Extending Snoop to Handle IPSec Packets

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The problem of using TCP in wireless networks

- Major causes for losses in wireless networks
  - lossy wireless links or hand-offs
- TCP can not distinguish between:
  - Congestion loss
  - Error loss
- When misunderstanding error loss as congestion loss, TCP sender back off => performance degradation.
Snoop

- A link layer protocol that snoops into the TCP header.
- Cache the TCP data packets that are being sent across the wireless link
- Error detection
  - local timeout
  - a small number of duplicate ACKs.
IPSec: encrypted IP packet

- IPSec packet format:

<table>
<thead>
<tr>
<th>Ipsec_seqno</th>
<th>IV</th>
<th>….</th>
<th>Tcp_seqno</th>
<th>ACK no</th>
<th>Pkt_type</th>
<th>….</th>
<th>Data load</th>
</tr>
</thead>
</table>

- The problem of Snoop over IPSec:
  - Snoop needs to access the higher layer (TCP) packet header
    - ACK sequence number.
    - Packet sequence number.
Snoop layer over IPsec

- **Network configuration:**

  At the Base Station:

  - **Traffic from FH → MH:**
    - Cache TCP data packets.
    - Identify congestion loss if receiving out-of-order packets
Snoop layer over Ipsec (cont.)

At the Mobile Host:

- set IV in the ACK to hash(IV).
- the IPSEC seqno is assigned a new one at TCP sink.
- when need to generate duplicate ACK (the received packet is out of order):
  - TCP: dup tcp seqno, but new uid
  - In our snoop version (for security reason):
    Use the cached ACK for duplicate ACK, so exactly the same ACK as before.
Snoop layer over Ipsec (cont.)

At the Base Station:

- Traffic from MH → FH:
  - New ACK: propagate.
  - Dup ACK:
    - Congestion loss => propagate
    - o/w, Propagate one, then suppress the following duplicate ACKs.
  - Use IV to identify which packet is being ACKed.
  - Use IPSec sequence number to do cumulative ACK.
Simulation results:

![Graph showing TCP receiver throughput vs. Bit error rate⁻¹]

- **TCP**
- **RLL-SNoop-qsize=50**
- **SNoop**

No error
Simulation results (cont.):

![Graph showing TCP receiver throughput vs. Bit Error Rate for different protocols: RLL-SNooop-qsize=50, SNooop, TCP.](image-url)