Development of Campus Hotspot Network Infrastructure using Peer Connection Queue Method based on Voucher System

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Abstract. The use of wireless technology in today's infrastructure has taken a very important role in the development of mobile communications. The use of wireless technology through the Wireless Distribution System (WDS) technique has also been widely applied to the hotspot network infrastructure in the campus area. WDS is a method of developing wireless network infrastructure that enables the development of wireless networks to become more extensive. However, distance and placement between access points become very important factors to consider that cause problem when sending data and when receiving data. Implementation of the PCQ method, which is one of the features of the proxy router, is aimed at ensuring the quality and performance of the network in good and optimal conditions. The quality of data services provided is regulated using a system voucher, the user is divided into several segments depending on the chosen service plan. This research begins with the planning stage which consists of design and topology selection, then continues with the design and implementation phase, and ends with the preparation phase. The test result data will then be compared with the standard determined by TIPHON which is 0% loss, 150 ms delay, and jitter under 75 ms.

1. Introduction

As developments and advances in the field of information technology at the STTM campus, students tend to be more creative and active in the use of information technology facilities that are available at the campus and used by lecturers or students within the campus environment. With the facilities that have been provided by the campus, lecturers or students can make good use of the available facilities. That way lecturers or students are more creative and easy in terms of teaching and learning.

One very rapid change inside the computer network is the use of wireless LAN (WLAN) to access the network both locally and on the Internet. One way to add an access point (AP) does not change the configuration of the software that has been used namely using a wireless distribution system network (WDS). WDS allows for configuration slightly different wireless to increase range wireless network area using several access point devices to become a single unit. There is more than one access point that will transmit wireless with the same SSID. Clients can connect to any access point, depending on the signal from which access point is well determined on the client-side. When a client switches locations...
and disconnects with one of the access points, the client will automatically move to another access point that reaches the client.

WDS works by connecting one Access point with another access point by remembering the MAC addresses of the two access points. To use WDS we have to match the settings of the two access points, be it SSID, password, and MAC address. WDS has many functions, such as expanding network coverage (cover area), increasing network user quota, strengthening the network.

In research conducted by [1], research has been conducted on how to optimize the WDS network infrastructure. Then on research [2], hotspot user management efforts are made so that network traffic becomes better and more efficient. In other studies [3][4][5], the PCQ method is implemented with the aim that the hotspot network becomes more stable and equitable. So that network performance increases so that it can make network service applications such as VoIP more optimal [6]. Network performance testing is done through indicators of test results in the form of output values throughput, jitter, delays, and packet loss.

Figure 1

Network infrastructure design

2. Material and method

Reviewing directly the research object to obtain data relating to research, in its implementation uses the PPDIOO Network method Lifecycle consisting of prepare, plan, design, implement, optimize, operate. PPDIOO lifecycle has four advantages: reducing the total cost of the organization by validating the technology needs to be applied and planning, increasing the availability of the network, increasing the agility (flexibility) of the company determining business needs and strategies used in technology, accelerating access to applications and services by increasing the availability, reliability, security, scalability, and performance of the network.
The design phase is done by making a flowchart diagram that is used in each stage of the bandwidth management system and user design, using the PCQ and Queue Tree methods can be seen in Figure 3.

In implementing bandwidth management and user management is to set the IP address and interface name so that the configuration is easy to do. After setting the IP address then the routing configuration. Routing configuration is used so that the network under the router can connect to the network. Furthermore, configuring bandwidth management includes the configuration of mikhmon as a voucher code and an internet speed limit for each user. Bandwidth management (QoS) using the PCQ (Peer Connection Queue) method on routerboard RB941-2nD-TC. The process carried out by the admin to the system that can do the login process by entering the username, IP address and password, after the login process is done, the admin can go directly to the system management menu in the application such as giving an IP Address, blocking the website, making voucher management bandwidth, and monitoring.[9][10]
The voucher code generated by the mikhmon will then be used by each user when logging into the hotspot network. This voucher is classified into 3 packages namely gold, silver, and bronze. Each of these packages has differences in bandwidth speed and access rights.

3. Results and discussion

Tests carried out on each hotspot package in traffic conditions that are not too dense. The test results can be in the form of bandwidth, throughput, jitter, packet loss, and delay. The scheme is applied in the form of conditions after and before PCQ is applied. The user uses a laptop device in which the dude client application has been installed. This is intended to facilitate network monitoring. The Dude can notify about devices that are connected and not connected. Each device that is connected to the Dude client can find out some information from the device such as the name, IP address, mac address, device condition, and the traffic history of the device.

![Figure 4. Voucher code](image)

The following results are observations of bandwidth traffic using the dude application for each hotspot package.

![Figure 5. Traffic history Information](image)
Table 1. Bandwidth result test

| User      | Packages | Max Bandwidth (kbps) | Non-PCQ (kbps) | PCQ (kbps) |
|-----------|----------|----------------------|----------------|------------|
| Client_1  | Silver   | 512                  | 863            | 487        |
| Client_2  | Gold     | 1024                 | 937            | 943        |
| Client_3  | Gold     | 1024                 | 853            | 952        |
| Client_4  | Bronze   | 256                  | 794            | 243        |
| Client_5  | Gold     | 1024                 | 896            | 967        |
| Client_6  | Silver   | 512                  | 823            | 473        |
| Client_7  | Bronze   | 256                  | 797            | 228        |
| Client_8  | Bronze   | 256                  | 857            | 238        |
| Client_9  | Bronze   | 256                  | 871            | 497        |
| Client_10 | Silver   | 512                  | 912            | 468        |
| Client_11 | Gold     | 1024                 | 892            | 983        |
| Client_12 | Silver   | 512                  | 864            | 487        |

The test results above show that the bandwidth that has been set for each packet can run well, there is no noticeable decrease in performance.

Table 2. QoS monitoring result test

| Test Result | Throughput | Jitter       | Delay        | Packet Loss |
|-------------|------------|--------------|--------------|-------------|
|             | Non PCQ    | PCQ          | Non PCQ      | PCQ         | Non PCQ   | PCQ         |
| Throughput  | 47.46%     | 75.53%       | 78.39 ms     | 47.68 ms    | 36.95 ms  | 29.72 ms    | 23.63%      | 11.47%      |

Based on the above table, the QoS test value before the implementation of PCQ throughput is 47.46%, jitter 78.39 ms, delay 36.95 ms, and packet loss 23.63%. After applying the PCQ method the value of throughput is 75.53%, jitter is 47.68 ms, a delay is 29.72 ms, and packet loss is 11.47%. The application of PCQ has improved the quality of data services, based on the test results obtained an increase in network quality optimization that is 62.82% better throughput, 60.84% jitter, 48.53% packet loss, and 105% shorter delay than without using PCQ.

4. Conclusions

Based on the test results, we can conclude that the application of the PCQ method can improve the quality of network services. The improvement found in this test can be said to be quite significant. The hotspot packet clustering that was previously set can work effectively. Then in terms of the value of throughput, packet loss, delay, and jitter obtained are in a good range according to the TIPHON standard[11].

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