

A Method on Reducing Processing Time Using Signature Matching in a Router

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Abstract— This paper proposes a method on reducing processing time of the incoming packets using the signature matching in a router. According to the proposed method, the router has enhanced processing time using signature matching of necessary portion and referring of pre-investigated packet routing table. As a result, this method provides improved quality for real-time traffic such as VoIP and video streaming/conferencing.

Keywords—Router Processing Delay, Signature Matching, Real-Time Traffic, Quality of Service

I. INTRODUCTION

Recently, the mobile application market is rapidly growing with an increase in smartphone user, and a variety of applications was emerged. Especially, many real-time services such as VoIP and video streaming/conferencing were appeared on market[1]. As a result, because of flooding real-time traffic, the internet has problems, which caused by service disconnection and discontinuous service connection. Consequentially, the introduction of enhanced network equipment and the design for suitable network are required to process the flooding real-time traffic [2].

When designing a network, a router is one of the most important equipments and is used significantly in network such as 3G, 4G, and Internet. Therefore, the introduction of the enhanced router contributes to process the flooding traffic and improves the quality of service [2].

A router checks the packet header for routing of the incoming packet and configures the packet route and forwards the packet to suitable output port[2]-[4]. A router processes all packets as the procedure mentioned above and it results in the queuing delay. Therefore, in order to reduce a queuing delay, it needs another method which is a partial check on incoming packet. It is a signature matching.

A signature matching is a technology which checks particular fields of the packet and determines whether the packet has the problems[5]. Therefore, the proposed method reduces the processing time using the signature matching that extracts the information necessary about the incoming packets. Further, it reduces queuing delay by fast processing time of a router.

This paper is structured as follows. In section 2, we describe the related work. Section 3, describes the features of application service and signature matching method to increase performance in a router. In section 4, we analyse the performance concerning proposed method. Finally, we conclude in section 5.

II. RELATED WORK

A. The measurement of processing time and queuing delay in a Router [2]-[4].

The single-hop delay accounts for the time a data packet takes to pass through a single router. i.e., the time amount a packet spends inside the router [2]. The single-hop delay consists of three basic contributions: transmission delay, processing delay, and queuing delay. Transmission delay refers to the amount of time the router takes both to acquire an entire packet from the input link and to place the same packet on the output link; processing delay is related to the time the router needs to determine the appropriate output port and forward the packet to it; and queuing delay occurs when there is contention at input and/or output ports of the router [2].

However, these studies just presented the measurement value according to the parameters in a single-router(Here, various parameters are the packet size and the transition rate of the sender). The method improving the performance of a router is not mentioned.

B. Signature-based Traffic Identification Methods [5]-[9].

The signature matching is a technology to classify a traffic using the information such as IP address, port, protocol, the string of payload, packet size and flow.

The network equipment monitors traffic and checks a virus and the intrusion detection using the packet information and a signature.

At this time, the traffic monitoring equipment needs to predefine the packet field information necessary for matching the related field of the incoming packet because the signature matching is only operated by predefined field. As mentioned above, the signature matching technology is used for traffic monitoring or classification.

However, the signature matching does not consider the method to support the real-time traffic.

III. PROPOSED SIGNATURE MATCHING METHOD

This section presents the proposed method which provides fast packet processing using the signature matching of packet in a router.

Before introducing the proposed method, we take a look at the characteristics of the real-time traffic because the signature matching technology needs to determine the packet field information necessary for matching the related field of the incoming packet

For this end, we investigated the characteristics of the real-time and non real-time traffic using an ethereal tool.

A. The Features of the real-time traffic

Source	Destination	Protocol	Info
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-97,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-97,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-96,
218.38.31.82	10.76.47.223	RTP	PT=DynamicRTP-Type-97,

Figure 1. The example of real-time traffic(Afreeca-TV) by ethereal tool on smartphone

Fig. 1 shows the captured packets of the Afreeca-TV which is the one of popular real-time services in Korea. From the captured packets, we knew that the source IP address is an IP address of the smartphone and the destination IP address is the an IP address of the Afreeca-TV's server. The used protocol is RTP(Real Time Protocol). Besides, the application handling real-time service such as skype(VoIP), Daum-TV pot has the features as the Fig. 1.

TABLE 1. THE FEATURES OF APPLICATIONS

Name	The features of applications		
	HTTP(URL)	Dst's IP addr	Protocol
KaKao -Talk	Related-Chatting	203.246.172.54 110.76.140.57	TCP HTTP
	Related-Picture	203.246.172.38	
	Related-Video	203.246.172.41 110.76.140.45	
You Tube	Related-Video	173.194.51.9/42/81 /117 74.125.11.25/214	TCP HTTP
Afreeca -TV	-	10.76.47.223	UDP (RTP)

Table I shows the characteristics of applications such as Kakao-Talk, YouTube and Afreeca-TV. The Kakao-Talk and YouTube are the most popular applications as the non real-time application in Korea. The Afreeca-TV is real-time application for providing the real-time video service. Consequently, TABLE I shows the information which is the destination IP address and the protocol used for each application. In case of the Kakao-Talk, the servers independently exists to process the traffic related to text, picture and video. The YouTube has a lot of independent server for traffic load-balancing. However, the Afreeca-TV has only one server for processing the video traffic.

B. A method on reducing processing time using signature matching

When using the signature matching in a router, Fig.2 shows the processing procedures for the signature matching. The Pre-Surveyed table is TABLE I that refers to perform the signature matching in a router. It extends TABLE I which contains characteristics of real-time and non-real-time traffic.

The router parses the packet incoming from the queue and sets up the routing path and forwards the packet. However, if the router knows the information of packet, this process is unnecessary.

Therefore, the router can reduce processing time using a hardware signature matching through source IP, destination IP and protocol. That is, in order to reduce a processing time, a check of useful portion of the packet is more effective than checking the whole packet.

IV. PERFORMANCE ANALYSIS

This section presents the performance analysis for existing and proposed method. We compare the processing time of the existing and proposed method in a router.

Fig.3 shows the operation to explain the consumed time in each layer, which refers to the operation a Standard International Organization for Standardization (ISO)-open systems interconnection (OSI) protocol stack. The T1 is an input transmission delay that is consumed time to check a packet by a Network Interface Card (NIC) and to forward to input port. The T2 is an input queuing delay in an input queue and the T3 is an output queuing delay in an output queue. Finally, the T4 is consumed time to check packet in a NIC and to forward to the next path.

Therefore, the following expression is established [2].

The processing delay is,

$$d_p(n) = t_3(n) - t_2(n) \quad (1)$$

The input queuing Delay is,

$$d_{iq}(n) = t_2(n) - t_1(n) \quad (2)$$

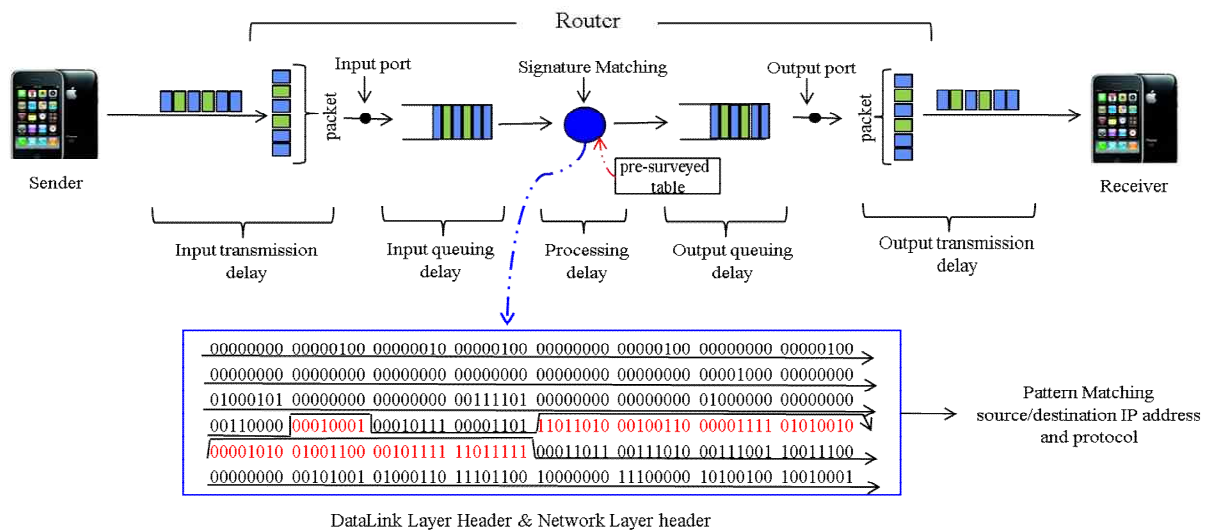


Figure 2. The processing time using signature matching in a router

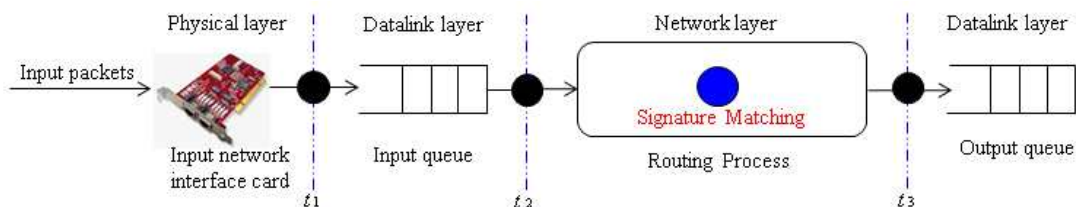


Figure 3. The location of the four measurement times with a standard ISO-OSI protocol stack

We do not consider the output queuing delay because that is variable depending on packet size and traffic load. And, we measure the processing time and the queuing delay using [2] in various scenarios.

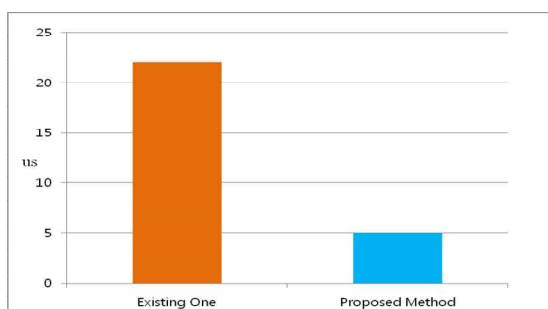


Figure 4. The comparison of the processing time in a router.

Fig. 4 shows the comparison of the processing time of the existing and proposed method in a router. In the existing method, the processing delay is 22~23us when the payload size is 20Byte [2].

However, the proposed method with the signature matching is just consumed 5us because it used to check a necessary portion using the hardware technology. For example, when the

existing method checks 40 bit-strings, the proposed method is checks 9 bit-strings. So, the proposed method consumes 9/40us of the existing method. Furthermore, when the processing time is to be faster, the input queuing delay will be shorter. Therefore, the proposed method provides a quality service for the real-time traffic and it can be usefully used in bottleneck point which has much traffic load.

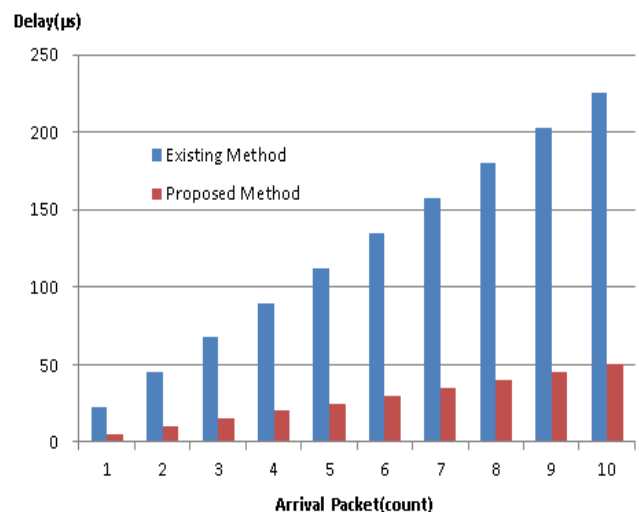


Figure 5. The comparison of the queuing input delay in a router

Fig. 5 shows the comparison of the queuing input delay of the existing and proposed method in a router. The existing and proposed methods were performed with the same parameters like Fig.4. Arrival Packet means the number of input packets in a router. Delay means the input queuing delay in a router. As a result, the proposed method has more short the queuing input delay than the existing method[2].

V. CONCLUSIONS

This paper proposes a method on reducing processing time of the incoming packet using hardware signature matching in a router. According to the proposed method, the router has enhanced processing time using signature matching of necessary portion and referring of investigated packet routing table. As a result, this method can reduce the processing delay and input queuing delay in a router compared to the conventional method. Moreover, it can provide fast service using surveyed table information and the signature matching on a non-real-time service.

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