Registered in Germany Europa Revue Journal
ISSN: 1862-6564 Vol. 6 No. 4 (2026) Published April 30, 2026

TECHNICAL AND SECURITY BASIS OF DESIGNING FREE AND PAID WI-FI NETWORKS IN UNIVERSITY DORMITORIES

Vahobjonov Islomali

Parpiev Behruz

Turin Polytechnic University in Tashkent, Uzbekistan

Email: i.vaxxobjonov@polito.uz; behruz.parpiyev@polito.uz

Annotation

This article analyzes the technical, organizational and security aspects of organizing free and paid Wi-Fi services in university dormitories. The study is illustrated by the example of the EduWiFi system implemented in the dormitory of the National University of Uzbekistan named after Mirzo Ulugbek. The article considers the relevance of organizing Internet services in dormitories of higher educational institutions of Uzbekistan, the issue of individual Internet connections for students, the inability of students to purchase Internet services from providers as independent individuals due to the fact that dormitory buildings are in the name of a legal entity, and the insufficient signal coverage as a result of the allocation of one Wi-Fi router per floor in the existing infrastructure. In the EduWiFi system, the number and location of access points are calculated based on the signal reaching each room, user identification, billing, monitoring, VLAN segmentation and security requirements. The research results propose a managed, secure, legally sound and scalable Wi-Fi service model for university dormitories.

Keywords

EduWiFi, university dormitory, Wi-Fi, MikroTik, VLAN, captive portal, billing, free Wi-Fi, paid Wi-Fi, network security, access point.

Introduction

In today's digital transformation, the quality of Internet service in higher education institutions has become one of the factors directly affecting the effectiveness of the educational process. Students regularly use e-learning platforms, distance learning, electronic libraries, scientific databases, videoconferencing services, cloud technologies and online communication tools. Especially for students living in university dormitories,

stable, fast and secure Internet connection is becoming an integral part of daily academic activities.

In the conditions of Uzbekistan, the issue of organizing Internet service in university dormitories is of particular relevance. Because many dormitory buildings are in the name of a legal entity, that is, a university or an organization affiliated with it. In this case, a student living in a dormitory usually does not have the opportunity to conclude an independent Internet contract with the provider as a separate individual. Telecommunications services are usually provided on the basis of contractual relations between the operator or provider and the subscriber; an individual or legal entity can participate as a subscriber. Since the dormitory infrastructure is owned or controlled by a legal entity, it is practically convenient and necessary to organize Internet services in a centralized manner.

However, in practice, the Wi-Fi infrastructure allocated to dormitories by the university is often not planned sufficiently. In some cases, it is limited to installing one Wi-Fi router on each floor. Although such a solution seems simple in appearance, if the structural features of the dormitory buildings, wall thickness, room location, number of users and device density are not taken into account, the signal does not reach all rooms equally. As a result, the signal weakens in some rooms, the Internet speed decreases, users are disconnected from the network, and students cannot use educational resources effectively.

Therefore, it is necessary to organize Wi-Fi service in university dormitories not by installing a simple router, but based on professional access points, network segmentation, user identification, billing, monitoring and security policies. This article analyzes the EduWiFi system as a practical solution to this problem.

The importance of Internet service in university dormitories for Uzbekistan

Digital education, electronic resources and distance learning opportunities are expanding in the higher education system of Uzbekistan. Stable Internet access is an important infrastructural condition for students to actively participate in the educational process. Students living in dormitories often rely on mobile Internet or a public Wi-Fi

network as their main Internet source. Mobile Internet is not a permanent and economically viable solution for all students.

Organizing a centralized Wi-Fi service in a dormitory performs several important tasks. First, it creates equal Internet access for all students. Second, it forms a secure and controlled network environment by the university. Third, it allows for fair use of Internet resources. Fourth, it allows you to identify users on the network, monitor sessions, and provide technical support if necessary.

If the dormitory Internet is organized without management, several problems arise. For example, the shared Wi-Fi password may be distributed among students, unauthorized users may connect to the network, some students may occupy the shared channel using a large amount of traffic, and in others the quality of the Internet may decrease sharply. In addition, in a network without user identification, it is difficult to detect security incidents, illegal use, or unauthorized access to internal university resources.

This issue is even more important in the conditions of Uzbekistan, since students living in university dormitories come from different regions and their need for the Internet is high. In the context of digital education, the dormitory Internet is not only a convenience, but also an important factor ensuring the quality of education. Therefore, a separate, secure, managed, and technically sound Wi-Fi model is necessary for dormitories.

Key problems with the current approach

One of the common problems in university dormitories is the incorrect or insufficiently calculated placement of Wi-Fi equipment. In practice, one Wi-Fi router is often installed on each floor, hoping to cover the entire floor. However, the Wi-Fi signal is weakened by walls, doors, reinforced concrete structures, furniture, and other obstacles. If the router is placed at one end of the corridor or in a technical room, the signal quality in distant rooms will not be sufficient.

Dormitory buildings have a high density of users. Each student can connect to the network with a smartphone, laptop, tablet, or other device. This means that the number of devices is much higher than the number of students. Installing one router on one floor

cannot provide sufficient not only signal coverage, but also user capacity. As a result, too many users connect to one device, bandwidth is distributed unfairly, and network outages occur.

Another problem with the current approach is the inability to distinguish between free and paid Internet services. If all users connect to the same network using a common Wi-Fi password, it will be difficult to provide them with different levels of service. For example, features such as minimal free internet, limited time connection, daily or monthly paid tariffs, speed differentiation cannot be effectively managed through a simple router model.

In addition, the issue of security is also relevant. If the student Wi-Fi network operates in the same segment as the main internal network of the university, the risk of unauthorized access to internal information resources increases. In the dormitory network, users can see each other's devices, connect to incorrectly configured devices, scan the network, or create bandwidth abuse. Therefore, the dormitory Wi-Fi network should be separated into a separate VLAN segment and managed by firewall rules.

Conceptual approach to the EduWiFi system

The EduWiFi system is a model aimed at organizing free and paid Wi-Fi services in university dormitories based on technical, security, and billing requirements. This system, unlike the simple router installation approach, is based on the placement of access points, user identification, Internet access control, traffic restriction, payment integration and network security.

In the EduWiFi model, access points are placed based on instructions and technical calculations. The main criterion is to ensure that the signal reaches each room. The location of the AP is determined based on the floor area, number of walls, room location, user density, signal strength and access point capacity. The goal is not only to have a signal in the hallway, but also to ensure a stable connection in every room where students live.

In the system, after connecting to the Wi-Fi network, the user is redirected to the captive portal page. Through the portal, the user is identified using a phone number or login. This approach reduces the anonymity of the user and allows monitoring the status

of network usage. If the user has an active tariff, the system allows him to access the Internet. If there is no active tariff, the user can use the free limit or choose a paid tariff.

In the EduWiFi system, free Internet is maintained as a socially important service. For example, the user can be provided with free Internet based on a limited time, limited traffic and limited speed. This creates a minimum Internet access for all students. Paid Internet is organized on the basis of daily, weekly and monthly tariffs and is intended for users who require a higher quality of service.

After payment, the user status is automatically activated through the billing mechanism. This reduces the need for manual intervention by the administrator and allows for convenient service provision for the user. Payment status, tariff period, user status and session information are monitored through the admin panel.

Security model: VLAN, firewall and monitoring

One of the most important aspects of the EduWiFi system is the security model. The allocation of a separate VLAN segment for university dormitory users is the main technical solution for protecting the internal university network. Through VLAN segmentation, student traffic is separated from the university's administrative, educational or internal service networks.

This approach provides several advantages. First, students cannot directly see the internal network devices. Second, a dangerous or incorrectly configured device on the network does not directly affect the main university network. Third, firewall rules only grant the necessary permissions to access the Internet. Fourth, the monitoring process is simplified, since dormitory users are monitored in a separate segment.

Firewall rules restrict access to the admin panel, router management interfaces and internal servers. It is recommended to access the admin panel only through authorized IP addresses or a special management network. This reduces the risk of brute-force attempts, unauthorized access and disclosure of internal configurations.

The monitoring system plays an important role in the EduWiFi model. It tracks the number of active users, sessions, traffic volume, payments, tariffs, usage of free limits, and network load. This information is necessary to assess the quality of service, identify problems, and make decisions on future network expansion.

It is important to comply with legal requirements when working with personal data. The Wi-Fi system may record phone numbers, IP addresses, MAC addresses, payment status, and session information. Such data should be used only for the purpose of providing services, authentication, billing, and security monitoring. In the Republic of Uzbekistan, the issue of personal data protection is regulated by a separate law.

Results and Discussion

The EduWiFi system offers a comprehensive approach to organizing Internet service in university dormitories. In this approach, signal coverage, user density, security, billing, and monitoring are considered inseparably. It is this aspect that distinguishes the system from the simple router installation model.

In current practice, installing one Wi-Fi router on each floor is often not enough to cover all rooms with a stable signal. In the EduWiFi model, the number and location of access points is calculated based on the real coverage needs. This ensures that the signal reaches each room, users do not overload the access points, and the Internet service is stable. Another advantage of the system is the combination of free and paid Internet models. The free model creates a minimum Internet access for all students. The paid model provides an economically viable service for users who need high-quality Internet. This is also beneficial for the university infrastructure, as it allows you to partially cover the costs of the Internet channel, devices, and maintenance.

The EduWiFi system is also effective from a security point of view. VLAN segmentation separates the student network from the internal university network. A captive portal identifies users. A billing and monitoring system controls user status, traffic, and payments. Firewall rules restrict unauthorized access to network resources.

Conclusion

Organizing Wi-Fi service in university dormitories is one of the urgent technical and organizational issues for higher education institutions in Uzbekistan. The fact that dormitory buildings are owned by a legal entity, students have limited ability to conclude separate internet contracts with providers, the inability of the existing infrastructure to provide sufficient signal to each room, and the security problems of unmanaged Wi-Fi networks require a new approach.

The EduWiFi system is offered as a comprehensive solution to these problems. Access points in the system are planned to ensure that the signal reaches each room. Users are identified through a captive portal. The ability to manage free and paid Internet models in a single system is created. The billing and automatic activation mechanism after payment makes the service convenient. VLAN segmentation and firewall rules protect the university's internal network from dormitory users.

Thus, the EduWiFi model is a practical solution for organizing a secure, stable, legally sound, monitored, and cost-effective Wi-Fi service in university dormitories. This model can also be used in dormitories of other higher educational institutions of Uzbekistan with adaptation.

References

1. Law of the Republic of Uzbekistan “On Telecommunications”. No. ORQ-1015, 27.12.2024.
2. Rules for the provision of telecommunications services. Document registered by the Ministry of Justice of the Republic of Uzbekistan, No. 3762, 26.01.2026.
3. Law of the Republic of Uzbekistan “On Personal Data”. No. ORQ-547, 02.07.2019.
4. MikroTik Documentation. HotSpot — Captive Portal. RouterOS Official Documentation.
5. MikroTik Documentation. VLAN and Bridge VLAN Table. RouterOS Official Documentation.
6. MikroTik Documentation. Firewall and Queue Management. RouterOS Official Documentation.
7. IEEE Std 802.11. Wireless LAN Medium Access Control and Physical Layer Specifications.
8. IEEE Std 802.1Q. Bridges and Bridged Networks.
9. Kurose J. F., Ross K. W. Computer Networking: A Top-Down Approach. Pearson Education.
10. Tanenbaum A. S., Wetherall D. J. Computer Networks. Pearson.