



## Load Balancing Performance in Etherchannel Technology Using the VLAN Trunking Protocol (VTP) Method

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### ABSTRACT

*Increasing the number of network technology users is functioned so that network performance increases, it is necessary to have a network renovation process. The results of previous studies, the use of Load Balancing on Etherchannel technology using the VTP (VLAN Trunking Protocol) method can maximize network performance. In this network topology, VLAN and Etherchannel technology has been configured so that the operation runs efficiently. Etherchannel protocol used in analyzing VTP network performance, namely PAgP and LACP. QoS analysis results for 1 hour, when all connected conditions have an average value of 1.8 Mb / s throughput and 8.1% packet loss. The second test of CORE\_SW2 condition was turned off, got an average throughput of 1.8Mb / s and 8.2% packet loss. When testing all three Po1 line conditions is disconnected, the connection is multiplied to 2 lines. Po5 gets an average throughput of 15MB / s and packet loss of 23.15%, Po2 gets throughput of 1.8 Mb / s and packet loss of 8.7%. Then the influence of Etherchannel technology when the first and second conditions are classified as good, while the third condition throughput is classified as very good, but the packet loss generated is of medium condition.*

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## 1. Introduction

The use of computer network technology is enabled so that the network performance in the data transfer process increases. With a small scale and a small number of users on a Local Area Network (LAN), then use the resulting bandwidth little likely does not affect the user dissatisfaction[1], With the growing number of users in a LAN network connection is necessary to the process of re-mapping the network, especially in terms of bandwidth usage[2],

Rigid Nugroho and Mohammad Syamsul Fallah perform testing using the Network Load Balancing EtherChannel technology with PAgP and LACP protocols. The results obtained from the use PAgP protocol is able to improve performance network seen from the parameter Throughput, Delay and Jitter[3], Research conducted by Patient Hanadwiputra and Subandri using VTP get the best results from the use of value EtherChannel technology on VTP, seen from the results obtained Throughput and Delay[4],

Based on the results of previous studies, the use of technology EtherChannel Load Balancing on using VTP (VLAN Trunking Protocol) to maximize network performance. Coupled with a different protocol as an alternative pathway to the port group when damaged.

This study aimed to analyze the extent of influence EtherChannel technology is deployed on VTP. This study aimed to analyze the extent of the influence of technology on the network VTP EtherChannel. With the Link Aggregation able to increase the capacity and availability of data channels using technology Fast Ethernet and Gigabit Ethernet. And can also be distributed processing across multiple links to a single link is not down when the handle traffic[5],

VTP system of its own that can reduce the excess traffic in the delivery of data packets, and can help the device when one of the lines do not work [6], The concept will be used in technology *EtherChannel* which aims to combine multiple physical ports on the device to one lane in a port group.





Maximum-making in the first port group of up to eight physical ports. Another function of Etherchannel to improve connections between devices in order to track the data sent or received work more smoothly and if one device is damaged / lost, the track will continue to work through the port group

## 2. Research Methods

This study originated from the literature study conducted by collecting reference previous research related to the concept of load balancing, EtherChannel and VTP. In implementing the concept of a VLAN network has produced many advantages for companies and organizations [7],

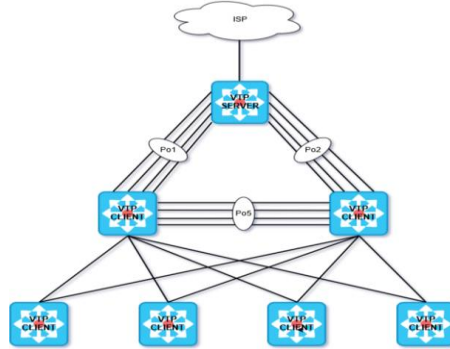


Fig 1. Topology Hybrid Network Load Balancing

Figure 1 illustrates the design of the Hybrid network topology used in the analysis process. In the analysis of this network is already there as routers and switches are configured VLAN in order to help operations run more efficiently LAN switches.

In the router in Figure 1 also had been induced in the VTP configuration that is useful for mensingkronkan all existing VLAN configuration to all switches in the network that is configured VTP running in the methods of the trunk. In this analysis has also been used EtherChannel, a trunking technology that is used to combine a number of physical ports on the device becomes a logical port in a port group.

Topology in Figure 1. In the lane *port group*(Po1, Po2, and PO5) has been used load balancing and SSL configuration spanning-tree working in the distribution of the data traffic of bandwidth that can be used balanced. Data bandwidth is already in the configuration of 10 GB.

TABLE 1  
VTP CONFIGURATION

Device	VTP	
	Mode	Domain
CORE_SW1	server	unas
CORE_SW2	client	unas
CORE_SW3	client	unas
ACC_SW1	client	unas
ACC_SW2	client	unas
ACC_SW3	client	unas
ACC_SW4	client	unas

TABLE 2  
CONFIGURING IP MANAGEMENT

Device	IP Address	VLAN
CORE_SW1	10.1.99.101/24	10
CORE_SW2	10.1.99.102/24	10
CORE_SW3	10.1.99.103/24	10

TABLE 3  
DHCP IP CONFIGURATION

Device	IP Address	VLAN
LAB_JK	192.168.10.1/24	100
LAB_I1	192.168.20.1/24	200
LAB_I2	192.168.30.1/24	300
LAB_HW	192.168.40.1/24	400





## A. Network Design Flow Diagram

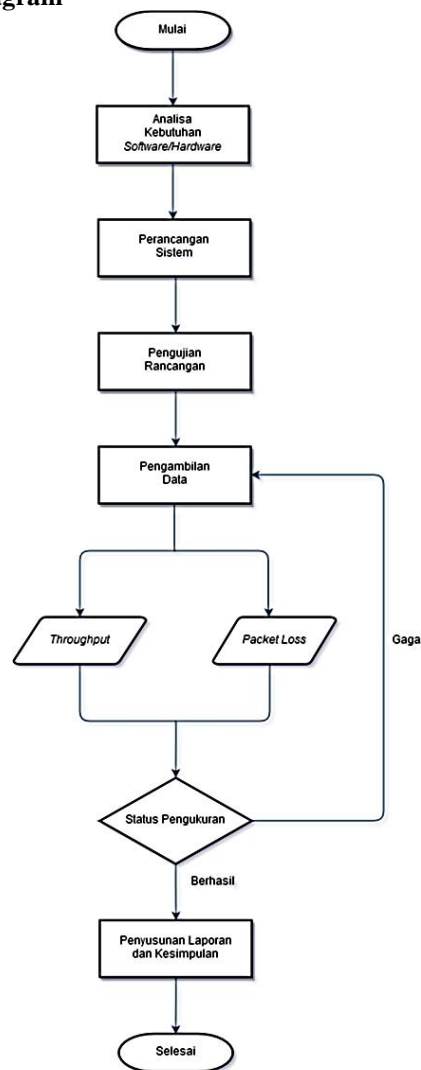


Fig 2. Flowchart of the system design

Based on flow charts, the information obtained:

- Analyzing the needs of software and hardware that will be used for network analysis process.
- Perform the design of the device.
- Collect data throughput and packet loss.
- Checking the status of the measurement to finish and when it falls back ketahap data collection. If successful it will proceed to the next stage.

## B. EtherChannel Technology

SwitchCisco uses port link aggregation technology called EtherChannel (PortChannel). This technology enables multiple Ethernet interfaces to be like one logical Ethernet interface, which is used to provide high-speed links between switches, servers, and routers. Also provides fault tolerance for the device. EtherChannel channel is also used between switches and servers and can be from two to eight active interface active interface, the interface can be fast, gigabit ports or 10-Gigabit Ethernet, also used in the backbone network, and is sometimes used to connect end user client[7], Backbone is a connection that is designed to send a stream of data traffic in a network[8],

There are 2 kinds of Etherchannel protocol used in analyzing network performance VTP, namely Port Aggregation Protocol (PAgP), a protocol that help automate the manufacture of a link Etherchannel. Then the Link Aggregation Control Protocol (LACP) is the protocol part of the IEEE 802.3ad link that





allows the incorporation of multiple port physical EtherChannel into a single port group. LACP protocols are also useful for doubling the bandwidth between the switch and make backup link between two switches[9],

**TABLE 4**  
PORT AGGREGATION PROTOCOL (PAGP)

	Active	passive
Active	Yes	Yes
passive	Yes	No.

**TABLE 5**  
LINK AGGREGATION CONTROL PROTOCOL (LACP)

	Active	passive
Active	Yes	Yes
passive	Yes	No.

### C. Parameter QoS (Quality of Service)

*Quality of Service* is a network performance measurement method and is used to measure the performance of a set of data that has been filtered and is associated with a service, and attempts to determine the characteristics of the service [10], There are several parameters used in peroses measurements, such as Throughput, Packet Loss, Delay and Jitter.

- a) parameters Throughput

Knowing reliability performance of the network in transmitting data packet is sent to the destination.

$$Throughput = \frac{Pt}{Lp} \times 8 \text{ bits} \quad (1)$$

Ket:

Pt = The data packets received

Lp = Length package delivery

**TABLE 6**  
STANDARD THROUGHPUT BY TIPHON

Category Throughput	throughput	Index
Bad	0-388 kbps	0
Low	388-700 kbps	1
moderate	700 - 1200 kbps	2
Well	1200 kbps - 2.1 Mbps	3
Extraordinary	> 2.1 Mbps	4

In Table 6. Throughput standard according TIPHON (Telecommunications and Internet Protocol. Harmonization Over Networks)

- b) Parameter Packet Loss

Knowing the number of packet wasted survivors compared with the data at the time of the data transmission process takes place.

$$Packet Loss = \frac{Pk - Pd}{Pk} \times 100\% \quad (2)$$

Ket:

Pd = Packages are experiencing drop

Pk = Packets sent

**TABLE 7**  
STANDARD PACKET LOSS BY TIPHON

Category Throughput	packet Loss	Index
Low	> 25%	1
moderate	15-24%	2
Very nice	3-14%	3
Perfect	0-2%	4

According to the standards in Table 7. Packet Loss TIPHON (Telecommunications and Internet Protocol. Harmonization Over Networks)

- c) Needs analysis

Needs of the hardware devices that are needed, namely 1 piece Laptop Windows 10 operating system x64. While the needs in terms of the necessary software, the software simulator GNS3 as a tool to





build a network simulation VLAN Trunking Protocol, software VMWARE as a server simulator GNS3 in order to run the router type of IOU (IOS on UNIX) from CISCO, and software Wireshark as tools of network analyzer ,

### 3. Discussion Result

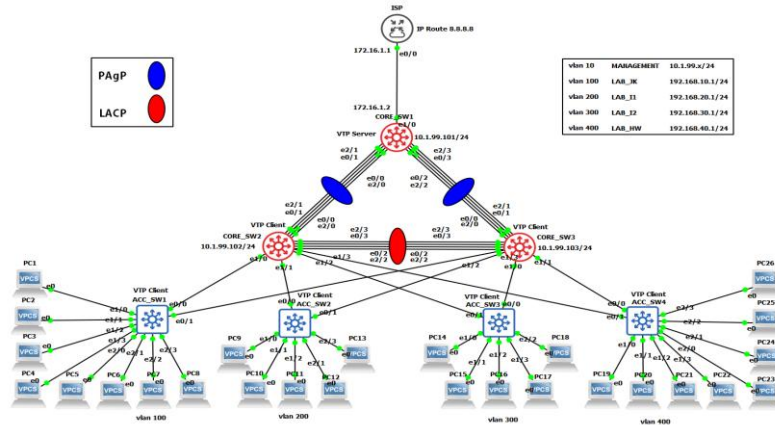


Fig 3, VLAN Trunking Protocol network scheme

Topology in Figure 3. The track (PAGP and LACP) has been used load balancing methods that worked in the division of the bandwidth of data traffic that can be used balanced. By using VLAN Trunking Protocol are already in every router and switch configuration. So with the VTP will facilitate the transfer of frames from two different devices. Core\_SW1 as router server to deploy the trunk of the ISP. This topology has given Etherchannel technology to increase the speed of connections between switches, routers or servers, and if one port or line is damaged then the port group will keep working with the track or other ports.

#### A. Analysis of QoS (Quality of Service)

The parameters used for measuring QoS in the analysis process, the throughput and packet loss.



Fig 4. Throughput measurement in all conditions

Table 8. Measurement results *throughput*

Condition	Status Port Channel	Packets	Throughput (Mb / s)
all Connected	Po1 FWD, FWD Po2, PO5 BLK	1303	1.8
		2590	1.8
		3886	1.8
		5172	1.8
		6477	1.8
CORE_SW2 off	Po1 off, PO5 BLK	1304	1.8
		2599	1.8
		3884	1.8
		5176	1.8
		6472	1.8
Strip disconnected Po1	PO5 FWD	12 253	15
		24 645	15
		37004	15





Condition	Status Port Channel	Packets	Throughput (Mb / s)
		49406	15
		61 760	15
		74133	15
	po2 FWD	1379	1.8
		2598	1.8
		3897	1.8
		5191	1.8
		6564	1.8
		7782	1.8

The results of this measurement is based on conditions that have been tested in Figure 4 and Table 8. The test begins with the Ping from the PC Client to the ISP (Internet Service Provider) or internet service providers are already configured IP Route. Measurement is carried out in three different conditions. In each of the conditions tested periodically for 1 hour every 10 minutes using the software as a tool Wireshark Network Analyzer.

The first condition when the routers and switches are all connected. Is shown in Table 8. The results obtained, ie the number of packets is obtained 7754, the average throughput produced during 1 hour of 1.8 Mb / s, the path through the port-channel 1 with PAGP EtherChannel.

The second condition when CORE\_SW2 shut down the port-channel 1 is offline and port-channel 5 still a block and the number of packets obtained increased to 7762, the average throughput produced during 1 hour of 1.8 Mb / s. Because the current is turned off, the connection will be switched on as a router CORE\_SW3 alternative path through the port-channel 2 with PAGP EtherChannel.

The third condition when the line *port-channel1* CORE\_SW2 disconnected while still alive, then the port-channel 5 will automatically forward status. Packets obtained from the path of the port-channel 5 with LACP EtherChannel amounted to 74133, the resulting throughput 15 Mb / s. Then the connection passes through the port-channel 2 and receive packets 7782, resulting throughput of 1.8 Mb / s.

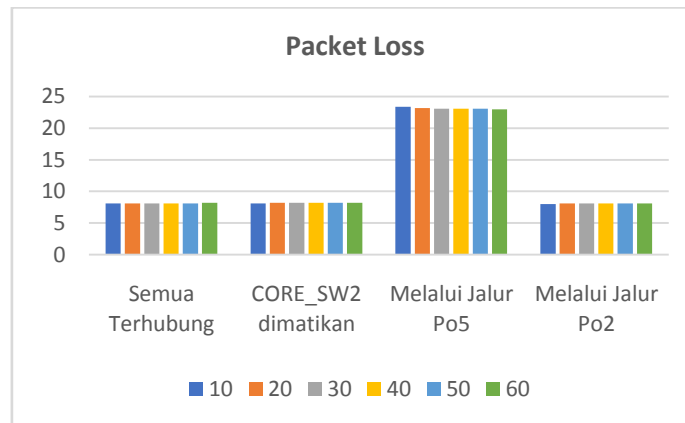


Fig 5. Packet Loss measurement in all conditions

Table 9. Measurement results *packet Loss*

Condition	Status Port Channel	packets Loss (%)	Average (%)
all Connected	Po1 FWD, FWD Po2, PO5 BLK	8.1	8.1
		8.1	
		8.1	
		8.1	
		8.1	
CORE_SW2 off	Po1 off, PO5 BLK	8.2	8.2
		8.2	
		8.2	
		8.2	
		8.2	
Strip disconnected	PO5 FWD	23.4	23.15





Condition	Status Port Channel	packets Loss (%)	Average (%)
Po1		23.2	8.1
		23.1	
		23.1	
		23.1	
		23	
	po2 FWD	8	
		8.1	
		8.1	
		8.1	
		8.1	

The results of this measurement is based on the measurement results in Table 9. *packet Loss*, This testing process begins with the Ping from the PC Client to the ISP which is already in the IP configuration Route, Measurement is carried out in three different conditions. In each of the conditions tested periodically for 1 hour every 10 minutes using the same software when testing throughput.

The first condition when all devices are connected properly, the average *packet loss* produced by 8.1%. The second condition when CORE\_SW2 shut down the port-channel 1 is offline and port-channel 5 still a block and the number of Packet Loss gained 8.2%. The third condition when the line port-channel 1 is disconnected while CORE\_SW2 stay alive, then the port-channel 5 will automatically forward status. Packet Loss obtained from the path of the port-channel 5 with LACP EtherChannel 23.15%. Then the connection passes through the port-channel 2 gain of 8.1% Packet Loss.

#### 4. Conclusion

The results of the analysis of QoS for 1 hour tested periodically for 10 minutes has a throughput parameter and packet loss in a state where the first test all connected has an average value of throughput of 1.8 Mb / s and has an average of 8.1% packet loss , When the second test CORE\_SW2 condition is turned off, get an average throughput 1,8Mb / s and an average of 8.2% packet loss. Then, when the third test track conditions Po1 disconnected, dialikan connection to PO5 and Po2, PO5 get an average throughput of 15Mb / s and an average of 23.15% packet loss, while Po2 get a throughput of 1.8 Mb / s and get packet loss 8.7%.

Based on the testing of the effect of EtherChannel technology is applied to the VTP network when in a state of all the devices connected and when one dies client router has a good condition, whereas when the condition Po2 Po1 or breaks it will affect the network, especially in Packet Loss parameter. When passing lane throughput PO5 gets extraordinary conditions, but the resulting packet loss unconditioned being, almost a low condition. Meanwhile, when the passing lane throughput and packet loss Po2 getting good condition.

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