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Design and Implementation of Network Infrastructure at MTSS Salafiyah Al-Falah to Support Digital-Based Education Programs

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Abstract

Currently, in education, all reporting is mandated to be digital-based. Therefore, all reporting related to academic matters, school activities, and operations must use information systems. This community service activity is conducted at MTSS Salafiyah Al-Falah a madrasah type of school. Based on the initial survey conducted at the school, it was found that the school needs computer internetworking infrastructure support for the teaching and learning process as well as for school operational activities, such as recording school, student, and teacher data. MTSS Salafiyah Al-Falah must report monthly, and school exams also need a network infrastructure to ensure that online exams can run smoothly without issues. To address these problems, the community service team from Telkom University offered a solution to the school by designing and implementing the necessary network infrastructure. The network design and implementation results at MTSS Salafiyah Al-Falah provided ease in operational activities, a more stable internet network, and the successful execution of online exams without any issues.

Keywords: *information system, network infrastructure, online exams*

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Introduction

MTSS Salafiyah Alfalah is one of the schools under the auspices of the Ministry of Religious Affairs. This school is located at Ciganitri Street, RT. 01/08, in the district of Bojongsoang, regency of Bandung, as shown in Figure 1. The distance between MTSS Salafiyah Alfalah and Telkom University is about 1.8 kilometers. Based on the accreditation data of the formal education authorities, MTSS Salafiyah Alfalah has been accredited with a score of B since 2019 (BAN-PDM, 2024).

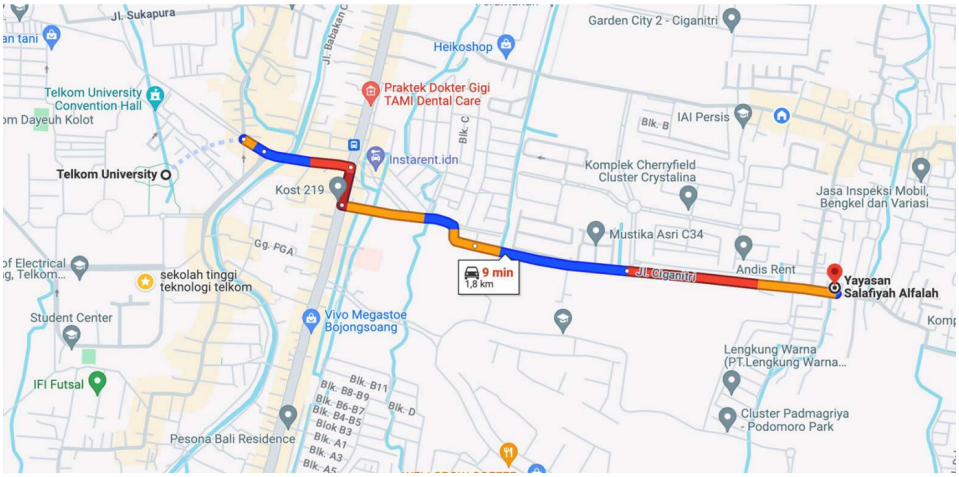

Fig. 1. The location of MTSS Salafiyah Alfalah

The Ministry of Religious Affairs requires *madrasah* administrators to use applications provided by the ministry. MTSS Salafiyah Alfalah is one such school. This requirement from the Ministry of Religious Affairs affects the funding or subsidies received by the school, so the school must fulfill this obligation properly. On one hand, this requirement is beneficial, but it is not well-supported by the facilities and infrastructure available to the *madrasah* or school.

Another obligation that the school must fulfill is to provide classrooms for online exams. The school must provide application operators and, of course, network infrastructure to fulfill the above obligations. The *madrasah* operators are responsible for inputting school data into the server provided by the ministry. Reporting is done through various applications, including ERMIS, SIMPATIKA, ERKAM, SIM-Sapras, ANBK, VERVAL, and others (Ilyas, 2022).

Several community service activities that have previously existed have focused on training for school academic systems (Apriyani et al., 2022; Ariyanti et al., 2022; Dawam et al., 2023; Hadinata et al., 2022; Muhammad et al., 2021). These include developing a web-based

information system to manage academic data in vocational high schools, assisting schools in implementing a vocational high school academic system, and building a website-based school academic system (Bahar et al., 2021; Pangaribuan & Subakti, 2019; Sihombing et al., 2022).

However, there were challenges in providing the applications and ensuring that the operators or school administrators were technologically proficient and that the school's network infrastructure was adequate. Telkom University saw the need for community service activities to help solve the problems faced by this school. Therefore a community service team was assigned with the intention to help solve the problems of MTSS Salafiyah Alfalah by designing and implementing a computer network topology so that several key areas of the school could be covered by the internetworking and school operators can work more optimally to manage the applications. By redesigning and planning the network topology, the team aimed to minimize the risk of network communication failures and optimize the functions of each component used in the design.

Methods

In conducting this community service project, the team followed several stages, as shown in Figure 2. The activities include an initial survey, analysis of partner needs, implementation and configuration, and evaluation.

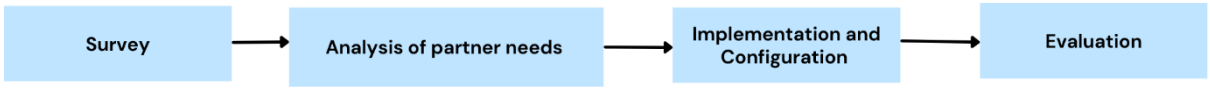

Fig. 2. Methodology

Figure 2 shows the research methodology. Here is a more detailed explanation of the community service activities:

1. Initial survey

   The team conducted a survey to confirm the needs and requirements of MTSS Salafiyah Alfalah. The initial survey aimed to determine the existing condition of network infrastructure at MTSS and future needs for network optimization.

2. Analysis of partner needs

From the survey results, the team tried to formulate the existing needs into a gap analysis of the design topology and detailed the network architecture required. This design serves as a reference for the next steps.

3. Implementation and configuration process.
   In this stage, the team carried out the installation and configuration of the networking devices utilized.
4. Evaluation and closing process.
   The evaluation of the activities was conducted in the form of feedback. This stage was used to review the implementation and configuration results and ensure that no issues might arise in the future.

Results and Discussions

This chapter discusses the results of the community service activities that had been carried out, including the stages of the community service process, the implementation of community service, feedback from the target community, and a detailed discussion.

The community service team members conducted the first survey process to the target community, specifically MTSS Salafiyah Alfalah. The survey was conducted by visiting the MTSS Salafiyah Alfalah school and interviewing the principal. Based on the survey results, it was concluded that there were several weaknesses at MTSS Salafiyah Alfalah in supporting teaching and learning activities, especially in the school's information system and the network infrastructure supporting the school's academic system. The results of the school survey showed that the school only has one access point device, which was currently placed in the school office. Meanwhile, various activities such as online exams in class, meetings in the hall, teaching and learning processes in class, and daily operations in the school office were often carried out but did not get adequate network support. Of the four main activities, three of them did not have optimal network access. Therefore, the Telkom University community service team offered the first solution; the development of network infrastructure at MTSS Salafiyah Alfalah to support better connectivity throughout the school area.

Based on the previous survey results, the community service team began designing a network architecture according to the current conditions of MTSS Salafiyah Alfalah. The network

architecture implemented at the school consists of several devices, including wireless routers, switches, access points, LAN cables, and others. Routers were installed and placed in several positions that support or cover the school area. One router was installed at a previously surveyed point, such as on the front wall of the first-floor classroom. The complete network architecture diagram can be seen in Figure 3.

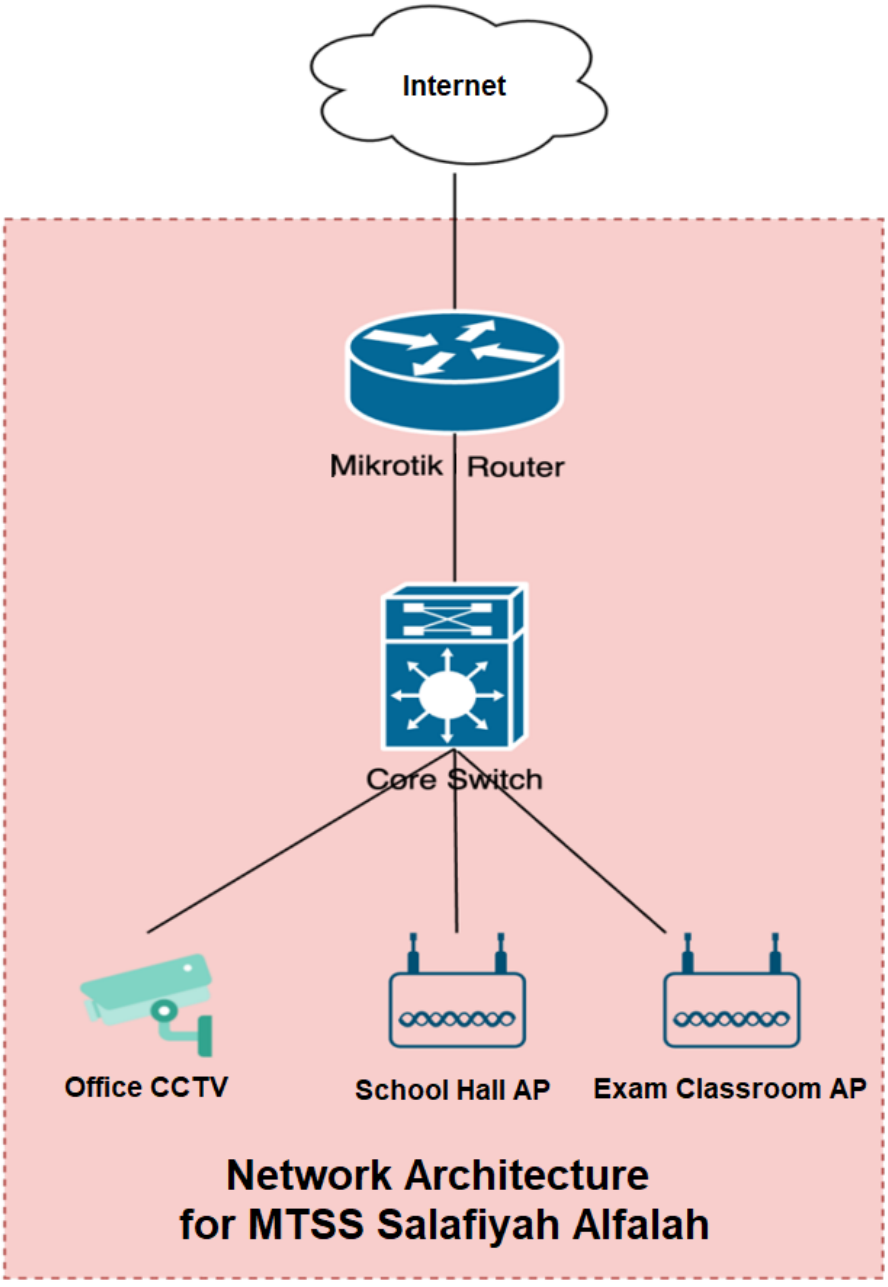

Fig. 3. Network architecture

The next step was to install and configure the devices. The community service team installed routers at several predetermined points and used LAN cables for connections and links between

nodes. After the installation, the router devices were configured. Each device was configured according to the device's needs, such as the device's IP address, gateway IP address, subnet mask, network address, bandwidth allocation, and others.

Fig. 4. Mounting point and router device installation

After the installation and configuration were completed, the testing process began. This was to determine, ensure, and evaluate whether the network design, installation, and configuration processes were correct and connected from one node to another. Figure 4 shows the mounting point and router device installation. Figure 5 shows the switch device installation.

Fig. 5. Switch device installation

After the testing process, further testing involved several users or teachers at MTSS Salafiyah Alfalah accessing the student data input application integrated with the education data management system managed by the Ministry of Religious Affairs. These applications include

the Education Management Information System (EMIS), SIMPATIKA, ERKAM, SIM-Sapras, ANBK, VERVAL, and others. This aimed to determine the network access speed and the bandwidth consumption. Therefore, the community service team could evaluate the implemented network design. Table 1 shows network equipment requirements at MTSS Salafiyah Alfalah. All the devices provided were newly purchased through Tokopedia e-commerce. These devices were selected based on several considerations, including high-quality performance with minimal errors, access points (APs) capable of handling up to 50 simultaneous connections, and pricing that aligns with the available budget.

Table 1. Network equipment requirements at MTSS Salafiyah Alfalah

Device Name	Device Type	Quantity
Wireless Router	Ruijie RG-EW1200 Dual Band 1200M	1
Switch	Tarmoc TSW-1004-1G-1S-52W 4 port	1
LAN Cable	CAT 5E GREY INDOOR	300 meters
Access Point	Ruijie RG-RAP 2200 1267 Mbps	1

The implementation results can be seen in Figure 6, which shows the speed test results at the school. The achieved speed is considered sufficiently good for school needs. Additionally, an online exam trial was conducted with approximately 30 students taking the test simultaneously, and the network operated smoothly without any issues.

The community service activity was attended by the principal of MTSS Salafiyah Alfalah, the vice-principal, class guardians, and subject teachers. The number of participants who participated in the event was 10 people. The community service activity aimed to present and evaluate the previously implemented network design results, provide improvement suggestions, and gather feedback from the target community, including the principal, vice-principal, teachers, and some students. The target community gave the evaluation after trying to access several applications through their web browsers or smartphones. This aimed to elicit improvement suggestions and feedback from the target community.

For the continuity of community service activities, feedback was needed from the activities that have been previously implemented and carried out. The results of the feedback and improvement suggestions from the target community would then be collected and used as evaluation material for the implementation of community service for the next semester or

period. The feedback included six questions discussing community satisfaction with the community service activities and the sustainability program.

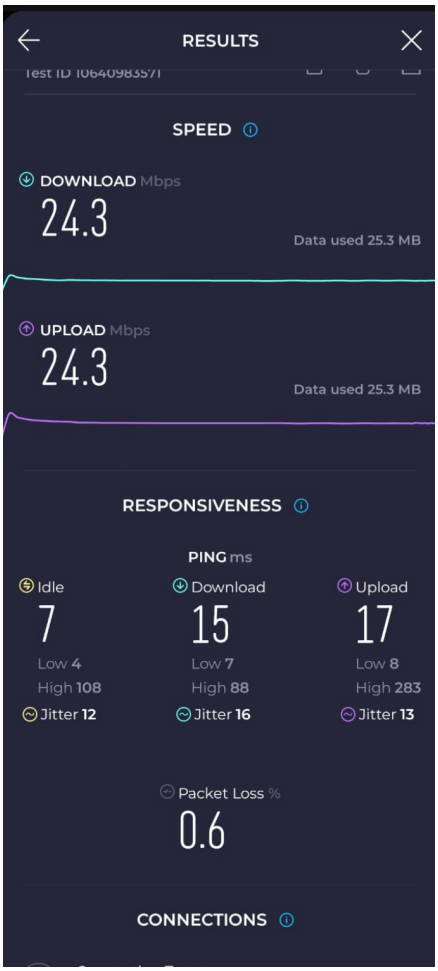

Fig. 6. Internet speedtest

From the total of participants who completed the online survey provided during the community service activity, the results are shown in Table 2 above. Based on the feedback, the training activities conducted have met their needs. Regarding the timing of the implementation, 60% of participants strongly agreed, 30% agreed, and 10% disagreed. Additionally, the organizing team left an excellent impression on the participants. Regarding the content or activities presented, 60% of participants strongly agreed, and 40% agreed that the activities were clearly and easily understood.

Regarding the committee providing good service during the event, 50% of participants strongly agreed, and 50% agreed. Moreover, 80% of participants strongly agreed, and 20% agreed that such activities should continue in future communities. Overall, based on the feedback, the

satisfaction level and the expectation for the continuity of this community service activity is 98%. Therefore, a plan for the sustainability of future community service activities will be continued.

Table 2. The recapitulation of training activity feedback

Evaluation Parameter	Answer Score 4*	Answer Score 5*
Activity material is in accordance with the needs of partners/participants	30 %	70%
The implementation time of this activity is relatively suitable and sufficient	40%	60%
The material/activities presented are clear and easily understandable	40%	60%
The committee provides good service during the activity	20%	80%
The community receives and hopes that activities like this will continue in the future	10%	90%
The offered technology is very beneficial	10%	90%

*The scoring for each statement on a scale of 1 to 5 (where 1 = strongly disagree and 5 = strongly agree)

What makes this service unique was that the network recommendations for schools were tailored to the existing network conditions and heavily depend on the specific needs of each room within the school. Therefore, a thorough survey was essential to ensure accurate and effective network recommendations.

Conclusion

This community service activity aimed to support the academic system and teaching programs at MTSS Salafiyah Alfalah. This was based on the initial survey conducted previously. Amid the development and advancement of information technology today, a network architecture that supports the academic system at MTSS Salafiyah Alfalah is necessary. The impact is that it can help them implement an academic information system, such as managing academic data like attendance records, student data records, semester reports, and other activities. According to reports from teachers who have used the results of this community service activity, accessing

applications integrated with the EMIS academic information system is now very easy and much faster compared to the previous conditions.

Additionally, the utilization of this network implementation has had a direct impact on the online examination process for upper-grade students (Class 9) at MTSS Salafiyah Alfalah, where the online exam process ran smoothly and quickly compared to the previous condition, where internet connections often dropped, causing failures in accessing the online exam system. Based on feedback survey results, the sustainability of such activities is highly expected by the target community. The material provided matches the needs of the target community. The support from the target community was evident when the community service team initially conducted the survey and during the implementation of the community service activity. This was demonstrated by the enthusiasm of the target community in providing space and consumption, as well as helping fulfill the administrative needs required by the Telkom University community service team.

From this community service activity, it can be concluded that schools in Indonesia, particularly MTSS (*madrasah*), require a well-designed internet network infrastructure. This is essential as various school activities, such as online exams, daily operations, meetings, and teaching and learning processes, rely on stable internet access. The network architecture developed in this program can serve as a reference for other schools as a solution to network-related issues in educational environments. By implementing the right network architecture and proper device placement based on needs, internet connectivity can be optimized. Additionally, network expansion and improvements can be carried out more effectively and sustainably.

However, there were challenges in the community service activity process, namely the delayed arrival of the purchased devices, which resulted in a very short time for device installation and configuration. Therefore, in the future, preventive measures are needed so that the community service team can minimize obstacles.

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