Media Header Extensions for Wireless Networks

draft-kaippallimalil-tsvwg-media-hdr-wireless-00

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Motivation for this draft
- latency + bandwidth requirements of media packets
- link capacity variation in wireless networks
- why E2E congestion control may not be sufficient

Metadata about Media Packet(s)
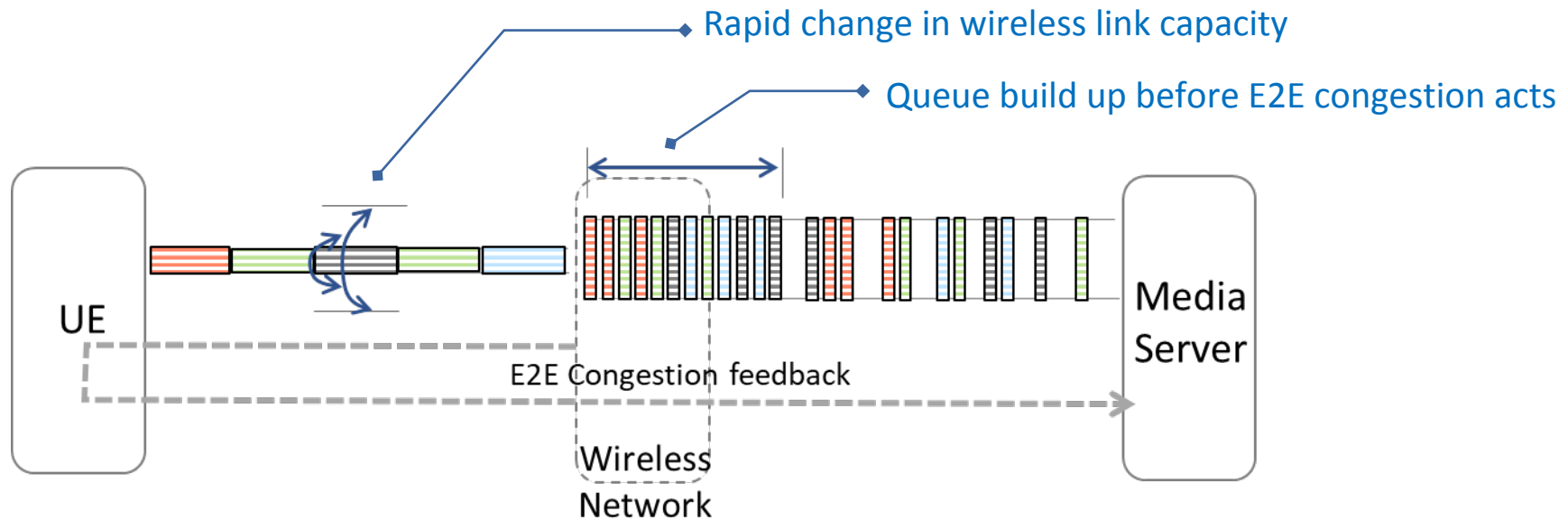- packet(s) information for wireless to schedule better

Transport of Metadata
- various transport options with different trade-offs

Abstract:

Wireless networks like 5G cellular or Wi-Fi experience significant variations in link capacity over short intervals due to wireless channel conditions, interference, or the end-user's movement. These variations in capacity take place in the order of hundreds of milliseconds and is much too fast for end-to-end congestion signaling by itself to convey the changes. Media applications on the other hand demand both high throughput and low latency, and are able to dynamically adjust the size and quality of a stream to match available network bandwidth. However, catering to such media flows over a radio link where the capacity changes rapidly requires the buffers to be managed carefully. This draft proposes additional information about the media transported in each packet to manage the buffers and optimize the scheduling of radio resources. The set of information proposed here includes relative importance of the packet, burst length and timestamp to be conveyed by the media application in a header extension. This can be used to provide the wireless network the flexibility to prioritize packets that are essential when the radio capacity is temporarily low, defer packets that can tolerate some additional delay, or even drop packets selectively in more extreme conditions.

Another aspect considered here is the means by which the media pack information is transported. Potential solutions include carrying this information in Media over QUIC extension headers, UDP options, or in a MASQUE encapsulation between the application server and wireless network entity.

otivation for this draft

Rapid change in wireless link capacity

Queue build up before E2E congestion acts

E2E Congestion feedback

Wireless Network

UE

Media Server

Media applications demand low latency, high bandwidth.

Handling wireless link capacity variation and network utilization with the demands of media applications is challenging.

Encryption of media packets, multi-streaming may need different considerations than RTP packets

XRM Study in 3GPP SA2 has identified multiple potential solutions which impact IP transport (QUIC header extn, UDP option, MASQUE)

hat metadata does the wireless network need

Wireless network should be able to manage the latency (short queue)
But also keep network utilization high (longer queue)
.e., bounded queue in the presence of link capacity variations may need to selectively
drop or defer packets

○ Priority or importance level of a packet
(e.g., an I-frame should probably be sent even if there is congestion while an enhanced layer frame may be discarded if needed)

○ Packet Burst
Media frames tend to be periodic with heavy tails. This information is useful for the radio scheduler.

○ Delay Budget
Deriving a delay budget (along with priority) for packet discard when needed.

ansport of Metadata

- Media over QUIC Extension

- UDP Options

- MASQUE Encapsulation

Criteria for consideration include:
  Efficiency since each packet (or group of packets) are inspected for classification
  Secure means to exchange metadata
  API for media application to add metadata
  Extensibility

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○ Identifies challenges in wireless networks for low latency media applications

○ Encryption of media packets and multi-streaming requires consideration on what is the right set of metadata, choice of transport protocol extensions, APIs.

○ The draft proposes:
- a set of metadata (importance/priority, burst length, time budget)
- transport of metadata (QUIC header extn, UDP option, MASQUE)

Comments?