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IDENTIFICATION OF OPTIMAL STANDARD END-TO-END QUALITY OF SERVICE MONITORING PROTOCOL FOR LAYER 3 ETHERNET NETWORK

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ABSTRACT

Providing quality of service (QOS) guarantees in an important requirements for multimedia communication networks. Providing QOS guarantees the performance of any network and ensures that the agreed QOS is sustainable, but it is not sufficient to just commit resources since QOS degradation is often unavoidable. Because of these reasons, QOS monitoring is required to track the ongoing QOS and compare the monitored QOS against the expected performance. It helps to detect possible QOS degradation, hence can be tune the network resources accordingly to sustain the delivered QOS. When considering about multimedia networks, more often the network devices are implemented by the different vendors. In this situation each vendor introduces different kind of technologies and methods for QOS monitoring over their devices. So, there will be critical situations when it wants to monitor QOS between devices of two different vendors. It is very important to have standard QOS monitoring protocol technologies for avoiding this kind of situation in network administration. The purpose of this study is to identify the optimal end-to-end QOS monitoring protocol for layer 3 IP network by literature survey and justify the outcome of literature survey by feasibility study for the considering network. The Python based software program was used to analyze the outcome of literature review for deciding most appropriate protocols suitable for telecommunication companies in Sri Lanka.

Keywords: Quality of Service (QOS), Internet Protocol (IP), Provider Edge (PE)

1. INTRODUCTION

QOS monitoring mechanism can be classified into two main categories as, end-to-end QOS monitoring and QOS distribution monitoring. In end-to-end QOS monitoring approach, the end-to-end QOS between the sender and receiver of a real-time flow is monitored. When

considering about QOS distribution monitoring approach, the QOS distribution experienced by the flow in different network segments is also monitored. By considering the network architecture of the organization, end-to-end QOS monitoring approach was used for precede this study. As a first part of the study, observed already available standard end-to-end QOS monitoring protocols. Then observe the nature of the protocols with existing network by the literature survey. As a final part of the study feasibility analysis was done with the one of our newly developed software program for identify the optimal protocol for the layer 3 IP network.

2. METHODOLOGY

According to the layer 3 network architecture of the organization, it can identify six main traffics classes which flow through the network. It was monitoring the QOS of layer 3 network by considering the main traffic classes of Voice + Signaling traffic, Video traffic, Streaming traffic, Business critical traffic, Business data traffic, Best effort (internet critical) traffic. Standard protocols were selected by considering these main traffic classes. Four main standard QOS monitoring protocols were identified by observing the available protocols which use for monitor the QOS in IP network. The identified protocols are RFC 2544, RFC 5357, RFC 6812, EtherSAM. This study was based on these identified four main QOS monitoring protocols.

2.1. Review of literature

The factors for observe literature review was defined by considering the layer 3 network architecture and the main requirements for implement QOS monitoring protocol in this network. The main factors which consider for the literature review are, Standarbility of the protocol, Appropriate with layer 3 network, Device compatibility of the protocol, Compatibility of the protocols with QOS parameters, Compatibility with layer 2 network, Testing methodologies of the protocol. Table 1 shows the collected data set regarding to each QOS monitoring protocol by the literature review[1, 2, 3, 4, 5, 6, 7, 8, 9]. Marking method was used for reporting each data as,

1 : Condition is acceptable , 0 : Condition is not acceptable

Table 1: Final results of the review of literature

Weight	Parameters	EtherSAM	RFC 2544	RFC 5357 (TWAMP)	RFC 6812
A	Standarbility of the protocol	1	1	1	1
A	Appropriate with layer 3 network	1	1	1	1
	Device compatibility				

A	ASR 901	1	1	1	1
A	ASR 9006	1	1	1	1
A	ME 3600	1	1	1	1
A	ATN 910i	1	1	1	0
A	ATN 950b	1	1	1	0
A	NE 40	1	1	1	0
A	NE 5000	1	1	1	0
	QOS parameters				
B	Bandwidth monitoring	1	1	1	1
B	Latency monitoring	1	1	1	1
B	Jitter monitoring	1	0	1	1
B	Frame loss monitoring	1	1	1	1
C	Appropriate with layer 2,3 network	1	1	0	1
C	Testing methodology of the protocol	1	0	1	1

Weighting method was used for prioritize the each parameter which consider for observe the literature review as, A > B > C, A + B + C = 1 and all A, B, C values are restricted to two decimal points, where A is the highest priority value and C is the lowest priority value. Python software program was developed to find the average total marks for each protocol by considering the given weighting conditions. The average total value for each QOS monitoring protocol was generated by the Python code. The calculated average values are, RFC_2544 - 5.81326530612, RFC_5357 - 6.09275510204, RFC_6812 - 4.38224489796 and EtherSAM - 6.20551020408. According to the calculated average values, EtherSAM and RFC 5357 selected as the theoretically most effective QOS monitoring protocols for implement in layer 3 Ethernet network.

2.2 Feasibility study

Feasibility study for the selected protocols was done by considering three aspects of the network. They are Economical feasibility for protocol implementation, Adaptability of the protocols for existing network and Maintainability of the network for selected protocols.

2.2.1 Feasibility study for two-way active measurement protocol (TWAMP)

The TWAMP architecture is composed of four logical entities of TWAMP client, TWAMP session-sender, TWAMP session-reflector, TWAMP server that are responsible for starting a monitoring session and exchanging packets. It can deploy TWAMP in simplified network architecture, with the control-client and the session-sender on one device and the server and the session-reflector on another device. The TWAMP client has to implement in PE (Provider

Edge) routers of the network. There are six inner core sections as A, B, C, D, E, F and two PE routers for each section. The HP Proliant DL3800 GEN8 servers have to implement in each section of the inner core by covering the each section of the network. The total cost estimation for implement TWAMP client is considering network is $15,000.00.

HP Proliant DL380 G8 servers can be configuring as the client for TWAMP implementation. In this case there will not any issue for existing network or process of the network. When considering about the network architecture of the organization, it has to configure all aggregation service routers, sub-aggregation routers and cell site routers for cover entire network. In this case it has to consider about the IOS version of the routers for configure TWAMP server. According to the network Huawei ATN 910i and 950b devices required the IOS version upgrade for TWAMP server configuring. TWAMP network architecture it consist with less hardware components than hardware components. It use HP Proliant DL380 as TWAMP client and existing routers can be used as the TWAMP servers. According to the TWAMP network architecture there will be software maintain cost than the hardware maintain cost[4, 7].

2.2.2 Feasibility study for EtherSAM

The round-trip measurement scenario is used for implement the EtherSAM in considering network. In this case the measured value reflects the average of both test directions, from the test set to the loopback point and back to the test set. The BV-3100 verifier is used as the test-set for implement EtherSAM in considering network. It is a single integrated instrument that support for service turn-up, monitoring and troubleshooting phases of the IP and Ethernet services life cycle of the network. EtherSAM verifier has to implement in PE (Provider Edge) routers of the network. It was required to implement EtherSAM verifier in all PE routers for covering all inner core sections of the network. Total cost estimation for implement EtherSAM verifier in considering network is $16,800.00. The BV-10 performance end point unit is used as the loopback device for implement EtherSAM in the network. When considering about the network architecture of the organization, all aggregation service routers, sub aggregation routers and cell site routers have to be consider as the responders for cover the entire network. The total cost estimation for implement EtherSAm end point unit in considering network is $9450.00. So, total cost estimation for implement EtherSAM is $26.250.00.

EtherSAM QOS monitoring protocol used external devices for verifier and end point devices. It is not required to configure existing components of the network. Because of this reason EtherSAM can easily adapt to the existing network of the organization.

When considering about EtherSAM network architecture it is totally depends on the external devices of EtherSAM verifier and EtherSAM responder. So there will be hardware cost for maintain the EtherSAM effectively[2].

3. RESULTS AND DISCUSSION

According to the review of literature, it was selected EtherSAM and TWAMP as the theoretically most effective QOS monitoring protocols for implement in layer 3 networks.

According to the results of feasibility we identified that, total cost for implement EtherSAM is $26,250.00 and total cost for implement RFC 5357 is $15,000.00. EtherSAM can easily adapt to the existing network of the organization. Because it used external network equipments and it is not required to upgrade or change the existing system for implement the protocol. When considering about TWAMP, it required IOS upgrade for configure TWAMP servers. But TWAMP can adapt to the network without occurring any confuse situation for existing network.

Another aspect of the study is network maintainability. EtherSAM has high maintain cost estimation than TWAMP and TWAMP has low error occurring probability for the considering time period.

According to the overall results of the study TWAMP has the priority for implement in layer 3 network of the organization. So the TWAMP is proposed for implement in layer 3 network of the organization. But it has to highlight that TWAMP is not possible to implement in layer 2 Ethernet networks. If the QOS monitoring protocol wants to extend for measure QOS also in layer 2 network, we propose EtherSAM QOS monitoring protocol for implement in the considering network.

4. CONCLUSION

Quality of services monitoring in multimedia network is a very important process for guaranteed the better service provide for their customers. This study was basically focused on layer 3 network of the multimedia network. Because most probably network quality issues are occurring on layer 3 networks. This study can extend to identify standard QOS monitoring protocol for layer 2 and layer 3 networks equally.

When considering about the miner aspects of our study, we could use limited number of network devices for measuring parameters and feasibility of the network. This study can be farther extended to identify more convenient standard QOS monitoring protocol for the concerned network without having network devices dependency.

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