Losses in SATCOM systems: identification and impact

Nicolas KUHN and Emmanuel DUBOIS (CNES)
Alexandre FERRIEUX (ORANGE)
François MICHEL (UCLOUVAIN)
Emmanuel LOCHIN (ISAE)
Why focusing on losses?

- SATCOM system split the reliability management with TCP proxies
- The emergence of QUIC traffic raises a question:
  - Where are the losses and how do they impact the transmissions?
Are there E2E losses in SATCOM systems?

• End to end measurements on a real satellite public access

• Loss identified by missing QUIC packets are the receiver
  • Gilbert-Elliot model
  • Probability to go from «good» to «bad» state = 0.018!
Where are the losses?

• Identification on the losses
• AKAMAI servers, IETF-QUIC traffic and a real (dedicated) satellite
• Loss identification based on the method proposed in
Where are the losses?

No loss before the gateway

Loss after the gateway

Loss after the terminal

Loss-down out of 42092 packets:

Loss-down out of 79928 packets:

Loss-down out of 79095 packets:
Loss measurements on a residential Wi-Fi

- Residential router (802.11ac)
- D-ITG tool to generate traffic and collect metrics
- More than 9 million 1400 B packets
  - Average delay: 7 ms (with very high jitter)
  - Packet loss: 0.12%
  - Loss burst size: more than 2 packets
Impact of E2E losses on a TCP flow

<table>
<thead>
<tr>
<th>Loss ratio</th>
<th>Time needed to download 1 GB (s)</th>
<th>Goodput (Mbps)</th>
<th>Loss impact ((1 - \frac{\text{Goodput-loss}}{\text{Goodput-noloss}}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>797</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>0.0001</td>
<td>935</td>
<td>8.5</td>
<td>0.15</td>
</tr>
<tr>
<td>0.0005</td>
<td>1528</td>
<td>5.2</td>
<td>0.48</td>
</tr>
<tr>
<td>0.001</td>
<td>1863</td>
<td>4.2</td>
<td>0.58</td>
</tr>
<tr>
<td>0.005</td>
<td>7140</td>
<td>1.1</td>
<td>0.89</td>
</tr>
</tbody>
</table>

- Experimental evaluations of QUIC showed good performance for short flows with public accesses
- For long flows, the E2E losses can have a huge impact
Solutions to loss events

• Adding coding in QUIC
  • I-D.swett-nwcrg-coding-for-quic
  • Interaction between congestion control and coding
    • draft-kuhn-coding-congestion-transport-00
    • Presented at NWCRG

• Workshop on QUIC for high BDP network
  • Details: https://trac.ietf.org/trac/ietf/meeting/wiki/106sidemeetings
  • Time: 3pm30 – 4pm30 on Wednesday
  • Where: Bras Basah