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Scheduling Algorithm And IP Queue Types In WLAN

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Abstract:

This article provides an overview of various scheduling algorithms and IP Queue types in WLAN Scheduling algorithms are those which decide which method it has to adopt for the communication between sender and receiver. These can be implemented on CBR, VBR, ABR and UBR applications. IN this scenario the WLAN will be implemented on CBR application. The various QoS parameters like throughput, delay, response time can be considered for evaluating the performance of scheduling algorithms.

***Keywords**: CBR, VBR, ABR, UBR, QoS, throughput, delay, response time etc.*

INTRODUCTION

Internet technologies are one of the most demanding technologies in the recent trends, we can easily observe that wireless networking is the most attractive trend that has been discussed and developed for over decades. The significant change is mobility. Internet users are no longer sitting in front of desktops; instead, carrying wireless mobile devices connecting to the Internet has become a new phase of network communication. The desire behind this evolution is to build up an ultimate environment for Internet access and achieve the convenience and the flexibility for life. [1]

In recent years, the most active area in networking is - data, voice and video integration. Business users are beginning to combine real-time applications such as voice and video, which have a limited tolerance for network latency, with non-real time data traffic. With Voice over IP (VoIP) technology - defined as the ability to make telephone calls (real-time voice) over IP-based data networks with a suitable QoS and a much superior cost benefit - systems can provide simultaneous voice and Internet access over the same connection, or integrate existing phone connections with the Internet through VoIP Gateways [2]

Queue scheduling algorithms has been proved to be a very efficient, high throughput scheme for scheduling in input queue scheduling. [3].To queue something is to store it, in order, while it waits processing. In a computer network, when data packets are sent out from a host, they enter a queue where they await processing by the operating system. The operating system then decides which queue and which packet(s) from that queue should be processed. The order in which the operating system selects the packets to process can affect network performance.

Note that queuing is only useful for packets in the outbound direction. Once a packet arrives on an interface in the inbound direction it's already too late to queue it -- it's already consumed network bandwidth to get to the interface that just received it. The only solution is to enable queuing on the adjacent router or, if the host that received the packet is acting as a router, to enable queuing on the internal interface where packets exit the router.

The scheduler is what decides which queues to process and in what order. When a packet arrives, it is immediately placed in a queue that is dedicated to its outgoing port, where it will wait for its turn to depart. [4].Various types of scheduling algorithms are Strict Priority, Round Robin, weighted fair and Weighted Round Robin and can be implemented on different IP Queue types. Figure 1 shows the functionality of scheduler.

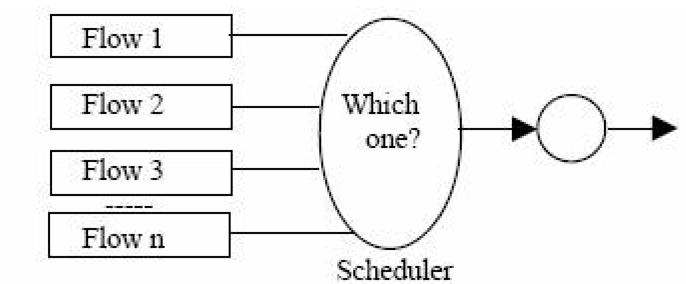

Fig 1 Functionality of Scheduler

In a data communication network packets belonging to different traffic flows often share links in the way to their destination. When a node cannot send all the packets it receives in a particular moment, packet queues are originated [5].

The distinguishing feature of the Scheduling algorithms is the support of different levels of quality of service as required by subscribers and their applications. QoS is an end-to- end concept that has to be satisfied through the inter-working of all the entities that the data is passing through. As a matter of fact, every different application has its own QoS contract and every contract has its own QoS parameters such as end to end delay, jitter, packet loss, response, and turnaround time and throughput which in general could vary with continuity.

2.0 Parameters evaluating QoS

QoS in Scheduling algorithms on WLAN with CBR application means the required throughput and delay in a particular service. The QoS parameters upon which we guarantee the best service and which are used in the simulation are:

2.1 Throughput

Throughput is the average rate of successful message delivery over communication channel. It is measured in bits per second (bit/s or bps) and sometimes in data packets per second or data packets per time slot. Due to varying load from other users sharing the same network resources, the bit-rate (the maximum throughput) that can be provided to a certain data stream may be too low for real time multimedia services if all data streams get the same scheduling priority.

The throughput at the server is calculated as,

$$\textbf{Throughput} = \frac{\textbf{Total bytes sent * 8}}{\textbf{Time last packet received – time first packet received}} \quad \text{---------- (1)}$$

2.2 Average Jitter –

As the packets from source to destination will reach the destination with different delays. A packet's delay varies with its position in the queues of the routers along the path between source and destination and this position can vary unpredictably. This variation in delay is known as Jitter. Jitter can seriously affect the quality of streaming audio and/or video. As we know jitter is the variation in delay suffered by different data packets reaching a destination, thus it is an unwanted parameter. But it is also unavoidable in IP based communication systems as we use routers for the data packets and different data packets choose different routes for attaining bandwidth utilization.

$$\textbf{Average Jitter} = \frac{\textbf{Total packet jitter of all received packets}}{\textbf{Number of packets received - 1}} \quad \text{-------------- (2)}$$

Where, packet jitter = transmission delay of the current packet - transmission delay of the previous packet.

2.3 Average end-to-end delay-

Due to queuing and different routing paths, a data packet may take a longer time to reach its destination .The end-to-end delay experienced by the packets for each flow the individual packet delay are summed and the average is computed

$$\textbf{Throughput} = \frac{\textbf{Total of transmission delays of all received packets}}{\textbf{Number of packets received}} \text{ -------------- } \textbf{(3)}$$

Where, transmission delay of a packet = (time packet received at server - time packet transmitted at client),
Where the times are in seconds.

3.0 QoS mechanisms

Several mechanisms have been proposed to support real-time and multimedia traffic at different layers of networking.

3.1 Data Link layer

At this layer (Layer 2) media access control needs to be modified to provide service differentiation so that QoS guarantees can be supported. Asynchronous Transfer Mode (ATM) is associated with wide area network (WAN) and in the local area network (LAN), Frame Relay (FR) in the WAN and IEEE 802 style in the LAN media.

1. **ATM:** Constant Bit Rate (CBR) and Variable Bit Rate (VBR) are best suited for telephony and voice applications, and for multimedia applications such as video. Available Bit Rate (ABR) and Unspecified Bit Rate (UBR) are designed for best-effort delay-insensitive traffic such as file transfers and e-mail. The commitment on the part of the network to provide network delivery.

2. **IEEE 802.1:** 802.1p specification provides a method to allow preferential queuing and access to media resources by traffic class, on the basis of a “priority” value signaled in the frame. This value will provide across the sub-network a consistent method for Ethernet, token ring, or other MAC-layer media types. The priority field is defined as a 3-bit value, resulting in a range of values between 0 and 7, with 0 assigned as the lowest priority and 7 indicating the highest priority. Packets may then be queued based on their relative priority values.

3.2 Network layer

At this layer (Layer 3) too real-time services should be distinguished from non real-time services. IP precedence utilizes the three precedence bits in the IPv4 header's Type of Service (ToS) field to specify class of service for each packet. These bits may be assigned by an application or a user, or by destination and source subnet, and so on. Typically this functionality is deployed as close to the edge of the network as possible, so that each subsequent network element can provide service based on the determined policy.

1. **Packet marking:** The ingress router must mark the packets as they enter the network with appropriate values so that interior routers can handle packets differentially. The marking of the IPv4 packets use the ToS octet.

2. **Packet classification:** Routers must check all received packets to determine if the packets should receive differential treatment. The traffic can be policed and shaped to the network in order to maximize the probability that the traffic will meet the service required and receive the desired quality of service.

3. **Packet queuing:** In interior routers, packets must be handled differently. The routers may employ multiple queues along with some scheduling disciplines such that delay-sensitive traffic will be serviced sooner.

- **FIFO queuing:** In a traditional IP router, first-come first-serve is the scheduling policy used. This is a fair algorithm and same delay is imposed on all queued packets. It is necessary to alter this fairness and introduce mechanisms such that preferential treatment may be given to differentiated classes of traffic.

- **Priority queuing:** There is a queue for each distinct priority levels and queues are serviced in order of priority. Highest priority traffic receives minimal delay but lower priority queues may be prevented from being serviced leading to their starvation. This simple priority mechanism must be used with some other mechanism to police traffic into the queues.

- **Weighted Round-Robin:** Queues are serviced round-robin in proportion to a weight assigned for each queue. The assigned weight is normalized by dividing it by the average packet size for each queue. Normally, at least one packet is transmitted from each non-empty queue in every round.

- **Deficit Weighted Round-Robin:** Each non-empty queue has a deficit counter that begins at zero. The scheduler reads the packet at the head of each non-empty queue and tries to serve one quantum of data. A packet is served if the counter is zero and if it is less than or equal to the quantum size. If the packet cannot be served, then the value of the quantum is added to the deficit counter for that queue.

- **Weighted Fair queuing:** It schedules interactive traffic to the front of the queue to reduce response time, and it fairly shares the remaining bandwidth among high-bandwidth flows. It ensures that queues do not starve for bandwidth, and that traffic gets predictable service.

3.3 Transport and Application Layer

Packets may be marked and classified by transport layer and application layer. Routers could use port numbers, however, they will have to locate the transport-level header that might be behind the optional IP header. By adding application-specific information to packet payloads, the routers need to know the many application-level protocols. The transport and application levels must however provide new functionality to support real-time applications. The real-time transport protocol (RTP) is the standard for real-time data transmission on an IPbased network. RTP provides no QoS capability but implements specific framing for real-time media, such as sequence numbers and time stamps, to the user datagram protocol (UDP).

4. Conclusions

Internet users are increasing day by day, more and more companies provides internet in the form of mobile computing, dial up, wireless, leased lines etc. This increases the basic problem of the internet and doesn't taking care for QoS. This paper presents the different QoS mechanisms and purposes architecture for implementing the end to end QoS. The various scheduling algorithms provides different services and with different QoS parameters with their Queuing types to provide better QoS for end to end implementation.

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