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Basics of Quality of Services (QoS)

Chetan J. Ghyar, Dr. Makarand R. Shahade, Swapnil V. Bamb, Vrushali B. Mankar
IT Department, J.D.I.E.T , Yavatmal, Maharashtra, India

ABSTRACT

Quality of service (QoS) is becoming an increasingly important aspect of today's world in the infrastructure of networking. QoS is not only necessary for voice and video streaming over the network, it is also important for supporting the growing Internet of Things (IoT). But it is also a challenging task in the networking. Providing a QoS guarantees becomes more difficult when you add the complexities of wireless and mobile networks. This paper elaborates the concept of QoS, Techniques to improve the QoS such as scheduling, traffic shaping, admission control. In scheduling there are three types FIFO queuing, Priority queuing and weighted queuing. In traffic shaping there are Leaky bucket and Token bucket techniques discusses. Also here we introduce the two deploying QoS model name as Integrated Services (IntServ) and Differentiated Services (DiffServe).

Keywords: Bandwidth, Delay, Jitter, Packet Loss, TCP, UDP, DSCP, TC.

I. INTRODUCTION

QoS stands for the 'Quality of Service' and it defines "the quality of service as something a flow seeks to attain". QoS has the ability to provide different priority to different users, applications, data flows, or to guarantee a certain level of performance to a data flow over a network. The goal of the QoS is to provide guarantees on the performance of a network to deliver desired results. A network monitoring system is use in the network to insure that the networks are performing at a desired level or not.

QoS is more important for the new generation of internet application, because most of the applications based on internet uses the concept of IoT. In the relation between client and ISP,

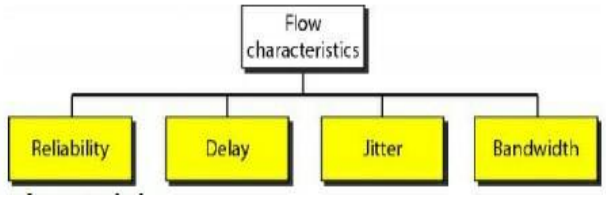

Figure 1. Characteristics of Network Traffic

QoS is more important because client expected to take service guarantees from their ISPs.

Traffic over network while sending a data from source to destination in the network affects the quality of QoS. There are four main characteristics of network traffic that we must to deal with

1. Bandwidth:

Bandwidth is the rate of amount of data that can be transmitted over a network in the fixed interval of time. Bandwidth is observe in both analog and digital communication system. It is usually measure in the Bit per second (i.e. bit/sec) or may be in the Byte per second (i.e. byte/sec) in the digital system and for analog system it is measure in the cycle per second (cycle/sec) or in Hertz (i.e. Hz). Bandwidth is also called as the carring capacity of the channel.

Bandwidth of both the source and destination must be matches with each other for proper communication. Because while we sending a data from source to destination all the data that we send from source over

the network is must to be gathered by the destination, unless there will be a data loss and effecting on the performance of the communication.

2. Delay :

Delay is an important performance factor in the telecommunication network. Delay means the time required to transfer a bit of data over a network from source node to the destination node. It is unit to measure delay of the network is multiples or the fraction of seconds. Different applications can tolerate delay in different degrees.

There are some types of delay that are observe which are:

a. Processing Delay: It is a time taken by routers to process the packet header.
b. Queuing Delay: It is sum of delays, Time of insertion of packet into network and time required to delivery of that packet to the destination address.
c. Transmission Delay: It is a time required to push the packet's bits into the link.
d. Propagation Delay: It is a time required for signal to reach it's destination.

3. Jitter :

Packets reaches at the destination point to source point will reach with different delays. The packet delay may varies as the position of transmitter point to receiver point and this position can vary unknowingly. This variation in delay to reach the packet at destination point from source point is known as jitter.

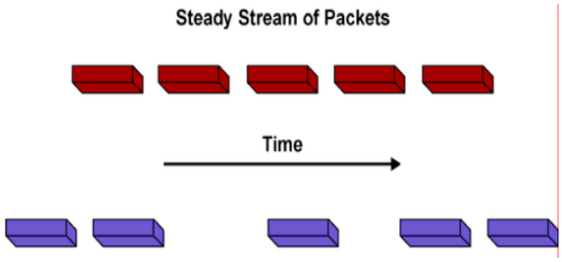

Figure 2. Delay in Networking

The main drawback of jitter is that it makes the traffic jam and network congestion. Network congestion concept is same as the traffic jam on the highway. In this the vehicles cannot go forward with a speed. Like in network congestion the packets can't reaches in specified speed or they may be reaches at the same time so that packets collapse with each other. Due to this there may be a packet loss, which reduces the performance of network.

4. Packet Loss :

The packet which is send from source end to the destination end over the network for the communication, but the packet send from source end is not meet at the destination end then we called it as a packet loss. Packet loss may be caused by network congestion, error in data transmission, etc.

The Transmission Control Protocol (TCP) ensure that there is no packet loss in the transmission of data, because it is a connection oriented protocol. But the User Datagram Protocol (UDP) is not ensure that there is no packet loss between the transmission of data, because it is a connectionless protocol.

II. TECHNIQUES TO IMPROVE QoS

There are some techniques which are used to improve the QoS and help in the network management system.

1. Scheduling :

Packets from the different signal arrive at the router and switch for processing. We call the best scheduling technique which treats the different signal in the fair and appropriate manner. For this some scheduling techniques are used to improve the performance of the network these are,

A. FIFO Queuing :

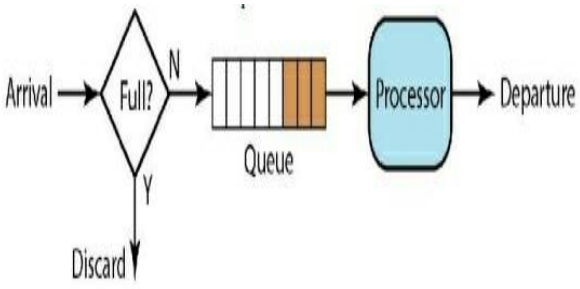

Figure 3. FIFO Queue

In the FIFO queuing scheduling technique, the arrival packets are stored in the queue on the basis of FIRST IN FIRST OUT. The stored packets wait until the node is not processing them. If the rate of input packet is greater than the rate of processing then the queue will fill up. Now when the new packet arrival then they will discarded, because there is no space is remaining in the queue to store them in the queue.

B. Priority Queuing:

In the priority queuing technique as the packet arrival at the node it is given first to the priority class. Then packets are stored in the queue on the basis of priority class. Each priority class has its separate queue to store the packet where they waiting for the processing. If the queue is full then it discarded the packet. In the priority queuing higher priority packets are first executed than the lower one. This process is repeated until all the queues are not get empty.

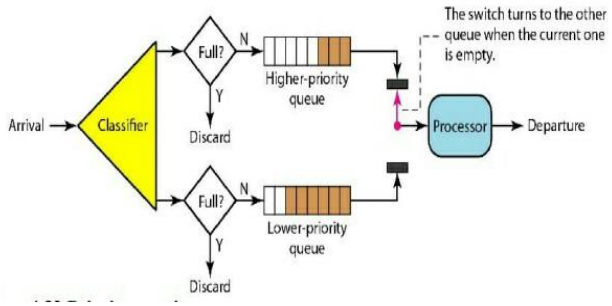

Figure 4. Priority Queue

Priority queuing performance is better than the FIFO queuing, because in the priority queuing technique the higher priority processes are executed first so that higher priority traffic can reach the destination point with less delay.

C. Weighted Fair Queuing:

In the weighted fair queuing technique, packets are assigned to priority class first and stored in that priority queue where packets are waits for processing. Here also each class has its own queue where packets are stored of the same type of priority. Each queue has its own weighted based on the priority of of queue. Higher priority queue has higher weight. Here system processes the packets based on Round- In the weighted fair queuing technique, packets are assigned to priority class first and stored in that priority queue where packets are waits processing. Here also each class has its own queue where packets are stored of the same type of priority. Each queue has its own weighted based on the priority of queue. Higher priority queue has higher weight. Here system processes the packets based on Round- Robin fashion from each queue with their corresponding weight.

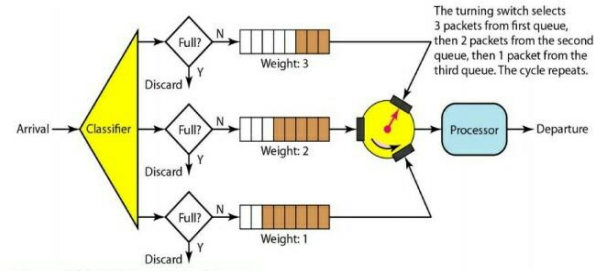

Figure 5. Weighted Queue

Suppose in given example, If the weights of queues are 3, 2 and 1. Therefore 3 packets are processed from queue which has weight equals to 3, 2 packets are processed from queue which has weight equals to 2 and 1 packet is processed from queue which has weight equal to 1. Now system will perform this sequence to processes the packet until all the packets will not get empty. If system does not assign priority on the classes , all weights can be equal.

2. Traffic Shaping:

Traffic shaping is a technique which control the amount and rate of traffic send over the network. Main use of traffic shaping is to control the traffic over the network. There are some techniques use to control the traffic are as follows,

A. Leaky Bucket:

If the bucket is full with water and it has a small hole at the bottom side. Therefore the water leaks from this bucket with the constant flow, with constant rate of the water until the bucket is empty. Between this process if we provide input water to bucket, which is ten times greater than that of output flow of water from the hole at bottom. But we observe that whatever the input to the bucket the rate of water leaks does not change. Simply, rate of output does not depend on the rate of input to the bucket output rate remain constant.

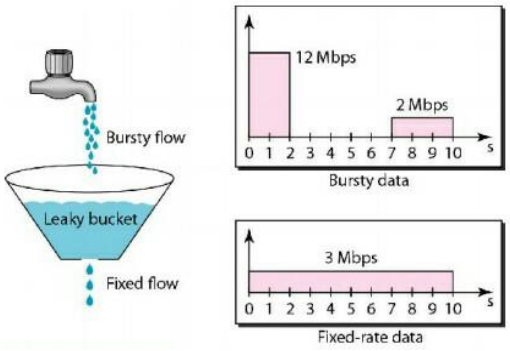

Figure 6. Leaky Bucket

Similarly, this concept is use in the networking for traffic shaping and called it as a leaky bucket technique which can work to smooth out bursty traffic. Bursty chunks are stored in the bucket and sent out with average rate.

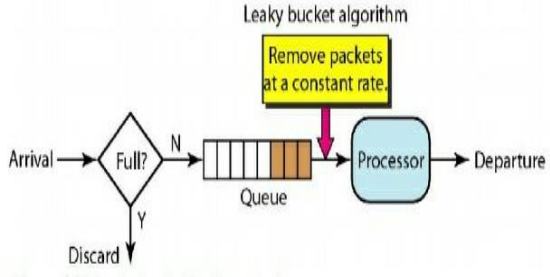

Figure 7. Leaky bucket Implementation

Consider the given example, we use here a concept of leaky bucket and assume that network has bandwidth of 3 Mbps for host. First host sends the burst of data for 2 seconds at the rate of 12 Mbps and stop, Thus he sends the 24 Mbits of data. After 5 seconds he again sends data for 3 seconds at the rate of 2 Mbps, thus now he send 6 Mbits of data. In all process host sent 30 Mbps of data in 10 second. By applying leaky bucket technique we smooth's the traffic by sending out data for 10 second at a rate of 3 Mbps. A leaky bucket algorithm converts the bursty traffic into the fixed-rate traffic by sending a data with average rate. It is possible to drop the packets by the leaky bucket if the bucket is full.

B. Token Bucket:

A leaky bucket algorithm is very restrictive to use. It transmits the data in average rate from burst data. It is not in use when the host is idle. But in the token bucket algorithm the idle host allow to accumulate credit for the future use, because it create a token at each tick of the clock and forwarded the token towards the bucket at each tick. The whole working of token bucket is depends on the token thus it is a token dependant system. One most important advantage of using the token bucket over the leaky bucket is that it does not discard the packet, here token may be discarded when the bucket is full. As wel as it allow to sent large burst traffic with faster rate than the leaky bucket.

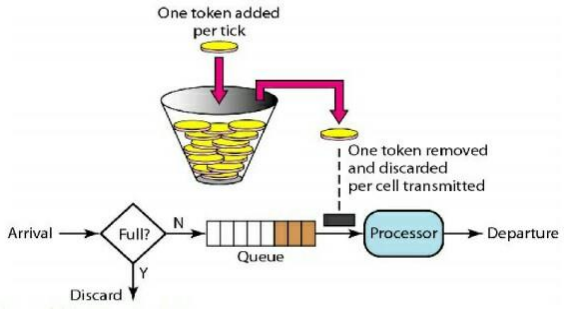

Figure 8. Token Bucket

If we want to implement token bucket, then it is easily implemented by using counter. First token is initialize to zero. Each time when the token is added,

the counter is incremented by one. And each time when the unit of data is sent, counter is decremented by one. When the counter has no value, i.e. token equals to zero then host cannot send data.

3. Resource Reservation:

Every data signal needs some resources such as bandwidth, buffer, CPU time, etc. If these resources are reserved first then the quality of service is improved at great level in the network. The protocol use for this purpose is RSVP protocol.

Resource Reservation Protocol (RSVP), It is a transport layer protocol use in network for reserve resources to improve quality of service in the unicasting and multicasting data flow. It is design for all, i.e. for sender, receiver and routers. RSVP is not a routing protocol it is just a signaling protocol. It identifies a communication session by the combination of destination port number, destination address and type of protocol at transport layer.

There are two types of reservations in the RSVP,

a) Distinct Reservation: Reserve separate resources for each sender.
b) Shared Reservation: Reserve common resources for all sources.

4. Admission Control:

Admission control refers to the mechanism and technique to control the congestion in the network. It is achieved by restricting the routers or switches for accepting the signals from host. Before accepting the signal, it checks the capacity parameters in terms of buffer size, bandwidth, CPU speed, and its last status to other signals can handle the new signal etc.

If there is no admission control in the network then congestion may occur, because load on network is greater than capacity of network.

III. MODEL DEPLOYING QOS

IntServe and DiffServe are the two main model are use in the network for providing QoS in the network.

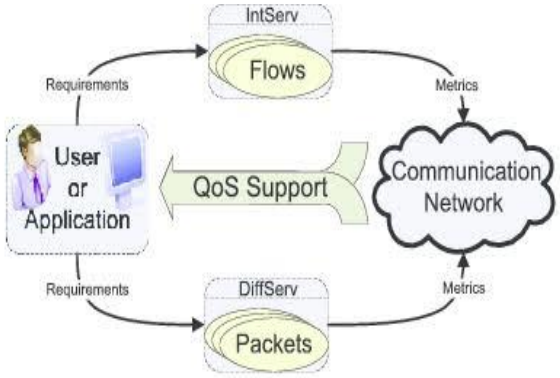

Figure 9. QoS model with IntServe and DiffServe

1. Integrated Services (IntServ):

IntServe model stands for the Integrated Services model, which is also called as Hard QoS Model. This model is based on the flow of data, i.e. destination and source IP addresses and ports. By using IntServe model application ask to the network for an explicit resource reservation per signal for communication, resulting the application get resources guarantees and a required behavior of the network.

For implementing this model there is need of IntServ capable router in the network and also use of RSVP protocol for end-to-end resource reservation. RSVP provide facility for host to establish a connection over connectionless IP internet:

1. Before sending a data application forwards some level of service request to network.
2. Network rejects or admits the reservation by considering the available resources.
3. After cleared, network expects the application to stay in the requested traffic profile.

Advantages of using IntServe models are it is a better solution to manage a data flow in small area. Also it gives a guaranteed rate service and controlled load service.

2. Differentiated Services (DiffServe):

DiffServe model stands for the Differentiated Services model. It is also called as a Soft QoS model. This model is based on the two things one is service classes and second is per hop behaviour related with each class.

DiffServe provides hosts or end devices to differentiate packets into different Traffic Classes (TC) or treatment categories, each of these will get a different Per-Hop-Behaviour (PHB) at every hop from sender to receiver. Every network device between the path treats packets basis on the locally defined PHB. PHB states how node treats a TC.

By using the DSCP priorities are defined in each packet for traffic classification. This marking is done as per packet usually at the QoS boundary. Marking process is perform at the several levels of the networking layers.

Advantage of using the DiffServe model is it high scalable QoS mechanism. Operations, configuration and maintenance are easy. By using this flows of number of applications can be aggregate into number of TCs.

IV. CONCLUSION

This paper focused on a general concepts regarding with QoS in the network. Also we discussed the factors such as delay, bandwidth, packet loss, jitter, network traffic, etc are affecting on the QoS of the network. When the delay is more the QoS reduces, when the source's and destination's bandwidth are not matches with each other the packet loss may occur in the network. Therefore for high QoS and proper communication the bandwidths of both the sides must to be matches with each other. If there is a jitter in the network then the traffic jam condition may occur as same as the traffic on the highway road and it reduces the QoS.

At the same time this paper also focused on the various techniques to remove the error and faults in the network to improve the QoS. In that section we focused on some techniques such as scheduling, traffic shaping, resource reservation and admission control. All these are helps to reduce the cases which are affecting on the QoS like packet loss, delay, etc. and send the flow of data in proper rate which increases the QoS.

In the last section of this paper we focused on the two models, IntServe and DiffServe which are use to apply all the features of QoS to give better service to the user.

V. REFERENCES

[1]. Vittorio Bilo. Quality of Service in Wireless Network. (2003). IEEE Computer Society.

[2]. P. Calduwel Newton. An Intelligent technique to improve QOS in multihomed mobile networks. (2009,June). International Journal of Advance Science and Technology. Volume 7.

[3]. Agung Ariwibow . Bandwidth Management System to Support QOS of rural Digital Learning. (2012) . International Conference in Green and Ubiquitous Technology.

[4]. Roman Burachok. Research of QOS in Telecommunication Networks with packet Switching. (2007,Feb) . CAD Syatems in Microelectronics.