UPLINK QOS PROBLEMS DURING LTE QOS SCHEDULING

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Abstract

QoS uplink scheduling for LTE cannot incorporate packet delay information due to specification constraints of LTE. The limited information results in difficulty ensuring a QoS when conventional scheduling algorithms are employed. So we are analyzing the impacts a delay estimation tailored to QoS that the uplink performance of the QoS scheduling scheme

LTE provide all services as packet services based on IP networks and QoS of all services should be guaranteed in wireless networks, including a radio access network.

The network uses schedulers to guarantee QoS requirements for all service flows.

A random access scheduler located at MAC eNB schedules service packets in accordance with QoS profiles received from the upper layer. A QoS profile consists of information such as priority, allowable delay, and minimum bit rate. The scheduler maximizes the number of service flows that satisfy QoS limits. For delay-sensitive services, all incoming packets have timestamps, the schedulers monitor the service delays in the queue and allocate resources accordingly, taking into account the channel conditions. However, the uplink scheduler for LTE cannot know about the packet delays [1].

An LTE uplink scheduler is located in the eNB and allocates resources based on reports from user entities (UEs). Since reports do not provide time information for each packet, delay-based scheduling algorithms cannot be directly used for LTE.

Is proposed estimate packet delays based on feedback from the UE and examine the impact of delay uncertainty on QoS scheduling performance. For uplink scheduling, UEs buffer service packets in their storages. At the same time, the buffer status report in the serving eNBs is saved periodically or at the very end via buffer status messages (BSR). Each UE simultaneously manages several buffers since several UE services can be provided and each service has its own buffer. The buffer status message provided by LTE consists of two fields: a two-bit logical channel with identifier 3 and the size of its buffer. The buffer size is the sum of the data of the corresponding channel, stored in the corresponding buffer until the time of this message. Using buffer status messages, UEs support QoS-based packet scheduling.

Consider the moments of operation of the buffer status messages [1]:

1) the UEs transmit the BSR to their serving eNB when the uplink data in the radio link control or packet data convergence protocol entity becomes available for transmission;

2) when uplink data with a higher priority arrives (normal BSR). UEs also report their buffer status when the specified timer expires (periodic BSR);

3) when the amount of filling equal to or greater than the size of the BSR (BSR padding).

When packets arrive at a UE and buffer status messages, service packets arrive randomly and accumulate aт a the buffer. The current UE informs the BSR value for service of the serving eNB only when at least one of the buffer status messages triggering conditions is satisfied. When the BSR is started, the UE notifies the serving eNB of the amount of packet data stored in the buffer at current of time.

.Data packets in LTE are scheduled by a scheduler at the MAC layer. Most are dynamically scheduled by the QoS scheduler according to channel condition and QoS require-ments. Special service packets are persistently transmit-ted without QoS scheduling. QoS scheduler is necessary in order to adhere to the QoS requirements of multiple services.

The QoS requirement of each service is defined by a QoS Class Identifier (QCI) and a minimum data rate Guaranteed Bit Rate (GBR). When the service is connected, the network assigns one and only one QCI to each service, a minimum data rate is assigned only to GBR type services.

The assigned QCI specifies the service packet treatment in terms of the following performance characteristics: resource type; priority; Packet Delay Budget (PDB); and Packet Error Loss Rate (PELR).GBR services request guaranteed minimum data rates, non-GBR services have no bit rate requirement. Since applications have different levels of allowable time delay and error, LTE standardizes multiple QoS classes.The QoS class of an application service is determined by the chosen policy.

The priority level idefines relative importance between different service aggregates. A PELR value specified for a standardized QCI wholely applies to the radio interface between a UE and an eNB so that the PELR is not a QoS scheduling parameter [2].

The PDB is a soft upper bound for the allowable packet delay time between the UE and the serving network. The PDB is interpreted as a maximum delay with a confidence level of 98 percent. In other words, the QoS of the service is considered to be satisfied when the ratio of service packets that violates the PDB is less than 2 percent, QoS constrain is identical to that of the M-LWDF.

The main issue is how to procure time delay information Wi(t) for QoS scheduling. In contrast to the downlink case, buffers for uplink service packets are located at UEs. eNB schedules the stored uplink packets. LTE does not provide time delay information of individual packets for uplink. The BSR from a UE to the serving eNB provides only the amount of packet data stored in the UE at the BSR triggering time. BSR does not provide time information and the serving eNB does not possess delay information for uplink QoS scheduling. So QoS performance cannot be guaranteed. In particular, the delay-sensitive non-GBR of services OCI are susceptible to QoS failure. One can use the BSR report time as packet arrival time. Buffer size in BSR indicates a total length of the packets buffered by the reporting time .The time delay of the oldest packet is also renewed by every BSR so that the eNB will consider the packets as a new arrival.

To overcome this problem, more sophisticated delay estimation is necessary for uplink QoS scheduling.

Conclusion

In this thesis is proposed a QoS uplink scheduling for LTE taking into account with delay estimation. Un-like downlink scheduling, uplink scheduling does not possess packet delay information due to specification constraints. The limited information results in difficulty supporting QoS without delay estimation. With delay estimation tailored to LTE, that UL scheduling supports QoS. System parameters can affect QoS scheduling performance, so we are analyzing their the impacts and studying optimal parameters for UL QoS scheduling at further work.

References:

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