Ontology of QoS for Comparative Analysis of Dynamic Network Protocols OSPFv3 and RIPng in File-sharing

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Abstract: The quality of services offered is vital in file quality requirements for good reasons. All information must be as expected. An Ontology of QoS for the investigation and analysis of network protocols, is the presentation of performance, the results of sampling data from several measurements of QoS parameters. The ability of IPv6 specifications that have a higher capacity than previous versions, as part of the media in sharing resources. It affects the facilities offered in supporting file-sharing services. File-sharing services are activities where Internet users can share files with other internet users by providing data files that first upload a file to the server computer. Then other Internet users can download the file. The dynamic routing protocol in addressing IPv6 RIPng and OSPFv3 can affect performance due to the testing required with QoS parameters. The protocol performance testbed technique is finished by analyzing the results of the process of downloading documents that are done from the server, then observed using Wireshark. The test results in general, the quality of QoS services in the RIPng routing protocol is slightly better than OSPFv3 to be implemented in file-sharing services.

1 INTRODUCTION

The quality of services offered is vital in file quality requirements for good reasons, and all information must be as expected. In this case, it is critical to the design. It breaks down to determine the best quality for sending data in the form of file-sharing with parameters that determine parameters in QoS (Quality of Service). The essential objective of QoS is to give stream need, including devoted transfer speed, controlled jitter, and latency (required by some intelligent and delicate deferral traffic), and improved misfortune attributes (Fahmi, 2018)(Wulandari, 2016). The development of data communication services, for example, voice (VoIP) and video gushing on systems that have constrained cradle space and data transfer capacity. That is cause traffic loads, making VoIP users and video streaming require networks that can provide Quality of Service (QoS) in meeting user needs (Dian *et al.*, 2017).

Essential philosophical research in the building has been applied to a few sorts of studies to consider ontology to be a functioning component as a point of view, firmly identified with the function of the system, manifested through a prototype developed (Rusdi *et al.*, 2019). The QoS ontology approach to network protocol investigation and analysis takes the form of performance presentation, from the results of sampling data from several QoS parameter measurements. The QoS problem raised in the research proposal is whether, between dynamic routing protocols in one type and different types, there are differences in performance. The results of the analysis of the investigation of the performance and characteristics of each dynamic protocol will be used as a basis for thinking in obtaining a gap from each dynamic routing protocol between OSPFv3 and RIPng based on the foundation of QoS ontology. In this way, gathering verifiable usage records and directing QoS expectations, which do not require additional hard work, turns into an interesting methodology. Given the above checks, to provide QoS data to the application designer, we must provide a thorough examination of the approaching QoS estimates (Zhang and Lyu, 2017). The results of the study will make a basic reason for the use of dynamic routing protocols for certain conditions. Whether the routing protocol can affect the files received, this research designs and analyze to prove

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the best quality and provides information on the results of investigating QoS parameters.

2 RELATED LITERATURE REVIEW

The important in research is a literature review to explore the problem of Comparative Analysis of Dynamic Network Protocols using QoS rationale, and things that are reviewed are Computer networks, RIPng, OSPFv3 protocols, FTP, and QoS parameters

The router is a computer network device used for sending data packets to its destination through a process known as routing. Routers are used to connect two or more network groups using different media, such as from Ethernet to Token Ring. The routing process takes place in the third layer of the seven OSI-ISO standard layers.

Nodes store all their data about routes in their routing tables (Glabbeek *et al.*, 2016). Routing is the process of choosing a path on the network used to send data packets to the destination address. The router makes routing decisions based on the destination IP address of the packet (Sun *et al.*, 2019). Routing is a term used to select packet paths from one network to another network that is connected through a router (Zhang and Lyu, 2017)(Ramezani and Jahanshahi, 2017). Routers only pay attention to the destination network and the best path to get to the destination network. Routing on the Internet is generally affected by IP addresses. The new component of the Internet is that the hosts end up and switch the same part of the family tends to, and this greatly influences the directing. The location family is known as the IPv4 address family for 32-bit addresses, and the IPv6 address family for 128-bit addresses (Medhi and Ramasamy, 2018).

Routing Information Protocol (RIP) is a dynamic steering convention. This convention is along these lines named an Interior Gateway Protocol (IGP). This convention utilizes the Distance-Vector Routing algorithm. RIP has likewise been adjusted for use in IPv6 systems, known as the RIPng standard (cutting edge RIP), published in RFC 2080.

OSPFv3 used to support IPV6 according to RFC (Request for Comments) 5340 provisions have a significant difference with the previous version besides modification of Link State Advertising (LSA) to support IPV6 is the use of Router-ID to identify neighbors, use local link addresses to find neighbors. Dijkstra's algorithm is used to determine the shortest path from source to destination in LSDB using the accumulated cost of links on the track (Dhruba Ghosh and Abstract, 2016). Open Shortest Path First (OSPF) is further a modification to support version 6 of the Internet Protocol (IPv6).

File transfer protocol (FTP) allows one computer user to be able to send or receive files to devices on a networked computer. This service provides internet users to upload or download files between local computers and other computers connected to a computer network. FTP applications aim is 1. to promote file sharing (computer programs and or data), 2. to encourage indirect or implicit (via programs) use of remote computers, 3. to protect users from variations in file storage systems among the host, and 4. for reliable and efficient data transfers. FTP, although it can be used directly by users at the terminal, is designed primarily for use by programs.

3 METHODOLOGY OF INVESTIGATION

The investigation is carried out after the design of the test system series, and the realization process is complete. The first step is to install and connect the router, followed by configuration. The next step is capturing the data packet using the Wireshark monitoring application. Tabulating and converting it to a graphical display. The fourth stage analyzes the results of testing the system that has been in graphical form. Obtaining and drawing conclusions from the investigation of each QoS parameter is a process that aims to ascertain whether there are links and gaps between the routing protocol and the specifications of each protocol, through measurement of the fundamental thought of QoS ontology.

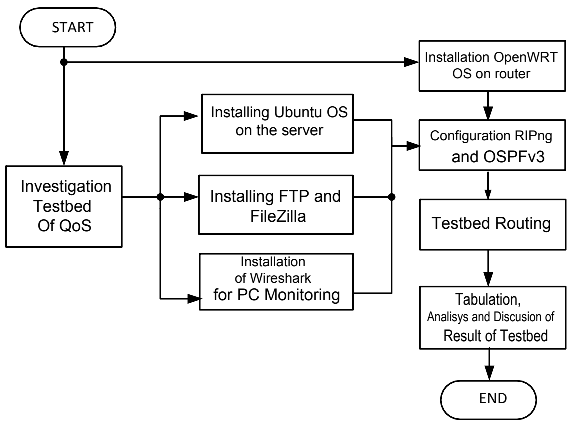

Figure 1 Describes the methodology flow

The server (which has FTP and FileZilla installed) is used to save the file from being downloaded. The router uses four routers, and then uses RIPng and OSPFv3 routing protocol configurations alternately. On the client-side, it will accept file transfers from the server, and everything that happens based on QoS parameters is monitored using Wireshark software. Investigation in the corridor of QoS parameters to testbed the file-sharing process, the realization for the testbed is divided into several stages. Figure 1 is a block flow chart explaining the steps of the system testing methodology realization.

Methodology for the realization of investigation through the testbed of route processing using the RIPng and OSPFv3 protocol methods.

4 QoS PARAMETER AND ALGORITHM

QoS parameters are the basis for measuring the quality of packet network service quality. And base on document of QoS from the Internet Engineering Task Force (IETF) directing to the calculation of QoS parameters, and will be described to logical thinking from the algorithm below.

4.1 QoS Parameter

The Delay. One of the principle QoS factors in voice transmission is the apparent postponement by the client. To permit typical discussion over the network, this defers must be kept practically consistent and underneath as far as possible. If a start to finish delay is excessively high, intelligent correspondence is troublesome or outlandish. A few examinations on delays have been completed and announced in the logical writing; they lead to the accompanying ends in the ITU-T Recommendation record (ETSI-TIPHON, 1999). This deferral is the entirety of a few variables. A few components are brought about by terminal equipment (for example, codec delays or buffering), others are brought about by networks (such as transmission delays) (ITU-T, 2003). All data communication through a computer network significantly experiences latency or Delay.

And for Standard delays that are permitted based on TIPHON (Telecommunications and Internet Protocol Harmonization Over Networks):

Table 1: Standard delays based on TIPHON

Latency Category	Large Delay
Very good	< 150 ms
Good	150 s/d 300 ms
Medium	300 s/d 450 ms
Poor	> 450 ms

(TIPHON)

The Throughput. Throughput is the real transmission capacity estimated by a particular time unit used to move information of a specific size. The best download time is the document size isolated by transmission capacity. While the whole time is the record size separated by throughput. The value of data transfer consumption or bandwidth is calculated in units of bits per second (bps) between the server and client at a specific time. And the definition of bandwidth is the width of the frequency range used by the signal in the transmission media. It was concluded that bandwidth is the maximum capacity of the communication channel used to transfer data in seconds. Function to calculate transaction data. The concept of bandwidth is not enough to explain network speed and what happens on the network. For this reason, the concept of Throughput emerged. Throughput is the actual bandwidth measured at a specific time size in a day using certain computer network routes when downloading files.

The Jitter. Jitter is a variation of delay, which is the difference in arrival intervals between packets at the destination terminal. The Variations of influence jitter in traffic load and the magnitude of collisions between packets (congestion) always exist in the network. The term end-to-end delay is used as a sum of all propagation, handling, serialization, and lining delays in the way as appeared. Jitter characterizes the variety in the postponement. In best-exertion systems, spread and serialization delays are fixed, while handling and lining delays are eccentric (Radivojevic and Matavulj, 2017). The higher the traffic load in the network will cause, the higher the chance of congestion so that the value of the jitter will be even higher.

Permissible jitter standards are based on TIPHON see table 2 below:

Table 2: Standard TIPHON for Jitter

Degradation category	Peak Jitter
Very good	0 ms
Good	0 s/d 75 ms
Medium	75 s/d 125 ms
Poor	125 s/d 225 ms

(TIPHON)

The Packet loss. Packet loss is the number of packets lost during the transmission process to the destination. Lost packets occur when one or more data packets that pass through a network fail to reach their goal.

And for packet loss standards that are allowed based on TIPHON, see table 3 below:

Table 3: Standard *packet loss* based on TIPHON

Degradation category	Packet Loss
Very good	0 %
Good	3 %
Medium	15 %
Poor	25 %

(TIPHON)

4.2 QoS Parameter Calculation Algorithm

The algorithm consists of two phases, as describing and formulae of the component. The QoS parameter consists of four elements, namely, Delay, Throughput, Jitter, and Packet Loss. Based on the document RFC 3644, RFC 5624, and RFC 5777, the paper mentions how to manage these QoS parameters (Snir *et al.*, 2003) (J. Korhonen, Tschofenig and Davies, 2009) (Korhonen *et al.*, 2010). The algorithm below describes the processing of the component calculation.

The calculation of Delay is described in the rationale of the equation algorithm as follows:
Delay = Packet Arrival time - Packet Start time, and the equation becomes:

$$D = (PAt - PSt) \quad (1)$$

And the total Delay is:

$Dt = \sum_{pai=1}^{pai=n} D$, substitute equation (1) to this equation, the equation becomes:

$$Dt = \sum_{pai=0}^{pan=n}(PAt - PSt) \quad (2)$$

where D: Delay, Dt: total Delay, PAt: Packet Arrival time, and PSt: Packet Start time.

Next formulae is Average Delay = total Delay / total Package received, equation becomes:

$$Davg=Dt/TPrec \quad (3)$$

$$TPrec=\sum_{pi=1}^{pi=n} Pri \quad (4)$$

Substitute equation (4), and equation (2) to equation (3), the equation becomes:

$$Davg = \sum_{pai=0}^{pai=n}(PAt - PSt) \ / \sum_{pi=1}^{pi=n} Pri \quad (5)$$

where Davg: average of Delay, Dt: total Delay, Tprec: Total Packets received, Pri: Packets received to i.

The algorithm to get the total variation of Delay is Total Variasi Delay, TvD = (D_2 - D_1) + (D_3 - D_2) + (D_4 - D_3) + ... + (D_n – $D_{(n-1)}$, and formulae becomes:

$$TvD = \sum_{n=1}^{n}(D_n - D_{n-1}) \quad (6)$$

where TVD: Total Delay variations, Dn: Delay n, and Dn-1: Delay n-1.

The following is the Throughput calculation that is described in the equation algorithm as follows:
Throughput = Total data packets successfully passed / Time of observation; the equation becomes:

$$Thpn = Tdpp / Tobs \quad (7)$$

$$Thpn = \sum_{pn=0}^{pn=n}((T_{dpp} + P_{dpn+1})/ \sum_{pto=1}^{pto=n} Tobs) \quad (8)$$

where is *Thpn*: Throughput, and *Tdpp*: number of data packets that successfully passed the nth, units in bit b, Pdpn is: Data packets that successfully passed, units in bit b, and then Tobs is: Length of time observed, units in seconds s.

The next algorithm is the Jitter, the equation as follows: Jitter = Total variation delay / (Total packets received -1).

$$Jt = TvD \ / \ (TPrec - 1) \quad (9)$$

Substitute equation (6), and equation (4) to equation (9), equation becomes:

$$Jt = \sum_{n=1}^{n}(D_n - D_{n-1}) \ / \ (\sum_{pi=1}^{pi=n} Pri - 1) \quad (10)$$

and where is Jt: Jitter, TvD: Total variation of delay.

And how the algorithm for calculating packet loss, the answer is as follows: Packet loss = (Data packet successfully passed - Data packet received) / Data packet sent x 100% or Plo = ((*P*dpn – Pprec) / Pdst) x 100%, becomes:

$$Plo = ((\sum_{pn=0}^{pn=n}(T_{dpn} + P_{dpn+1}) - \sum_{pi=1}^{pi=n} Pri - 1) \ / \ \sum_{pi=1}^{pi=n}(Tdst + Pdst)) \times 100\% \quad (11)$$

All the QoS parameter equation algorithms mentioned above are used to investigate and process data obtained from the testbed results, displayed in the form of line graphs.

5 TESTBED AND ANALYSIS

Testbed Results from The measurement of QoS parameters of the routing protocols is performed using data capture from WireShark. The results are tabulated and then processed into a graph to facilitate analysis. The results graph and analysis is shown in the following view:

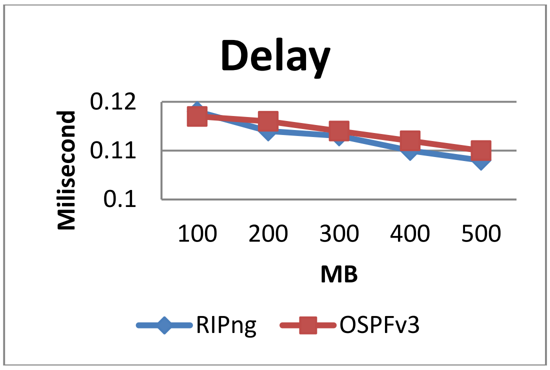

Figure 2: Delay Diagram of RIPng and OSPFv3 protocols

Delays in the RIPng and OSPFv3 routing protocols were found to show no significant differences. RIPng has a better delay value with an average value of 0.112 milliseconds than OSPFv3 which has an average value of 0.113 milliseconds because the processing time is slightly longer in OSPFv3, such as doing a metric calculation

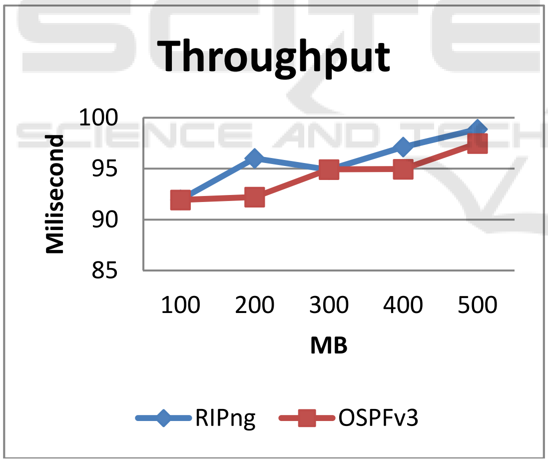

Figure 3: Throughput Diagram of RIPng and OSPFv3 protocols

The Throughput that is looks significantly different from small to large data. And from the results that prove RIPng has a not better average throughput value of 95.777 Mbit / sec compared to OSPFv3, which has an average value of 94.296 Mbit / sec. According to the working principle of OSPFv3, which provides data packets that are not sent usually or packet loss, it will be sent back from the data packet. The Throughput that looks very significantly different in sending from small data to large data, results that prove OSPFv3 has kind of better.

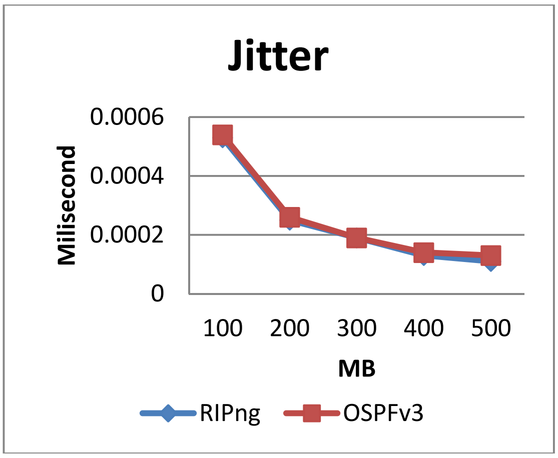

Figure 4: Jitter Diagram of RIPng and OSPFv3 protocols

The jitter obtained on RIPng and OSPFv3 does not show a significant difference. Even partially coinciding line graphs appear, but where RIPng has a better average value of 0,00012 milliseconds compared to the OSPFv3 protocol which has an average value of 0,00013 milliseconds because the RIPng jitter value is smaller than OSPFv3.

Jitter is a variation of the delay, the difference in the arrival interval between packets at the destination terminal. Variations influence jitter's existence in packet traffic load and the magnitude of collisions between packages. The subsequent analysis is a result of Packet Loss.

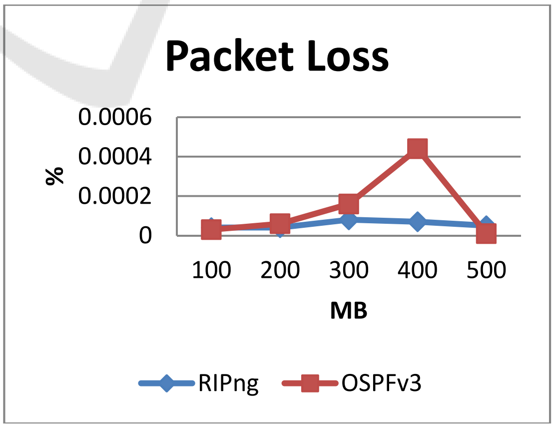

Figure 5: Packet Loss Diagram of RIPng and OSPFv3 protocols

Package Loss obtained from the results of the RIPng Testbed has a smaller average percentage value of 0.00005% compared to OSPFv3 with an average value of 0.00025%, so packet loss has a

tremendous amount will affect *throughput, delay, and jitter*.
The results, in general, the Quality of Service RIPng routing protocol, is better than OSPFv3 to be implemented in the file sharing service.

The data and result shown above is the process and results of the testbed, then the research conducts an investigative analysis with the following results:

1 The results of smaller delay measurements occur in the RIPng protocol compared to OSPFv3, and this is a state of network performance on the RIPng routing protocol that is better than OSPFv3.
2 In the comparison Throughput graph, it appears that the larger the file, the higher the throughput, can be seen in Figure 3. This provides an overview of network performance shown by throughput.
3 The smaller the Jitter test, the better the network. In the graph that evaluates the RIPng routing protocol with lower jitter values compared to the OSPFv3 routing protocol, the RIPng performance is not better than OSPFv3.
4 In testing, the Packet loss obtained on OSPFv3 is relatively more significant at the time of interruption of the queued data packet.
5 The measurement results of a smaller delay occur in RIPng compared to OSPFv3, and this is a state of RIPng routing network performance that is better than OSPFv3. The factors that cause RIPng delays are better because the processing time is slightly shorter than the OSPFv3 routing method. Such as performing metric calculations.

4 CONCLUSIONS AND FUTURE WORKS

Conclude that the results of QoS measurement data analysis are based on RIPng, and OSPFv3 routing protocols in file-sharing services using four routers found that QoS performance increased with different file sizes directly proportional.

The results of QoS testbed the RIPng routing protocol is slightly better than OSPFv3 to be implemented in file-sharing services. They were becoming a new thought to investigate alternative algorithms for Dijkstra routing.

In the future, there are several issues to enhance further research, the following are those that can be used for new research: expand discussions about routing, comparisons between routing methods, on one or two different types of ad hoc protocols and research on security issues. Delivery and routing media can vary; further analysis can be developed by adding a router or replacing it with a mini cellular router device with a different type, with different routing protocols.

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