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Optimizing the Use of Wi-Fi Bandwidth in the Bumi Jaya Village Office Environment

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Abstract

The efficient management of internet networks in public service environments is critical to supporting productivity and ensuring uninterrupted administrative operations. In Bumi Jaya Village, Pelaihari, Tanah Laut Regency, South Kalimantan, unrestricted use of Wi-Fi particularly for online gaming by local youth had disrupted office activities and compromised service quality. To address this issue, this study implemented the Queue Tree bandwidth management feature on Mikrotik devices, aimed at optimizing network performance and prioritizing essential services. The research was conducted through initial surveys and observations to assess usage patterns and existing infrastructure. A customized Queue Tree configuration was then applied to limit bandwidth for non-essential activities while preserving access. The results demonstrated a substantial improvement in bandwidth efficiency, with administrative and public service tasks receiving consistent and prioritized connectivity. Moreover, the initiative contributed to a more professional work atmosphere, reducing distractions, noise, and improper use of public facilities. Importantly, the program also involved capacity building for village office staff, equipping them with practical knowledge to monitor and manage the network sustainably. This approach not only resolved technical issues but also supported the development of digital governance competencies at the local level. The implementation of Queue Tree proved to be a strategic solution that enhances digital infrastructure, promotes responsible internet use, and fosters a more effective public service environment.

Keywords: Queue Tree; Bandwidth Management; Mikrotik; Network Optimization; Digital Governance.

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Introduction

In the current digital era, the internet has become a fundamental necessity that is inseparable from daily life (Mersereau, 2021). Its presence supports a wide range of essential activities, including communication, education, public services, and employment across various sectors (Connell & Franklin, 1994; Moon, 2001). With its broad accessibility and ease of use, the internet has emerged as a strategic infrastructure for building an information- and knowledge-based society (Blumenthal et al., 2023; Rasool, 2017). Nevertheless, despite its considerable benefits, internet usage also presents serious challenges, particularly in terms of misuse. Phenomena such as access to adult content, online gambling, and addiction to online games have become increasingly prominent social issues (Çelik, 2022; Jerman-Blazic, 2011; Vuorinen et al., 2022). Such misuse not only negatively affects individual productivity but can also have a detrimental impact on mental health and behavior, especially among adolescents and children who are vulnerable to the negative influence of digital media (Gedik & Gulec, 2024; Hidaayah et al., 2024).

Furthermore, network security has become a critical concern in the management of the internet ecosystem, particularly in public spaces such as schools, libraries, and community service centers (Rhodes, 2006). Threats such as personal data theft, malware dissemination, and other cyberattacks pose significant risks to privacy and the sustainability of digital systems (Tonta, 1997). Therefore, collective awareness and comprehensive cybersecurity policies are essential to creating a safe, productive, and responsible digital environment for all segments of society(Zhang et al., 2024). Bumi Jaya Village, located in Pelaihari District, Tanah Laut Regency, South Kalimantan, is one of the regions that face problems related to the use of the internet. Based on the results of observations, the village apparatus reported anxiety due to the high activities of children to teens who gathered in the village office environment to play online games. This activity often disturbs the comfort of village officials and people who visit, because the environment becomes crowded

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and less conducive. More than that, the impact is also seen in cleanliness, with a lot of food and drink waste scattered around the village office pavilion.

This problem shows that the use of internet networks in the Bumi Jaya Village Office has not been managed optimally. The internet, which should support administrative activities and public services, is actually used for activities that are irrelevant and harmful to the environment. This condition causes an urgency to implement policies and technologies that can regulate network use more controlled. One strategic step in network management is the implementation of the Queue Tree method on MikroTik devices. This method enables proportional and flexible bandwidth allocation based on user needs, thereby preventing bandwidth domination by a single device or application (Christanto et al., 2021). With proper configuration, network administrators can allocate resources to productive activities such as administrative services, online learning, and institutional communication, ensuring optimal service quality (Safinatunnaza et al., 2025).

Furthermore, this approach also allows for the restriction of access to non-productive applications, such as online games, without requiring a complete block. The configuration of Queue Tree in combination with the mangle feature provides more detailed control to separate traffic and manage its priorities (Wibowo & Yuswanto, 2023). This is particularly important in educational or governmental institutions that require flexible control without causing user resistance (Prasetyo et al., 2024). Thus, the system can automatically reduce non-essential bandwidth consumption while maintaining user access convenience (Marlina & Perdana, 2022). At SMK Muhammadiyah Prambanan Sleman studied by (Mahendra et al., 2020), WLAN network optimization was carried out to increase the coverage and speed of internet access that were previously limited in several school areas. This effort involves the addition of 10 access points based on the calculation of the budget link and the Multiwall Indoor Cost Propagation Model, which takes into account the attenuation of building materials so that the results are more accurate. The project uses insidder software, Radiowave Propagation Simulator (RPS), and Winbox, and includes security settings to limit access to information, including preventing students from playing PUBG and Mobile Legends games during study hours (07: 00-15: 00).

IDN Boarding School Vocational School in Bogor Regency (Shomad et al., 2022), as a national standard school, has an extensive internet network that covers almost all school environments. However, students often abuse networks to play games and access social media during study hours. This study aims to apply layer 7 protocols on proxy devices to limit access to social media such as YouTube, Instagram, and Tiktok through a proxy system. The results showed that this application was effective in blocking social media applications and online games during class hours, as well as having a positive impact on student learning outcomes. SMKN 1 Praya is a school in NTB that has a fairly good internet facility, but many students use networks to play games and access social media during class. Therefore, this study aims to test the use of packet filtering with proxy as a solution to overcome the problem. The results showed that this system succeeded in blocking access to applications such as Mobile Legends, Free Fire, TOT, and Facebook during study hours (Jayanto et al., 2021).

This study examines the application of Firewalls and Bandwidth Management in Coffee Coffee and Garden in Bandung, which provides WiFi access for visitors. Mikrotik RB941 is used to secure internet access and limit visitors so as not to access unwanted sites. The results showed that this system succeeded in providing proper distribution of bandwidth between staff, employees, and visitors, and was able to block the site in accordance with the network administrator policy (Az-zahra et al., 2021). As a solution based on the analysis of the problems and references above, this service proposes the application of Queue Tree to Mikrotik to optimize the use of internet networks. This technology allows the distribution of bandwidth based on certain priorities, by reducing bandwidth allocation for irrelevant applications or activities, such as online games (for example Mobile Legends, Free Fire, and TOT). With this technology, the internet network can be focused on supporting activities that are more productive and relevant to the needs of village administration, without being disturbed by non-uncensable use.

Method

In its implementation the dedication team as a proposer took an approach and socialization about the activities that would be carried out to establish cooperation with the village apparatus in Bumi Jaya Pelaihari Village located in Bumi Jaya Village, Kec. Pelaihari Kab. South Kalimantan Sea Land is carried out based on the method below Figure 1.

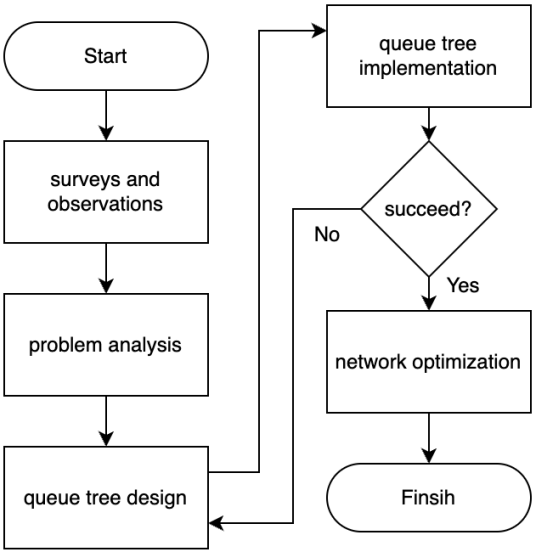

Figure 1. Method of implementing service

In figure 1 the implementation service method consists of Start, the initial stage begins with determining the main objective, which is to optimize the use of Wi-Fi networks in Bumi Jaya Village Office to further support administrative and community service activities, as well as prevent the use of networks for online games that can interfere with productivity. Survey and observation, a survey of existing Wi-Fi network infrastructure was conducted. Observation includes network quality measurements, signal coverage, and identification of network use patterns by connected devices, including access to online game applications. Problem analysis, based on data from the survey, analyzed problems found, such as bandwidth that are not well allocated, decreased internet speed, and high access to online games that are not relevant to the function of the village office. Queue tree gesign, the Queue Tree system design process is carried out to manage the bandwidth allocation effectively.

This design includes restrictions on access to certain sites or applications, especially online games, by utilizing proxy devices for the configuration of Layer 7 protocols. Queue tree implementation, after the design was successfully tested, the Queue Tree system was implemented permanently in the Wi-Fi Network of the Village Office. Reduction of bandwidth allocation for online game access is carried out with the rules that have been designed, so that the network can be utilized for the main needs of the office. Evaluation: Success or not? Design implementation is tested to ascertain whether the Queue Tree system functions according to the purpose. If the results are inadequate, then re -adjust the configuration until it achieves the desired results. Network optimization, this step includes monitoring network performance after the application of the system, such as bandwidth stability, connection distribution, and ensuring there are no obstacles to relevant access to office work. Finished, the final stage is to ensure the entire system runs optimally and achieves the goal of service, namely a more effective Wi-Fi network and supports the activities of the Bumi Jaya Village Office without interference from online game access.

Results and Discussion

Community service activities entitled "Optimization of the Use of Wi-Fi Networks in the Bumi Jaya Village Office through Queue Tree on Mikrotik" successfully carried out well. This activity was attended by 14 Bumi Jaya Village officials who were enthusiastic to participate in every series of events. This activity was motivated by the anxiety of the village apparatus related to the misuse of the Wi-Fi network in the village office environment, especially to play online games that disturb the comfort, cleanliness, and focus of community services. With this service, it is hoped that the problem can be minimized through the implementation of the Queue Tree feature on the proxy device.

The event began with a remarks from the Head of Bumi Jaya Village, which emphasized the importance of internet network management as a major support of public service activities. He also expressed his appreciation for the

implementation of this activity, considering that irregular management of bandwidth has become one of the challenges that must be immediately overcome. The remarks were also given by the Chairperson of the Network Computer Engineering Technology Study Program (Figure 2), which explained the main objective of this service activity, namely to increase the efficiency of network use through appropriate bandwidth management technology.

Figure 2. Greeting coordinator of network computer engineering technology study program

After the opening session, the dedication team began the delivery of material which included the introduction of the basic concepts and benefits of the Queue Tree feature (Figure 3). Participants were introduced to the working principle of Queue Tree as a method for managing network bandwidth allocation. It was explained that this technology allows the priority setting of bandwidth based on the type of activity, so that access to applications or activities is more important, such as community service, can be prioritized than activities such as online games. Participants are given an understanding that with this approach, network problems can be resolved without having to block full access.

Figure 3. Submission of material

The next stage is the direct practice session using a proxy device, which is the core of this service activity (Figure 4). In this session, participants were taught how to configure Queue Tree, ranging from determining bandwidth priorities to the application of bandwidth reduction for certain applications such as Mobile Legends, Free Fire, and TOT. The practice process is carried out in stages, with direct guidance from the service team. Participants who were originally unfamiliar with this technology were finally able to understand and configure independently, showing the success of the transfer of knowledge in this activity.

Figure 4. Direct prectice of microtik devices

The results of the implementation of Queue Tree showed success in optimizing the Wi-Fi network in the Bumi Jaya Village Office. The network bandwidth was successfully allocated in accordance with the predetermined priorities, where access to administrative activities and community services get a greater allocation. Conversely, access to online game applications that are often misused by children and adolescents in the village office environment successfully reduced without blocking them in total. This approach is considered effective in maintaining the flexibility of network use without sacrificing efficiency and productivity. In addition, this activity also provides insight to the village apparatus about the importance of internet network management that not only focuses on solving technical problems, but also supports efforts to create a conducive work environment. Reduction of online game play activities in the village office environment directly has a positive impact, such as reduced noise and increasing comfort of the village apparatus in carrying out tasks. Better bandwidth efficiency also allows the internet network to be used optimally for the benefit of administration and community services.

Figure 5. Question and answer session

Question and answer session (Figure 5) conducted after practice provides space for participants to convey their experiences during practice, as well as questions related to network management using proxy. Some of the questions asked are related to alternative solutions if there is a technical obstacle in the Queue Tree configuration, as well as how to update the bandwidth allocation rules if the network needs change in the future. The service team provides a comprehensive explanation, so that participants are increasingly confident to manage the network independently.

Figure 6. Photo session together

The event was closed with a group photo session to document this activity (Figure 6). Overall, this service activity not only succeeded in providing technical solutions through the implementation of Queue Tree, but also increasing awareness and understanding of the village apparatus about the importance of efficient and sustainable network management. This step is far away at a good start to support Bumi Jaya Village in creating a more productive and comfortable work environment.

The implementation of Queue Tree method on MikroTik devices has proven effective in optimizing Wi-Fi networks and managing bandwidth allocation. This approach allows for prioritizing administrative and public service activities while minimizing access to non-productive applications like online games (Nazila et al., 2023). Queue Tree offers flexible and detailed bandwidth management based on service protocols and ports, utilizing firewall mangle features for traffic control (Prambudi & Rofiq, 2023). Studies have shown that Queue Tree implementation can significantly improve network performance, stability, and user experience (Supendar & Siregar, 2018). Comparative analysis between Queue Tree and Per Connection Queue (PCQ) methods demonstrated Queue Tree's superiority in terms of throughput, delay, and jitter, making it more effective in maintaining network quality and stability (Ridobillah et al., 2024). Overall, Queue Tree implementation on MikroTik devices provides an efficient solution for bandwidth management and network optimization in various settings.

Conclusions

Wi-Fi network optimization in the Bumi Jaya Village Office through the application of Queue Tree on Mikrotik devices has succeeded in answering the main problems related to unproductive internet use. Previous conditions showed that internet networks are often used to play online games, which interfere with the comfort of the village apparatus and the community. By implementing a Queue Tree, bandwidth allocation is managed effectively to prioritize administrative and public service activities without fully blocking access to certain applications. This implementation shows positive results, where access to irrelevant applications like online games can be minimized. The efficiency of the use of bandwidth increases, and the network can better support administrative needs. In addition, the reduction in online game play activities in the village office area creates a more conducive, clean, and comfortable work environment for the village apparatus. This service activity also has a long -term impact, namely increasing awareness and understanding of the village apparatus about the importance of efficient internet network management. The village apparatus now has the ability to manage the network independently, which allows maintenance of the sustainability of the system that has been implemented. This step is a strong basis to support more optimal public services in Bumi Jaya Village.

Contribution: Eka Wahyu Sholeha: Concepts and Design, Analysis, Writing. Herpendi: Editing. Dery Yuswanto Jaya: Concepts and Design, Analysis. Dewi Indra Anggraeni: Manuscript Design, Writing.

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