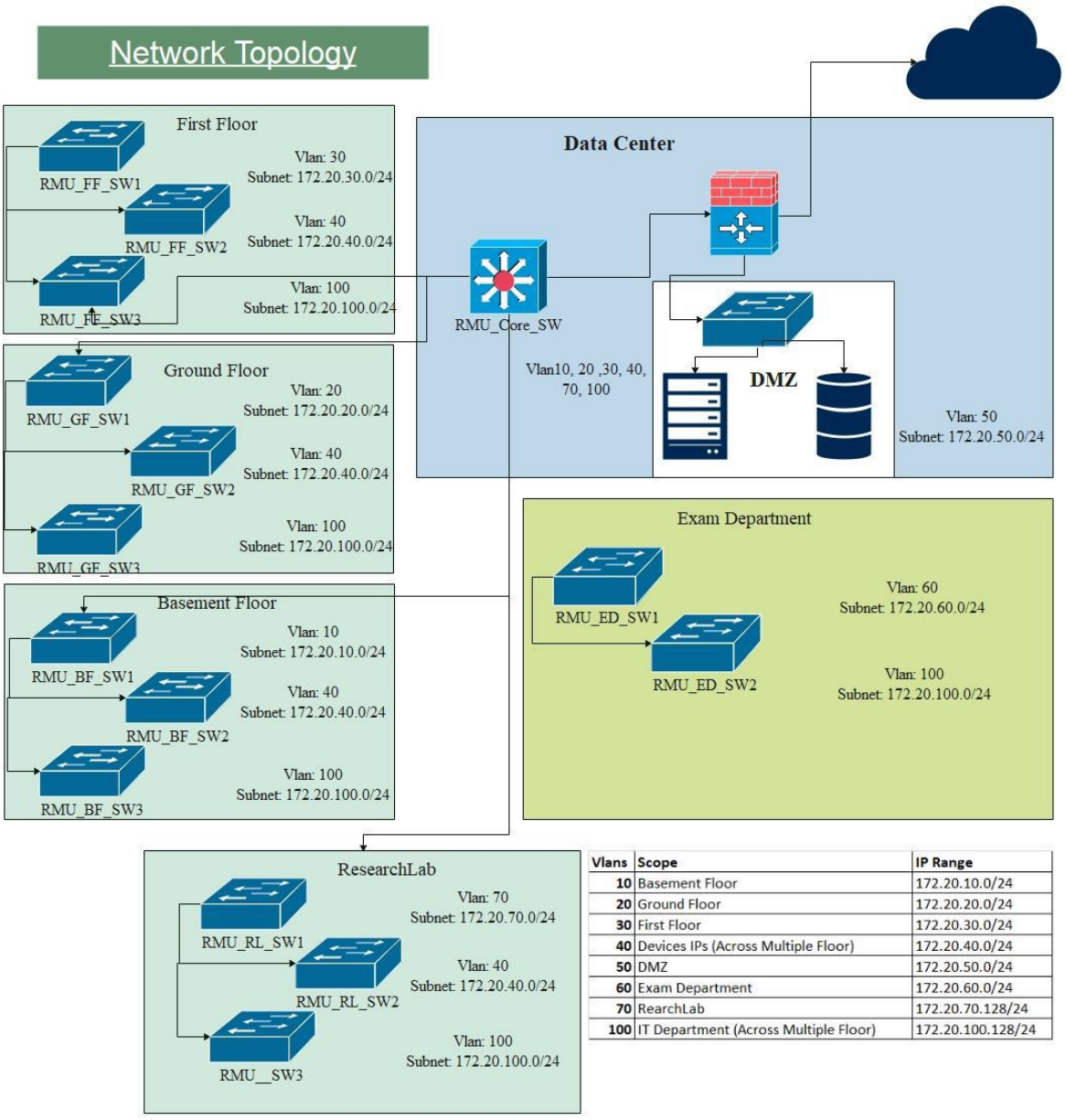
- **Network Deployment**:
  - Deploy the network across the campus, ensuring minimal disruption to university operations.

	o Enable EDUROAM authentication and access. • **Data Center Deployment**: o Bring the data center online, migrating services and data as needed. • **Fire Alarm and CCTV Deployment**: o Activate the fire alarm system and integrate it with building management systems. o Ensure CCTV systems are fully operational and integrated with security monitoring stations. **9. Monitoring and Support** • **Monitoring**: o Set up continuous monitoring of network performance, security, and availability. o Implement monitoring solutions for the data center, fire alarm, and CCTV systems. • **Support**: o Establish a support structure for ongoing maintenance, troubleshooting, and upgrades. o Define SLAs with vendors for critical systems support. **10. Review and Optimization** • **Review**: o Conduct a post-deployment review to assess the implementation against objectives and requirements. o Gather feedback from stakeholders to identify any issues or areas for improvement. • **Optimization**: o Make necessary adjustments to optimize performance, security, and reliability. o Plan for future upgrades and expansions based on evolving needs and technological advancements. By following this comprehensive implementation plan, Rawalpindi Medical University will achieve a robust, scalable, and secure network infrastructure, a state-of-the-art data center, and effective fire alarm and CCTV systems, ensuring the institution is well-equipped to meet current and future demands.
Budgetary Arrangements	HEC Funding, RMU own Resources, Annual IT Budget
Risk Management	**User Adoption:** Deliver thorough training and support to facilitate a seamless transition. **System Downtime:** Establish redundancy and failover mechanisms to minimize operational disruptions. **Data Security:** Implement robust security measures such as encryption and multi-factor authentication to prevent breaches.

Datacenter

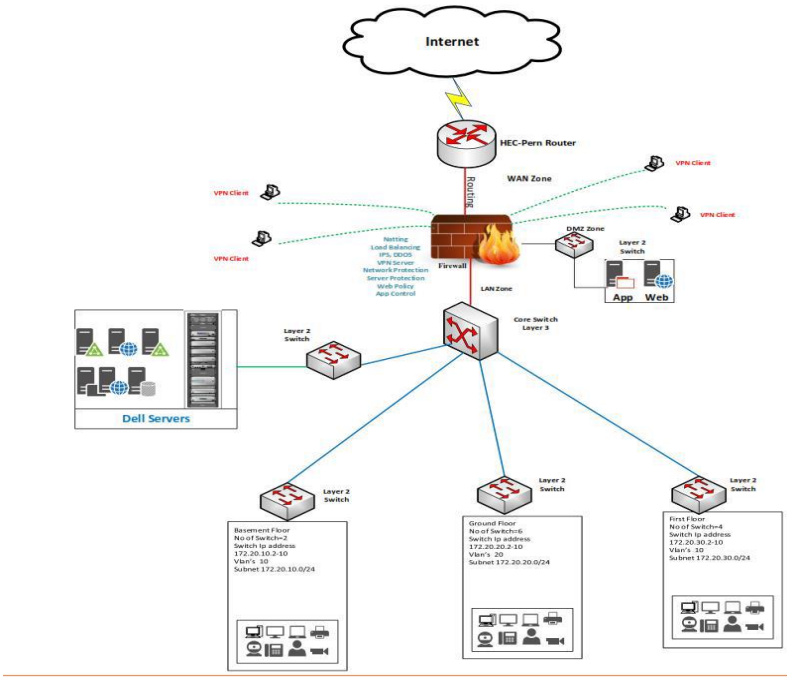
EcoStar
BATTERY

Network Topology

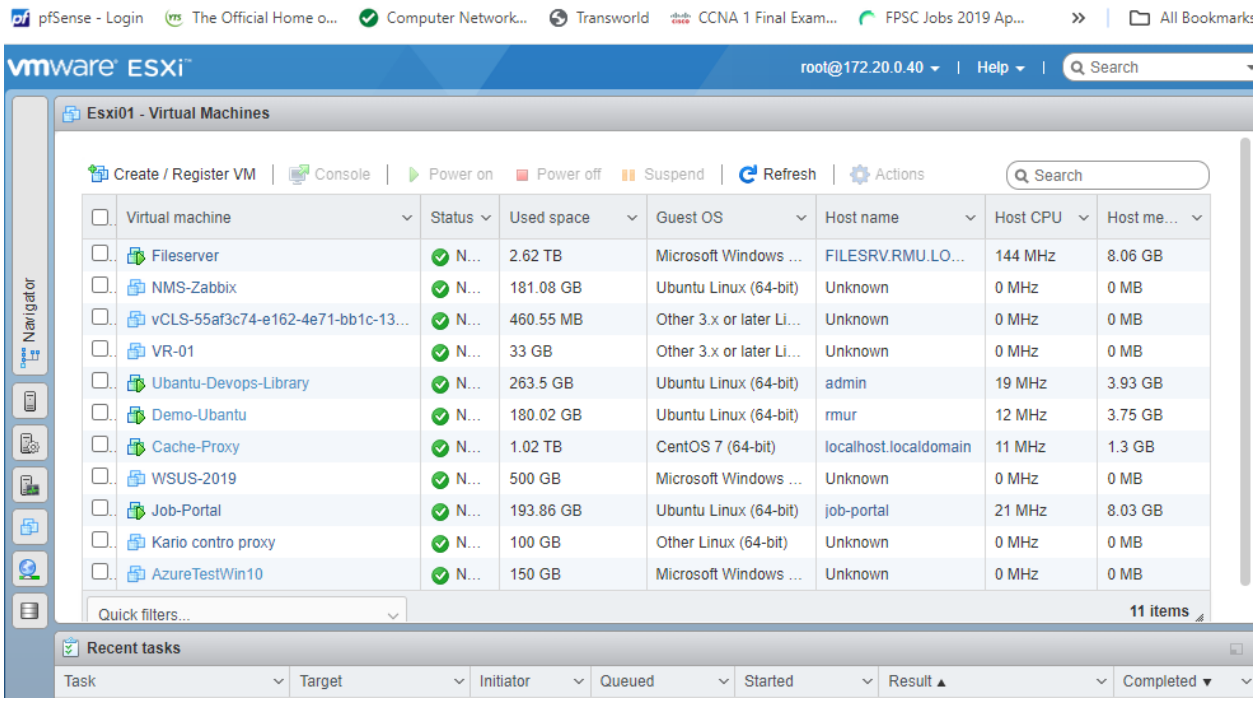


Vlans	Scope	IP Range
10	Basement Floor	172.20.10.0/24
20	Ground Floor	172.20.20.0/24
30	First Floor	172.20.30.0/24
40	Devices IPs (Across Multiple Floor)	172.20.40.0/24
50	DMZ	172.20.50.0/24
60	Exam Department	172.20.60.0/24
70	RearchLab	172.20.70.128/24
100	IT Department (Across Multiple Floor)	172.20.100.128/24

Network Diagram



Virtualization



NMS(LAN)

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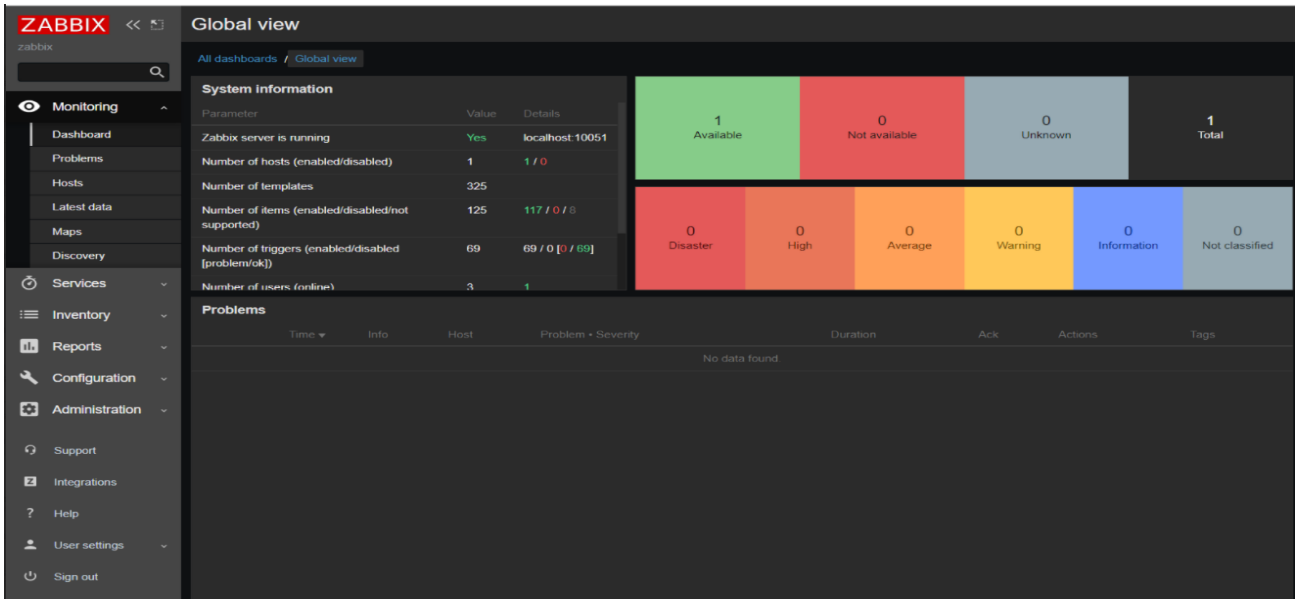
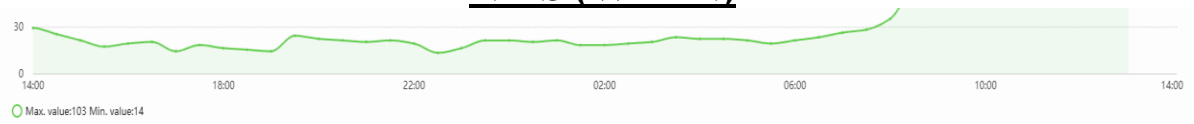
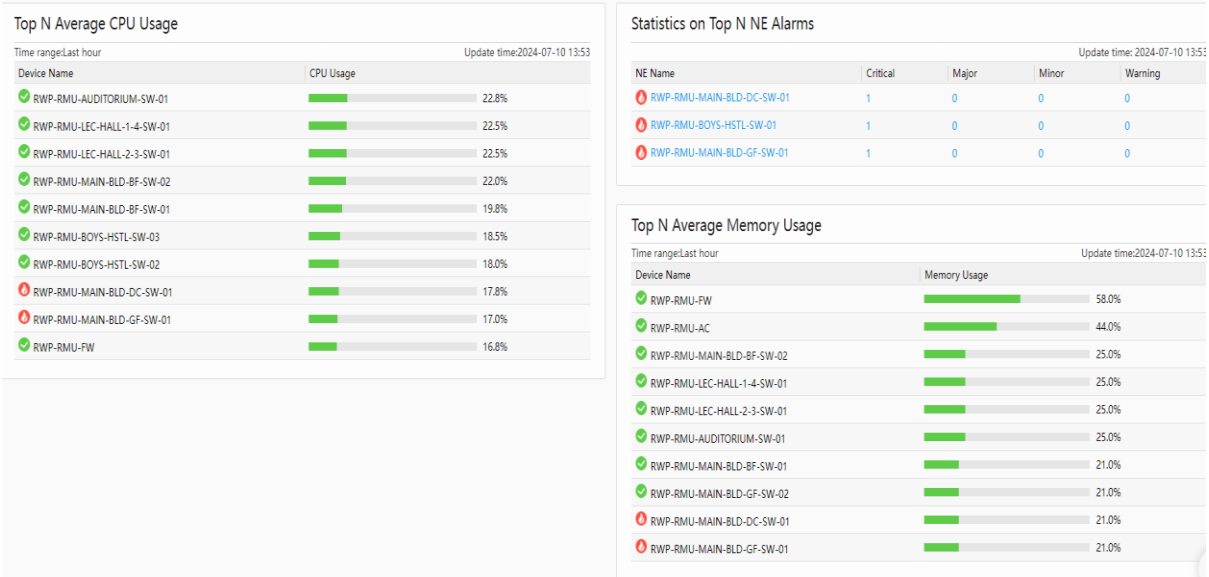
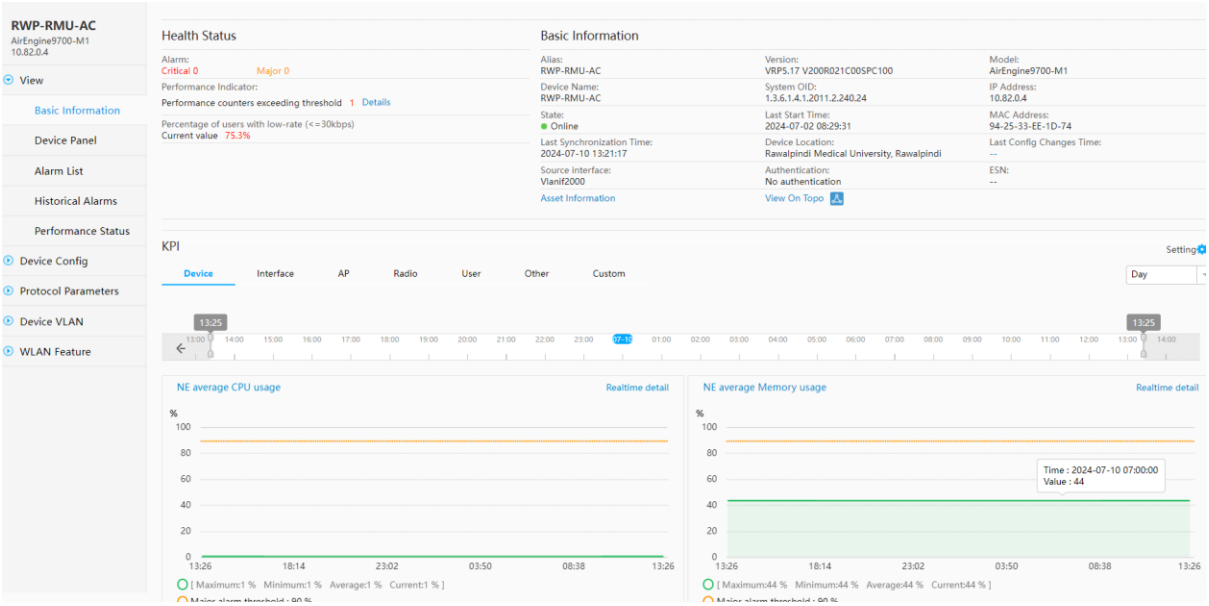


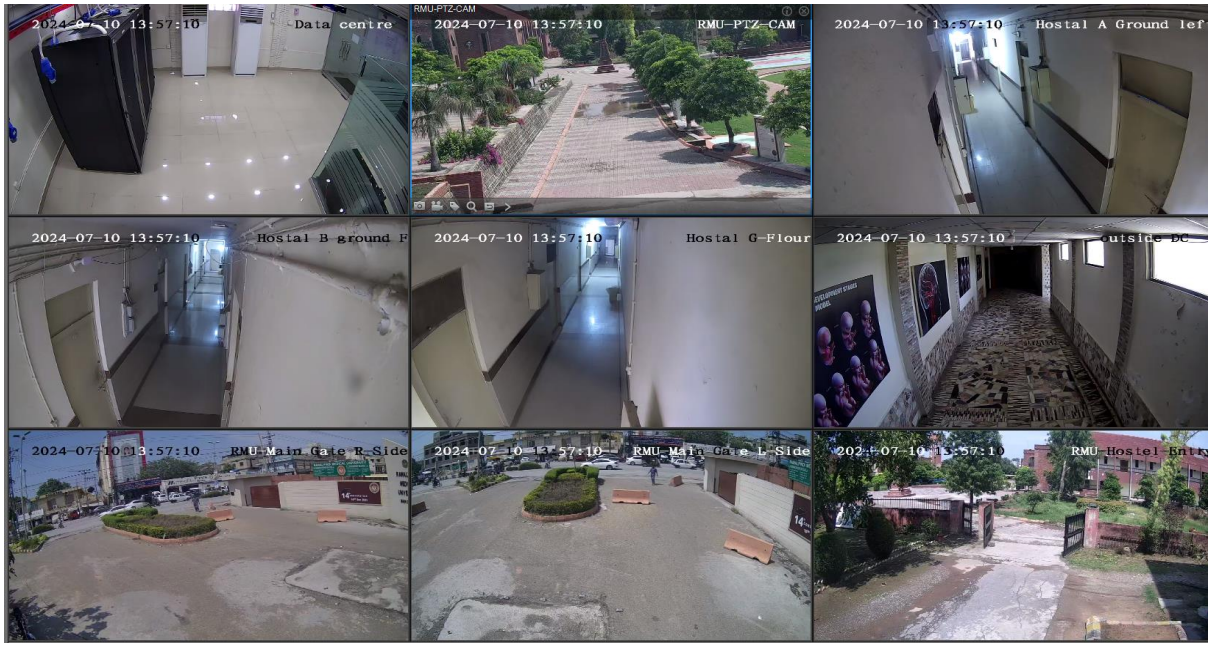
NMS (WLAN)






RWP-RMU-AC
AirEngine9700-M1
10.82.0.4
View
Basic Information
Device Panel
Alarm List
Historical Alarms
Performance Status
Device Config
Protocol Parameters
Device VLAN
WLAN Feature
Health Status
Alarm:
Critical 0
Major 0
Performance Indicator:
Performance counters exceeding threshold 1 Details
Percentage of users with low-rate (<=30kbps)
Current value 75.3%
Basic Information
Alias:
RWP-RMU-AC
Version:
VRP5.17 V200R021C00SPC100
Model:
AirEngine9700-M1
Device Name:
RWP-RMU-AC
System OID:
1.3.6.1.4.1.2011.2.240.24
IP Address:
10.82.0.4
State:
Online
Last Start Time:
2024-07-02 08:29:31
MAC Address:
94-25-33-EE-1D-74
Last Synchronization Time:
2024-07-10 13:21:17
Device Location:
Rawalpindi Medical University, Rawalpindi
Last Config Changes Time:
--
Source interface:
Vlanif2000
Authentication:
No authentication
ESN:
--
Asset Information
View On Topo
KPI
Setting
Device
Interface
AP
Radio
User
Other
Custom
Day
13:25
13:25
NE average CPU usage
Realtime detail
%
100
80
60
40
20
0
13:26
18:14
23:02
03:50
08:38
13:26
[Maximum:1 % Minimum:1 % Average:1 % Current:1 %]
NE average Memory usage
Realtime detail
%
100
80
60
40
20
0
Time : 2024-07-10 07:00:00
Value : 44
13:26
18:14
23:02
03:50
08:38
13:26
[Maximum:44 % Minimum:44 % Average:44 % Current:44 %]

IVS (CCTV)


2024-07-10 13:57:10 Data centre
RMU-PTZ-CAM
2024-07-10 13:57:10 RMU-PTZ-CAM
2024-07-10 13:57:10 Hostal A Ground lef
2024-07-10 13:57:10 Hostal B ground F
2024-07-10 13:57:10 Hostal G-Flour
2024-07-10 13:57:10 Outside DC
2024-07-10 13:57:10 RMU Main Gate R Side
2024-07-10 13:57:10 RMU Main Gate L Side
RMU Hostel Entry

SUMMARY OF SYSTEM IMPLEMENTATION AND IMPACT ANALYSIS	
System Title	Information Technology Infrastructure
Implementation Status	Successful
Implementation Date	April 17, 2022
Proposed by	RMU IT Team
Application Specification Areas	Networking(LAN/WAN/WLAN.), Datacenter, Virtualization,
Supervised by	Hafiz Shahid Rasool (Director IT)
Target Users	Faculty, Students, Researches, Employees, Guests, Technical Teams
Impact Area	Public Sector University (Government of Pakistan)
Current Status	Implemented
Executing Department	Department of Information Technology
Impact Analysis & Conclusion	The successful implementation of advanced IT infrastructure at Rawalpindi Medical University has significantly enhanced the university's research, innovation, communication, and overall operational capacity.These improvements have not only enhanced the academic and research output but also positioned the university as a leader in technological adoption and innovation. Continued investment in IT infrastructure will be crucial for sustaining these benefits and supporting the university's mission to drive excellence in education, research, and community engagement. These technological improvements include access to the latest software and tools, fostering a culture of innovation by allowing researchers and students to experiment with new technologies and methodologies.