IMPLEMENTATION OF LOAD BALANCE EQUAL COST MULTI PATH (ECMP) BETWEEN ROUTING PROTOCOL BORDER GATEWAY PROTOCOL (BGP) AND OPEN SHORTEST PATH FIRST (OSPF) USING DUAL CONNECTION

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Abstract

Currently, Internet is needed by everyone to lighten their work, then a method has been developed to be able to access the internet using 2 ISPs (Internet Service Providers), namely using load balance. This method can perform bandwidth management so that it can balance the bandwidth of 2 ISPs. To support this method, Load Balance Equal Cost Multi Path (ECMP) is used. Another innovation that continues to be developed routing, the process of exchange data packets between different IP networks and to identify the best route to each connected network, that can make routing better by using dynamic routing types, to unify the network if a change occurs of topology by exchanging new topology information with each other on a network using the Open Shortest Path First (OSPF) routing or using the Border Gateway Protocol (BGP). OSPF is an open source routing protocol that is often used[4] and OSPF is a link-state in the routing algorithm. This routing use the Dijkstra or SPF (Short Path First) algorithm to calculate the shortest path from each route. Coinciding with the increase in routers in an area, the information that routers in the same area must have at the same time will increase, then the Border Gateway Protocol (BGP) is the new routing protocol[7]. BGP is a vector-path protocol where each router decides locally the "best AS" line per destination. The local preference attribute is used to set the policy for outgoing traffic. Testing is done by comparing the performance of an ECMP network using OSPF routing and an ECMP network using BGP routing[3]. Testing is done by measuring based on the throughput and data delay parameters using 16, 32, 48 routers. the topology is divided into 3 areas, namely area 1 for user load balance, area 2 for ISP 1 and area 3 for ISP 2. Throughput is used to measure routing performance on the TCP transport protocol and UDP transport protocol. Then, data delay is for measuring the performance of routing on the TCP and UDP transport protocol with the addition of variations. The testing that have been carried out show that the network throughput with OSPF routing (764.13 bps) has a lower performance than the network with BGP routing (818.81 bps) when sending TCP and UDP data, and network delay with OSPF routing (85.61 ms) has a significant increase than the network with BGP routing (89.23 ms) when sending TCP and UDP data.

Keywords: Open Shortest Path First, Border Gateway Protocol, Equal Cost Multi Path, Throughput, Delay.

1. INTRODUCTION

A common problem in networking is traffic which affects how fast the packet is sent. In this case, there is a need for management in order to be able to control so that there is no data overflow and to be able to control traffic problems, so we need a load balance method which is used as a technique of distributing traffic loads on two or more paths, so that a balanced connection occurs.

One of the optimization methods on the network is to perform bandwidth management using the load balancing method. The load balancing method is a concept that functions to balance the bandwidth load of two or more ISPs through network performance parameters, that is delay, packet loss, jitter and throughput so that internet connections can be maximally utilized [10].

Data communication can be said to be good when the data sent can be received by the target device quickly and intact. For this reason, it is necessary to use Routing Protocols in carrying out data communication mechanisms[4]. Protockol Routing has 2 types of protocols, namely static and dynamic. Static routing protocol is a routing method in which the packet delivery path is inputted manually, while the routing protocol is dynamic and capable of updating routes by distributing information about the best path to other routers. Dynamic routing protocols allow routers to find alternative routes in case of link failures in the current network[9]. Open Shortest Path (OSPF) is an open source routing protocol which is a link-state in the routing algorithm[7]. Border Routing Protocol (BGP) the newest exterior routing gateway is used to communicate between different AS numbers in large networks such as ISPs[3].

Based on this, the research was conducted to get the performance results on the router density scenario on the ECMP load balance between the Open Shortest Path (OSPF) routing protocol and the Border Routing Protocol (BGP) on dual connections.

2. RESEARCH METHODOLOGY

a. Simulation Design

Simulation design is a scenario for obtaining simulation data. The scenario used is a scenario through throughput and data delay. Scenarios will be applied to both ECMP load balancing methods between BGP and OSPF routing. The design will use GNS3, a graphical network simulator (GNS3) is a program that can simulate more complex network topologies and use virtual boxes for its Windows 8.1 based clients.

b. Testing Scenarios

The test scenario trough Load Balance network using OSPF Routing and the Load Balance network using BGP Routing. Therefore, in order to get performance comparisons on 3 topologies, such as using 16, 32, 48 Router Testing includes testing the transfer performance of TCP and UDP packets using. TCP with sizes 64, 128, 256 bits. UDP datagram size 64, 128, 256 bit.

c. Hardware dan Software

PC hardware specifications for clients use (1) an Intel Core i5 processor, (2) 1 GB RAM and (3) 1 ethernet. software for clients are (1) Windows 8.1 Operating System, (2) Ostinato and (3) Wireshark.

d. Network Topology Design

Scenario will be applied to both ECMP load balance methods between BGP and OSPF routing. This simulation used the number of routers 16, 32, 48.

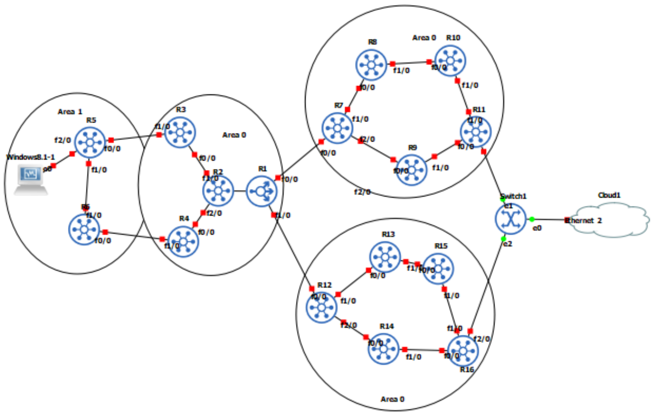

Figure 1. Design Topology 16 Router OSPF

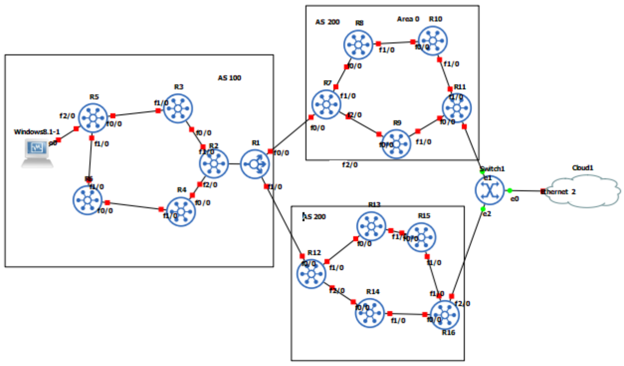

Figure 2. Design Topology 16 Router BGP

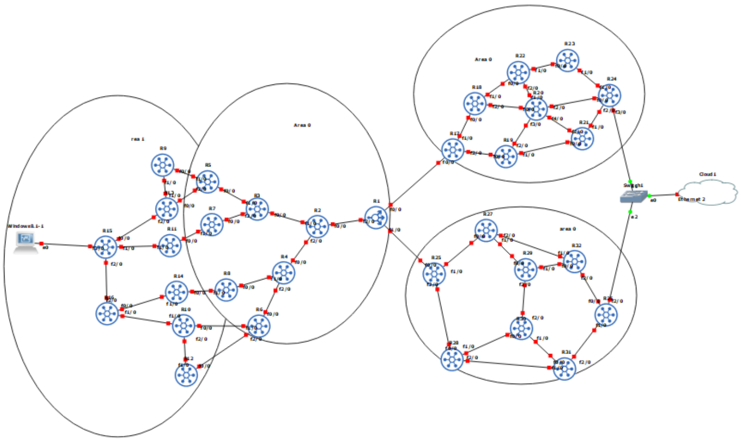

Figure 3. Design Topology 32 Router OSPF

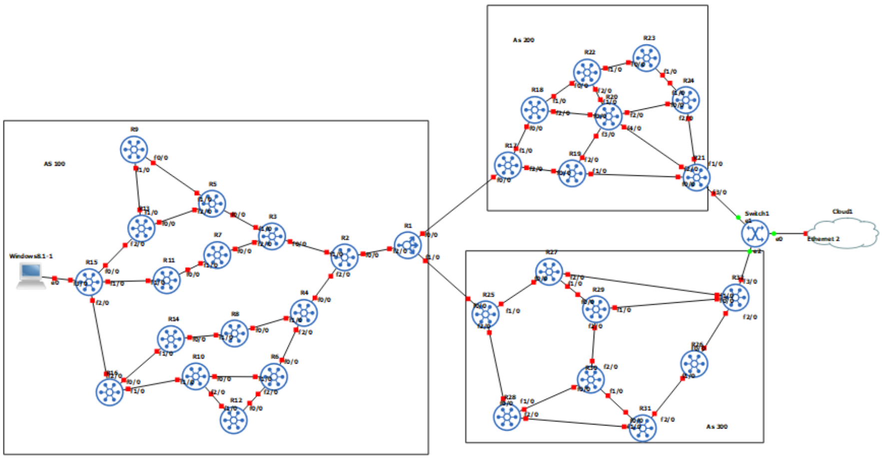

Figure 4. Design Topology 32 Router BGP

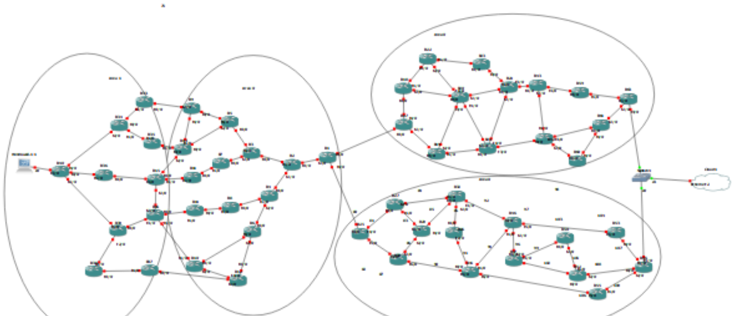

Figure 4. Design Topology 48 Router OSPF

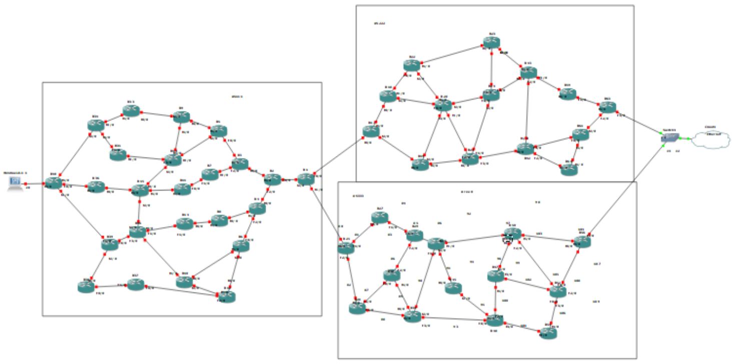

Figure 6. Design Topology 48 Router BGP

e. Throughput and Delay Testing

Throughput and delay testing using TCP and UDP packets, such as Web Server (80), SMTP (25), FTP (21), DHCP (68), SNMP (161), RIP (520) packets.

2.6 TCP and UDP Throughput Measurement

In throughput testing using Ostinato. Measurements have made by sending a TCP and UDP packets with a size of 64 Bit, 128 Bit, 256 Bit with repeated 5 times.

3. RESULTS AND DISCUSSION

a. Testing of Throughput Measurement based on Router Density

Based on the results in Table 1 and Table 2, Figure 7 and Figure 8, it is known that for sending 100 TCP and UDP packets between OSFP and BGP routing throughput based on router density, it is found that OSPF routing has a decreased percentage performance compared to BGP routing as the number of routers increases.

Table 1 Throughput Router Density OSPF 100 Packet (bps)

	OSPF Throughput								
Jumlah Router (bit)	16 (64)	32 (64)	48 (64)	16 (128)	32 (128)	48 (128)	16 (256)	32 (256)	48 (256)
TCP Web Server(80)	660	880.2	729.8	671.2	855	685.2	680	844	680.4
TCP SMTP(25)	655.6	923	705	679.2	899.8	673.8	653.8	841.6	498.2
TCP FTP(21)	646	830	640.8	669.6	865.2	686.8	658.4	844.4	500
UDP DHCP(68)	644.8	838.4	680	696.4	894.2	683.4	702.2	586	566
UDP SNMP(161)	651.4	786.4	736	683.2	840.4	653	685.8	846.8	536
UDP RIP(520)	644.2	838.4	719.6	676	899.8	704.6	647.2	845.6	565.8

Table 2 Throughput Router Density BGP 100 Packet (bps)

	BGP Throughput								
Jumlah Router (bit)	16 (64)	32 (64)	48 (64)	16 (128)	32 (128)	48 (128)	16 (256)	32 (256)	48 (256)
TCP Web Server(80)	763.8	798.4	883	803.6	829.8	785.8	795	694.8	976.6
TCP SMTP(25)	913.8	785.4	904.4	786.4	822.4	955.6	706.8	763.8	890.4

TCP FTP(21)	788.4	838.6	891.4	713.2	804.2	892	815.4	779.8	887.6
UDP DHCP(68)	807	860.6	915.6	701	761.4	898.8	732.6	838.6	892.4
UDP SNMP(161)	805.2	864.6	900	712	742	925.8	692.6	846.8	880.4
UDP RIP(520)	700.4	758.4	855.4	709.2	811.2	890.2	684	851	908.2

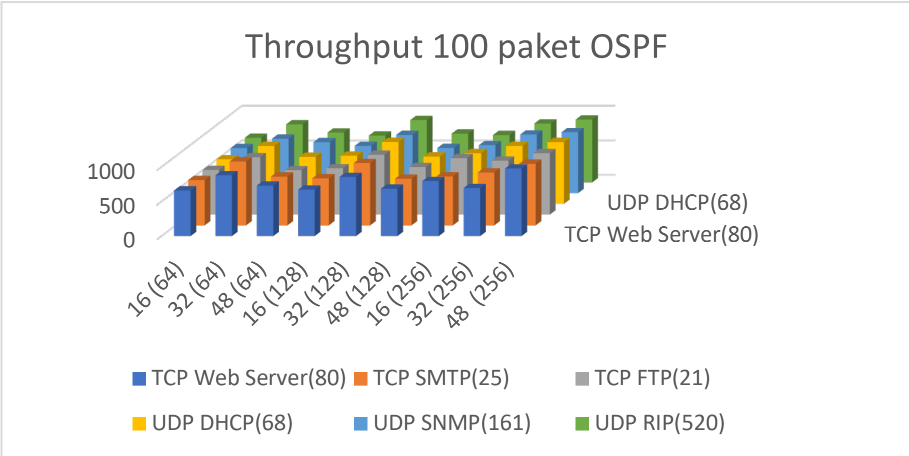

Figure 7 Throughput Router Density OSPF 100 Packet

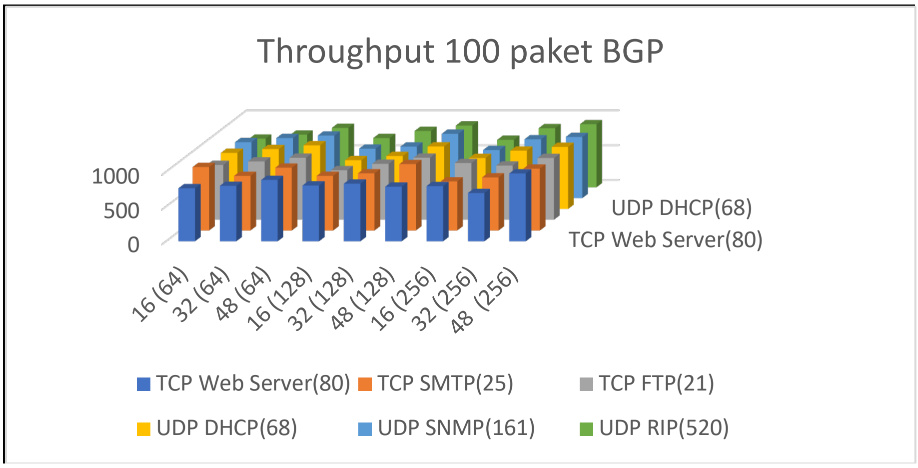

Figure 8 Throughput Router Density BGP 100 Packet

Based on the results of the experiment on router density, known that for the average delivery of 100 TCP and UDP packets between OSFP and BGP routing the throughput is, OSPF routing has a percentage performance tends to decrease and in BGP routing the throughput performance always increases every time you add a router.

b. Testing of Delay Measurement based on Router Density

Based on the results in Table 3 and Table 4, Figure 9 and Figure 10, it is known that for sending 100 TCP and UDP packets between OSFP and BGP routing delay based on router density, OSPF routing has a low percentage of performance and BGP routing has a high delay as the number of routers increases.

Table 3 Delay Router Density OSPF 100 Paket (ms)

	OSPF Delay								
Jumlah Router (bit)	16 (64)	32 (64)	48 (64)	16 (128)	32 (128)	48 (128)	16 (256)	32 (256)	48 (256)
TCP Web Server(80)	157.122	73.57	82.862	83.07	77.63	82.476	82.646	80.444	82.524
TCP SMTP(25)	152.906	74.28	81.606	81.842	78.788	83.502	82.63	78.732	83.46
TCP FTP(21)	153.342	76.482	85.474	83.278	79.178	84.508	83.75	80.406	85.266
UDP DHCP(68)	154.86	78.346	81.58	81.408	76.442	82.8	80.74	93.028	82.368
UDP SNMP(161)	154.836	78.914	77.214	80.206	78.496	83.392	82.644	80.554	77.344
UDP RIP(520)	154.32	77.91	82.898	84.27	78.382	82.888	81.78	75.978	83.14

Table 4 Delay Router Density BGP 100 Paket (ms)

	BGP Delay								
Jumlah Router (bit)	16 (64)	32 (64)	48 (64)	16 (128)	32 (128)	48 (128)	16 (256)	32 (256)	48 (256)
TCP Web Server(80)	84.424	87.21	87.168	81.562	80.154	85.15	80.054	90.154	77.242
TCP SMTP(25)	77.83	87.178	86.23	82.834	87.794	81.46	89.154	85.64	86.678
TCP FTP(21)	78.96	83.92	86.838	89.332	82.484	87.196	83.216	89.31	88.02
UDP DHCP(68)	85.466	86.802	80.188	88.172	88.23	86.028	88.236	83.604	86.346
UDP SNMP(161)	83.192	87.936	87.128	89.534	86.884	85.294	88.518	83.23	86.6
UDP RIP(520)	88.05	87.176	87.268	88.31	87.386	85.198	91.144	84.686	85.338

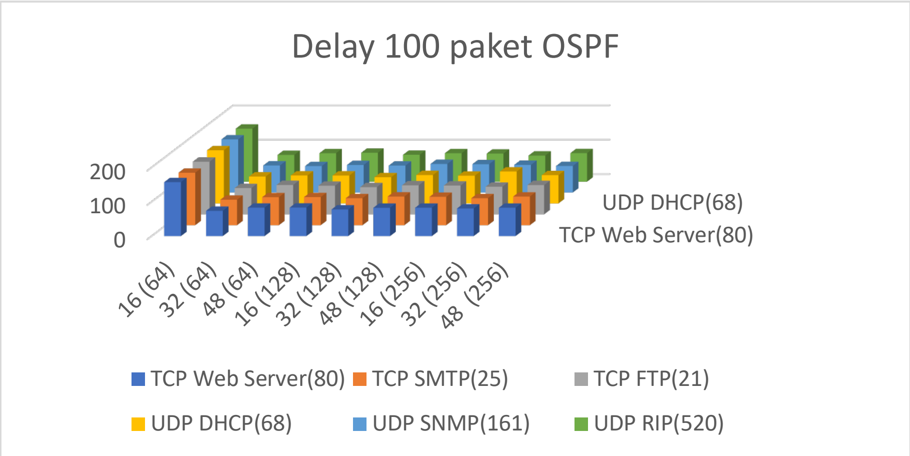

Figure 9 Delay Router Density OSPF 100 Paket

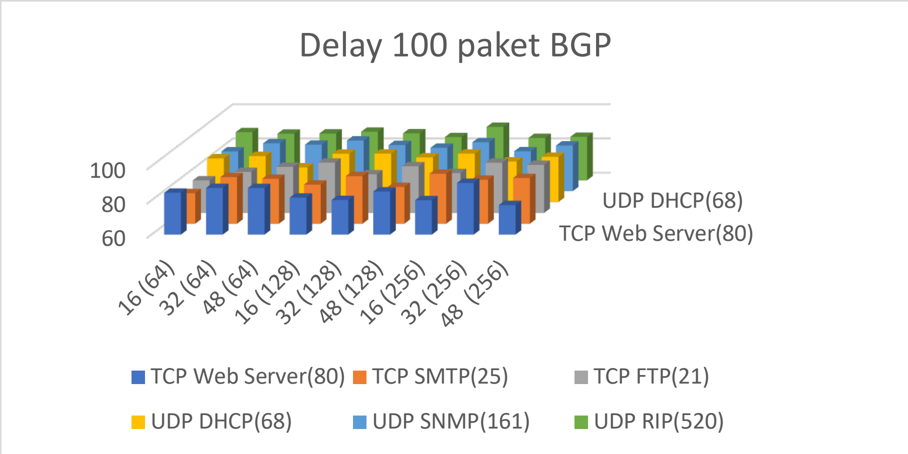

Figure 10 Delay Router Density BGP 100 Paket

Based on the results of the experiment on router density, it is known that for the average TCP and UDP packet delivery between OSFP and BGP routing delays, it is found that OSPF routing has a performance that tends to decrease and in BGP routing the performance delay always increases every time you add the number of routers.

4. CONCLUSION

The results showed that the network throughput using OSPF routing (764.13 bps) decrease performance compare to the performance of the BGP routing network (818.81 bps) while send TCP and UDP data. It can be concluded that the throughput of the load balance method of BGP routing is better than the load balance of OSPF routing.

The results also show that the network delay with BGP routing (85.61 ms) has a significant increase in performance compare to the OSPF routing network (89.23 ms) while send TCP and UDP data. It can be concluded that the delay in the load balance routing OSPF method is better than the load balance routing BGP.

The results also show that the router density for an average delivery of 100 TCP and UDP packets in the throughput for OSPF routing has a performance that decreasing compare to BGP routing. It can be concluded that the router density throughput on the load balance method of BGP routing is better than the load balance of the OSPF routing.

The results also show that the router density for the average sending of 100 TCP and UDP packets at the delay for OSPF routing has a performance that decreasing compare to BGP routing. It can be concluded that the router density delay in the load balance method of BGP routing is better than the load balance of OSPF routing.

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