# Routing Protocol RIPng, OSPFv3, and EIGRP on IPv6 for Video Streaming Services

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**Abstract—The growing of the internet use is proportional with the growing of IP address needs, but the increasing of the IP use is not equal with the number of available IPv4. Then, IPv6 was developed as a solution to overcome the limited amount of IPv4 address. Readiness of various aspects ranging from infrastructure to a service provider is required to implement IPv6. In order to improve the quality of IPv6 networking services, the network management is very necessary; one of them is by using a routing protocol. This study used a routing protocol RIPng, OSPFv3, and EIGRP for IPv6 that have work way with different algorithms. We compared those routing protocolsusing Quality of Services criteria (delay, packet loss and throughput). The data collection method got from a literature and simulation method. They have 8 stages simulation (problem formulation, conceptual model, input/output data, modelling, simulation, verification/validation, experimentation, and output analysis) for streaming video services. The results of research was indicate that the EIGRP routing protocol has better Quality of Services criteria (delay, packet loss and throughput) than RIPng and OSPFv3 for video streaming services.Routing Protocol EIGRP has an average value of 14.2 ms delay, packet loss 2.5%, and the throughput of 714.1 Kbit/s.**

**Keywords—Routing Protocol, Delay, Packet Loss, Throughput, SimulationMethod, RIPng, EIGRP, OSPFv3, Video Streaming**

## I. INTRODUCTION

The widespread use of the Internet is directly proportional to the evolving needs of the IP address. However, the increase use of IP is not matched by the number of is available. It has been around for over twenty years, the Internet is growing use IPv4. IPv4 provides all the 32-bit IP address or IP address a number of 232 pieces. IP address allocation as much as it was originally considered sufficient. Until 1991, there is a fear that one day number of devices connected to Internet will exceed the capacity of IPv4. That concern prompted experts to formulate internet protocol version newer. After experiencing a long journey, eventually forming a new protocol called Internet Protocol version 6. [6]

In 1998, the IETF which is an organization that encompass many parties in the development of computer networks and the Internet establishes a new addressing standard called IPv6 (RFC 2460). The main purpose of the development of IPv6 in order to meet the needs of IP addresses for the long term as well as enhance existing shortcomings in the previous version of IP. IPv6 [2] is designed in such a way to greatly exceed the capacity IPv4 commonly used today. The features of the future internet applications made possible by the implementation of IPv6 technology. In terms of the number of addresses, IPv6 can support 2128 addresses fruit. This is a very significant growth of IPv4 and the amount is more than enough to solve the problem of supply of IP addresses for a very long time. IPv6 architecture is also designed to resolve problems arising in permanently IPv4 technology. Most of the advantages of IPv6 is an integrated network security, the ability to multicast, support for high mobility and quality of service which is much better than its predecessor in favor of the convergence of information and communication technology.

In the implementation of IPv6 along with the increasing number of applications on the Internet there are some problems such as limited bandwidth for multimedia applications (audio and video). In order to improve the quality of network services indispensable good traffic management and resource-efficient, either by using a routing protocol[4]. Routing protocols are needed because of their role as a determinant of the path a packet to a destination. In a more complex network there are many possible paths to pass a package it needed the dynamic routing protocol. Dynamic routing protocol is a routing protocol to determine their own routes based on the situation and conditions at any time as well suited for networks that have many routes / track or route changes and dynamics that often occur. Some dynamic routing protocol that is applied to IPv6 is RIPng, OSPFv3, and EIGRP for IPv6. Their's algorithm or process are an entirely types of routing protocol distance vector which emphasizes the determination of routing based on the shortest distance between the point of origin of the package with the destination point by counting how many hops or jumps that must be passed by the packet before reaching the destination, then OSPFv3 is a type of routing protocol link state routing that

focuses determination made based on information about the current status of the router condition of each link is connected and obtained from other routers, while EIGRP is a hybrid routing protocol that works is a combination of distance vector protocols and link state. [5]

Utilization use the IPv6 routing protocol is also diverse. One example in the use of video-based digital broadcasting system (streaming). Below is a statistical number of subscribers Netflix (streaming) worldwide from 2011 to 2015 :

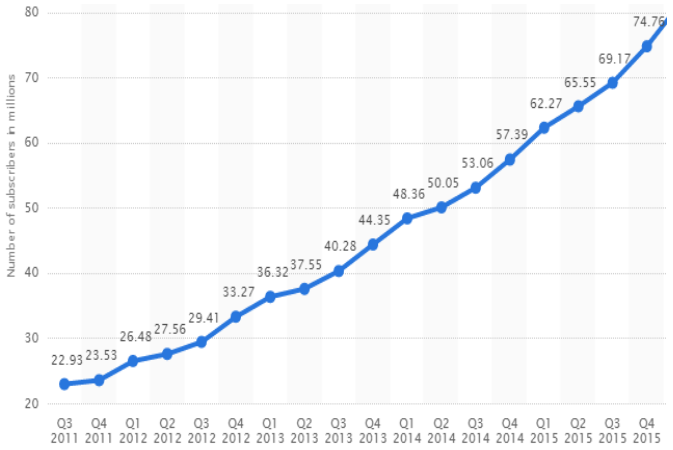


Figure 1. Statistics Netflix Subscribers Worldwide [7]

Referring to statistics from Statista, Netflix is a company that offers services via streaming media world today. After experiencing growth, Netflix already has tens of millions of customers streaming in the entire world. In the fourth quarter of 2015, Netflix has more than 74 million subscribers, three times the previous subscribers in the third quarter of 2011. The largest increase occurred in the number of subscribers between the third quarter 2015 and fourth quarter 2015, with the increase of 5 million streaming subscribers. It proves that the needs of streaming video services will continue to increase over time, to the required quality of service and network management either by using a routing protocol for streaming video services.

## II. RELATED WORK

### 2.1 IPv6

IPv6 is a protocol designed to address the demanding requirements of end-to-end service, mobility, and security and address the growth rate of the Internet.

When the Internet switched from using Network Control Protocol to Internet Protocol in 1983, IP is not a protocol as we know it today. Many extensions are commonly used and developed in subsequent years to meet the growing Internet requirements. At that time IPv6 support has spread beyond the basic network infrastructure and continues to expand.

It is important for us to get to know IPv6 as early as possible because its use can not be avoided in the long term. For example, if IPv6 is included in strategic planning in the future, if we consider the possibility of previous integration scenarios, and if the introduction is considered when investing in IT infrastructure, we can save costs and enable more efficient use of IPv6.

### 2.2 Routing Protocol

a. RIPng

Just like its predecessor IPv4, routing protocol was first introduced in IPv6 is RIPng. That routing protocol based on the distance vector algorithm. Most of the concepts in the same RIPng like RIPv1 and RIPv2. RIPv1 (RFC-1058) and RIPv2 (RFC 2080).[3]

RIPng uses a simple mechanism to determine the metric of a route. The process of calculated the number of routers to the destination. Each router is considered as one hop. Route with distance greater than 16 is considered unreachable. Router regularly distribute an information about route to a nearby router connected directly using a RIP response message. The next response message received from the RIP neighbor, the router adds to the distance between neighbor routers to route received any metric. The router procesed the new route entries, it was using Bellman-Ford algorithm. The first router initialized and it only know that the route connected directly. The information is forwarded to entirely neighborrouters, processed and then distributed to other neighboring router. Finally, all of these IPv6 is recognized by all routers. The router continues to send a response message at regular intervals to prevent a valid service order not stop. The time required for entirely router to learn these newly identified is called the time to convergence.[3]

b. OSPFv3

OSPFv3 for IPv6 is a modification of OSPFv2 running on IPv4. Basics OSPFv2 for IPv4 remains unchanged. The Some of the changes that exist only on increasing the size and change the address for the IPv6 protocol semantics between IPv4 and IPv6.[3]

OSPFv2 (RFC-2328). In addition to these documents, several extensions to OSPF (RFC-1584). Describes IPv4 multicast extensions to OSPF (RFC-1584). Added a NSSAs into OSPF (RFC-3101). OSPF modified to support the flow of information for IPv6 routing (RFC-5340). OSPFv3 classified as IGP and used in the autonomic system. OSPFv3 is designed to overcome some of the limitations that exist in the RIPng, such as the size of a diameter, time ofconvergence, and metrics that don't reflect the characteristics of the network.OSPFv3 routing tables to handle much larger to accommodate a large number of routes.[3]

c. EIGRP

EIGRP is an IGP developed by Cisco which is running on an AS called EIGRP domain. The goal of EIGRP is to eliminate the limitation of distance vector routing protocol (RIP) without having to switch to link state routing protocol (OSPF). In the link state routing protocol with its database requires higher CPU cores performance and more RAM consuming router. Therefore, although EIGRP developed as distance vector protocols but has a function that combines features of both distance vector

protocols and link state protocol so-called hybrid. EIGRP uses DUAL to calculate the route. It enables the rapid convergence and ensure loop free operation at every calculation of all these. EIGRP also supports protocols on different network layers. For every network layer protocol, EIGRP run different modules (IPv4, IPv6, AppleTalk, IPX). The basic function is still the same for all protocols. Different protocols are implemented using the protocol area TLVs. Cisco EIGRP develop as an open stack.[3]

### 2.3 Video Streaming over RTP

Real-time Transport Protocol with User Datagram Protocol is a one-way IP-based network protocol designed for real-time multimedia traffic. Because UDP is a connectionless protocol that can be missing packets and has problems in a firewall. On the other hand streaming video usually uses HTTP with a two-way connection that resends data packets in case of damage during the distribution video. Thus HTTP guarantees all data will eventually be delivered perfectly to the destination. Characteristics of highly compressed streaming video data packets are very sensitive to information, which is particularly unstable. Thus the practical protocol and can minimize the package is more desirable for streaming video over the internet, the delay should be calibrated well. HTTP is a standard protocol for data transmission that is widely used because it can work with many web servers and existing infrastructure, including CDNs, cache, firewalls, and NATs. Improved security for streaming can be achieved through more secure protocols such as HTTPS.

## III. THEPROPOSED SOLUTION

A Next Generation Network is an interesting innovation that mainly drives to reduce costs on the side of service providers while at the same time enhancing the capabilityof a given network to stay open to new services and applications. This innovation basically involves the transformation of public switched telephone networks (PSTN) which are circuit-based networks into packet based networks that mainly depend on Internet protocol. Therefore, it is one of those innovations to change the telecommunication industry forever.

Routing can be defined as transmitting information from asource to a destination by hopping one-hop or multi hop. Routing is carried out by devices known routers whose major objectives are; making routing decisions, construct routing tables to facilitate communication and sharing information amongst neighboring routers in the network. One way in which these objectives are achieved is through routing algorithms, the latter use a variety of metrics as a way of determining the best path of reaching a preferred network. A routing protocol can either be a distance vector routing protocol or a link state routing protocol; distance vector protocols operate mainly by passing duplicates of their routing tables to neighboring routers while link state routing protocols rely on advertising a list of available neighboring routers to a point where all the routers in the networks have a duplicate of this list; with this information the routers then run algorithms to analyze and select the best path available to transmit the packets.

Video streaming is the real time delivery process of videoto the user's media player services [1]. Normally, streamed video takes on the notion of being played as it downloads, compared to when the user first downloads the video and then plays it on their video application. In the ‘real time delivery process’, the video has various requirements with regards to delay, and bandwidth.

## IV. THE SYSTEM MODELS AND ASSUMPTION

### 4.1 Simulation

This stage are collecting some data and then observed network conditions that today's increasingly complex, and found the main problem lies in testing the performance of routing protocols in IPv6 networks, for it was performed in a simulation using several stages of them, namely :

#### 4.1.1Conceptual Model

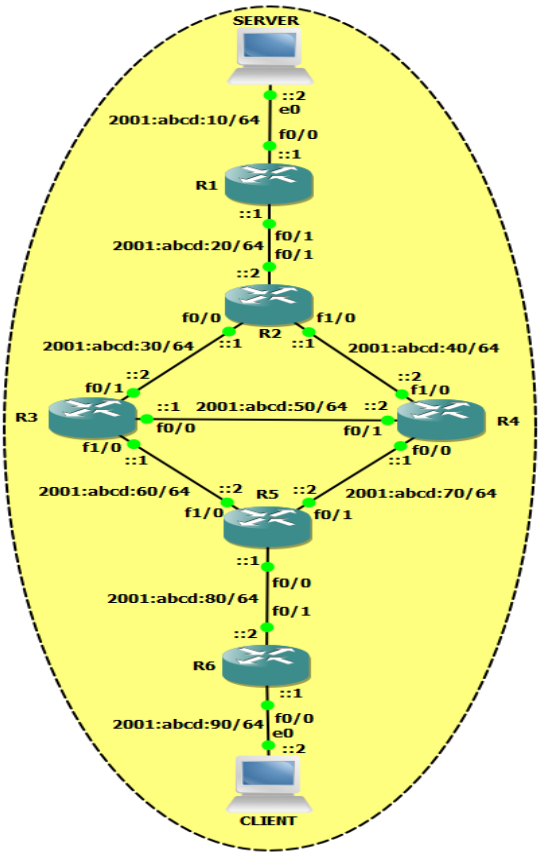


Figure 2.Network Simulation Topology

At this stage of the manufacturing conceptual model describes the network topology to adjust to the concept of routing protocol RIPng, OSPFv3, and EIGRP for IPv6. The conceptual model is designed as a reflection of the network topology in the real world. Simulations run using GNS3 and server / client using VirtualBox.

In the picture above is a network topology that will be evaluated, there are three (four) main components:

1. Server andClientused one server for distributed video streaming file to clientand one client for receiving video streaming.
2. Router, using 6 (six) c3725 Cisco router-based routing protocol which in there RIPng, OSPFv3, and EIGRP for IPv6.
3. Wireshark, use Wireshark application to monitoring the course of the distribution of video streaming from the server to and accepted by the client.

4.1.2**Modeling**

At this stage in the evaluation will run some kind of test scenarios are different, each scenario tested 5 times for each type of video format. In each scenario has a total of 15 times testing, while total research scenario is as much as 90 times. Scenarios are created, among others:

- Scenario 1 RIPng

Table 1.Scenario 1

| **Parameter** | **Format Video** | | |
|---|---|---|---|
| | .avi | .mkv | .mp4 |
| **Length (s)** | 29 | | |
| **Size (MB)** | 2 | 1.9 | 2.1 |
| **Screen Resolution (pixel)** | 240p | | |
| **Video/Audio BitRate** | 512/64 | | |

- Scenario 2 RIPng

Table 2. Scenario 2

| **Parameter** | **Format Video** | | |
|---|---|---|---|
| | .avi | .mkv | .mp4 |
| **Length (s)** | 29 | | |
| **Size (MB)** | 3.4 | 3.3 | 3.3 |
| **Screen Resolution (pixel)** | 480p | | |
| **Video/Audio Bit Rate (KB/s)** | 768/128 | | |

- Scenario3 OSPFv3

Table 3. Scenario 3

| **Parameter** | **Format Video** | | |
|---|---|---|---|
| | .avi | .mkv | .mp4 |
| **Length (s)** | 29 | | |
| **Size (MB)** | 2 | 1.9 | 2.1 |
| **Screen Resolution (pixel)** | 240p | | |
| **Video/Audio Bit Rate (kb/s)** | 512/64 | | |

- Scenario 4 OSPFv3

Table 4. Scenario 4

| **Parameter** | **Format Video** | | |
|---|---|---|---|
| | .avi | .mkv | .mp4 |
| **Length (s)** | 29 | | |
| **Size (MB)** | 3.4 | 3.3 | 3.3 |
| **Screen Resolution (pixel)** | 480p | | |
| **Video/Audio Bit Rate (KB/s)** | 768/128 | | |

- Scenario 5 EIGRP

Table5. Scenario 5

| **Parameter** | **Format Video** | | |
|---|---|---|---|
| | .avi | .mkv | .mp4 |
| **Length (s)** | 29 | | |
| **Size (MB)** | 2 | 1.9 | 2.1 |
| **Screen Resolution (pixel)** | 240p | | |
| **Video/Audio Bit Rate (KB/s)** | 512/64 | | |

- Scenario6 EIGRP

Table 6. Scenario 6

| **Parameter** | **Format Video** | | |
|---|---|---|---|
| | .avi | .mkv | .mp4 |
| **Length (s)** | 29 | | |
| **Size (MB)** | 3.4 | 3.3 | 3.3 |
| **Screen Resolution (pixel)** | 480p | | |
| **Video/Audio Bit Rate (KB/s)** | 768/128 | | |

## V. ANALYSIS AND SIMULATION RESULTS

Table7. Overall Results RIPng Testing

| Scenario | Screen Resolution | Bit Rate | Delay (ms) | Packet Loss (%) | Throughput (kbps) |
|---|---|---|---|---|---|
| 1 | 240p | 512/64 | 16.3 | 1.5 | 668.7 |
| 2 | 480p | 768/128 | 16.8 | 39.3 | 406.7 |
| Avreages | | | 16.5 | 20.4 | 537.7 |

From the table above can be seen the value of the average delay of 16.5 ms, 20.4% packet loss, and throughput of 537.7 Kbit/s. Here are the average results overall penujian scenarios using the routing protocol OSPFv3:

Table8. Overall Results OSPFv3 Testing

| Scen ario | Screen Resolution | Bit Rate | Delay (ms) | Packet Loss (%) | Throug hput (kbps) |
|---|---|---|---|---|---|
| 3 | 240p | 512/ 64 | 15.3 | 0.8 | 713 |
| 4 | 480p | 768/ 128 | 16.5 | 4.6 | 635 |
| Averages | | | 15.9 | 2.7 | 674 |

From the table above can be seen the value of the average delay of 15.9 ms, 2.7% packet loss, and throughput of 674 Kbit/s. Here are the average results overall penujian scenarios using EIGRP routing protocol:

Table9. Overall Results EIGRP Testing

| Scen ario | Screen Resolutio n | Bit Rate | Delay (ms) | Packet Loss (%) | Throug hput (kbps) |
|---|---|---|---|---|---|
| 5 | 240p | 512/ 64 | 14.2 | 0.8 | 716.3 |
| 6 | 480p | 768/ 128 | 14.6 | 4.3 | 712 |
| Averages | | | 14.2 | 2.5 | 714.1 |

From the table 9 can be seen the value of the average delay of 14.2 ms, packet loss 2.5%, and the throughput of 714.1 Kbit/s. The following graph the average value of delay, packet loss, and throughput between routing protocol RIPng, OSPFv3 and EIGRP for IPv6 can be seen below in figure 3.

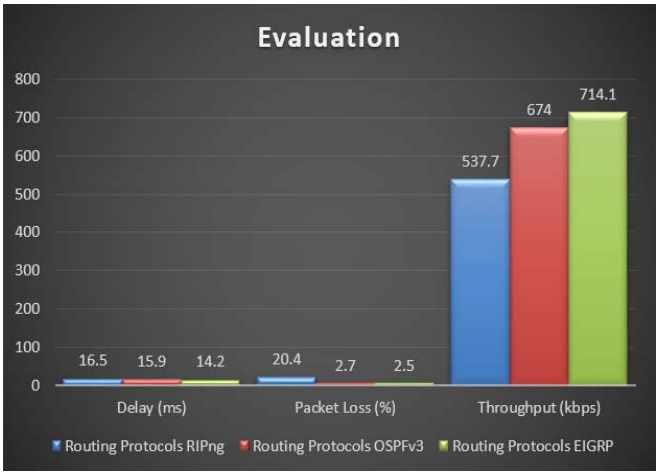


Figure 3. Evaluation

From the figure 3 chart with the overall results of testing RIPng, OSPFv3 and EIGRP for IPv6 when compared viewable throughput value affects the delay, throughput which is worth less to produce a value much larger delay on the grounds that server as the sender of the packet to spend more time idle ( do not send new packets) that reduces how fast throughput. Meanwhile, the throughput also affects the packet loss, throughput which is worth less to produce value greater packet loss on the grounds that packet loss has no effect on the speed of data transmission as packets deemed missing will be re-transmitted.

## VI. CONCLUSION

Based on the performance evaluation results that have been done with the author on the routing protocol RIPng, OSPFv3, and EIGRP for IPv6 for streaming video services, a number of conclusions as follows:

1. The lower the value of screen resolution (pixels) and bit rate (kbps), the greater the value of throughput (kbps) generated.
2. Value throughput affects the delay and packet loss, throughput of greater value to produce a value of delay and packet loss smaller.
3. Routing Protocol RIPng has an average value of 16.5 ms delay, packet loss 20.4 %, and the throughput of 537.7 Kbit/s.
4. Routing Protocol OSPFv3 has an average value of 15.9 ms delay, 2.7 % packet loss, and throughput of 674 Kbit/s.
5. Routing Protocol EIGRP has an average value of 14.2 ms delay, packet loss 2.5%, and the throughput of 714.1 Kbit

All the testing have indicated that the performance of routing protocol EIGRP routing protocol is better than RIPng and OSPFv3.

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