

# ECN for RTP over UDP/IP

draft-westerlund-avt-ecn-for-rtp-02.txt

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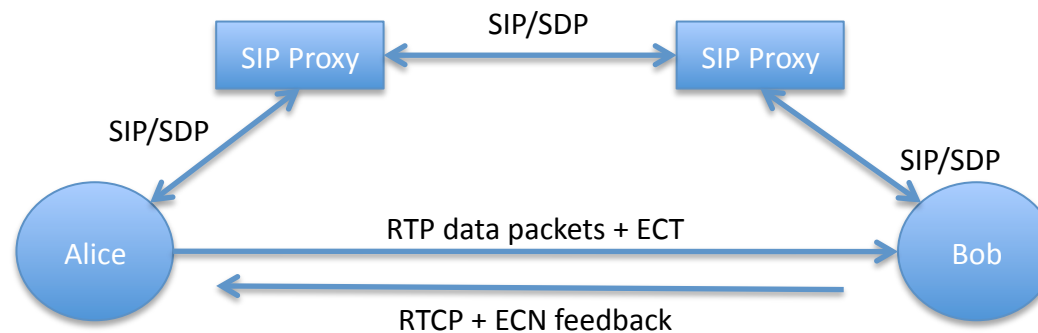
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# Overview of Proposal

- Discusses how ECN can be used with RTP sessions running over UDP/IP
  - Negotiation of ECN capability
  - Initiation of ECN use within an RTP session
  - Ongoing use of ECN
  - Detecting failures and receiver misbehaviour



# Changes since last meeting

- Merged with draft-carlberg-avt-rtp-ecn-02.txt and draft-carlberg-avt-rtcp-xr-ecn-01.txt
- Added leap-of-faith initiation
- Made use of ECN nonce optional
- Updated capability negotiation signalling
- Updated RTCP packet formats
- Editorial cleanup

# SDP Capability Negotiation

```
ecn-attribute = "a=ecn-capable-rtp:" SP init-list SP parm-list
init-list    = init-value *("," init-value)
init-value   = "rtp" / "ice" / "leap" / init-ext
init-ext     = token
parm-list    = parm-value *("; " SP parm-value)
parm-value   = nonce / mode / ect / parm-ext
parm-ext     = parm-name "=" parm-value-ext
parm-name    = token
parm-value-ext = token / quoted-string
mode         = "mode=" ("setonly" / "setread" / "readonly")
nonce        = "nonce=" ("0" / "1")
ect          = "ect=" ("random" / "0" / "1")
```

; external references: token, quoted-string

Parameters specify:

- Initiation method (RTP/RTCP, STUN/ICE, leap-of-faith)
- ECN mode (set ECT, read ECN bits, both)
- Nonce enabled or not
- Receiver preference for sender ECT marking (0, 1, random)

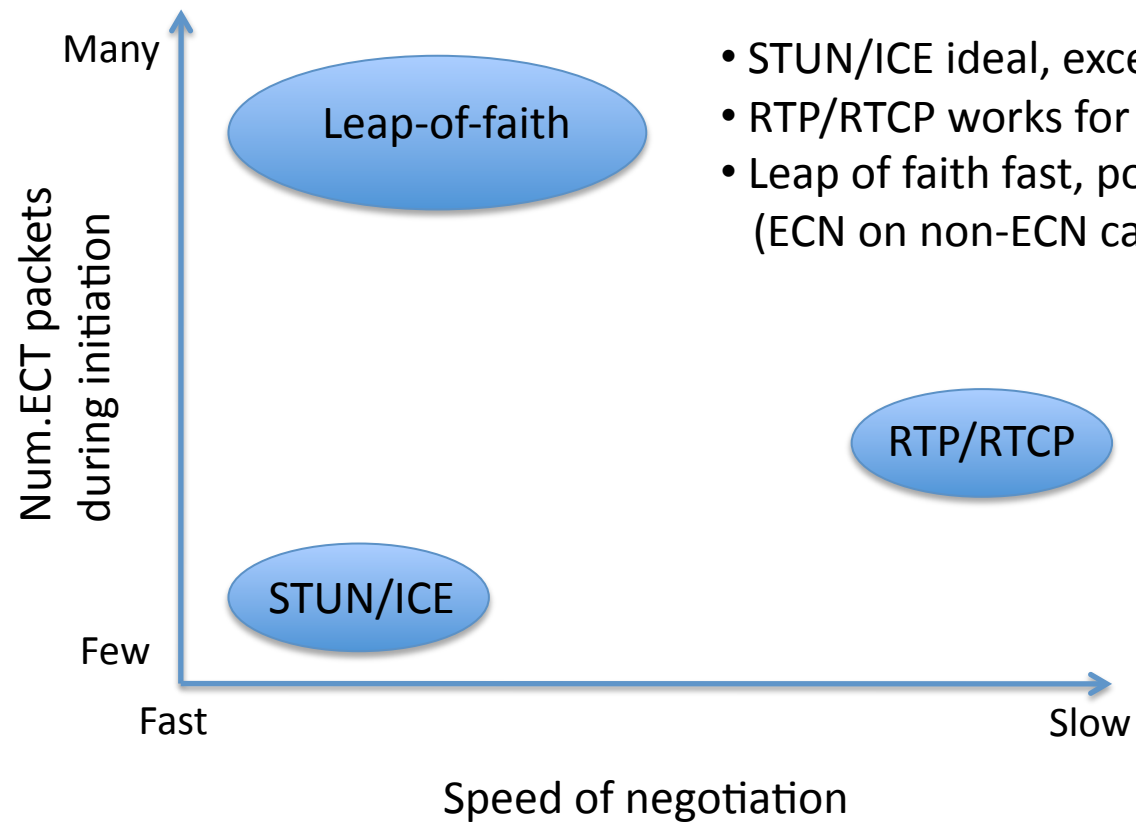
# SDP Capability Negotiation

- Negotiate capability to read or set ECT bits
  - Some systems only allow read or set ECT, not both
- Nonce can be enabled to detect cheating receivers
  - Increases required RTCP bandwidth
- Receiver preference for sender ECT: 0, 1, or random
  - Recommend random, but allow non-random to avoid disrupting header compression, especially in controlled environments
  - Sender can still ignore preference to use random

# Initiation of ECN Usage

- Three options
  - Probe using RTP data, use RTCP for feedback
    - Requires 3 RTCP reporting intervals with ECT marks received and stable receiver population before transition to full ECT
  - Probe using STUN request, feedback on STUN response
    - One additional RTT to verify ECN-support once candidate chosen
    - Only suitable for sessions using ICE for NAT traversal
  - Leap-of-faith: send RTP with ECT, report failure via RTCP
    - Assumes ECN-capable path; suitable for controlled network only
    - Some failure modes are *highly* disruptive to the media

# Initiation of ECN Usage



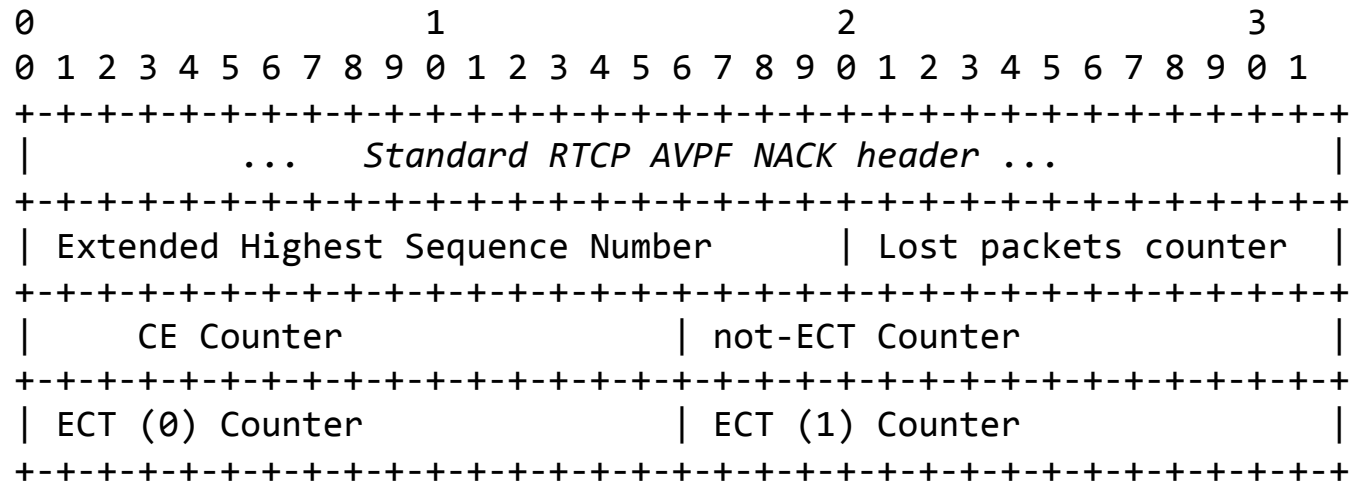
- STUN/ICE ideal, except not all sessions use ICE
- RTP/RTCP works for all sessions, but slow
- Leap of faith fast, potentially serious failure modes (ECN on non-ECN capable path -> total media loss)

# Ongoing use of ECN with RTP

- RTCP reporting and feedback
  - Regular RTCP reports to monitor continuous operation
  - Use RTP/AVPF with minimal reports for CE events
  - Optional ECN nonce + RLE of lost/marked packets in regular reports



# Rapid RTCP ECN-CE feedback



Sent in RTCP AVPF NACK to indicate CE-mark received; generally rapid feedback

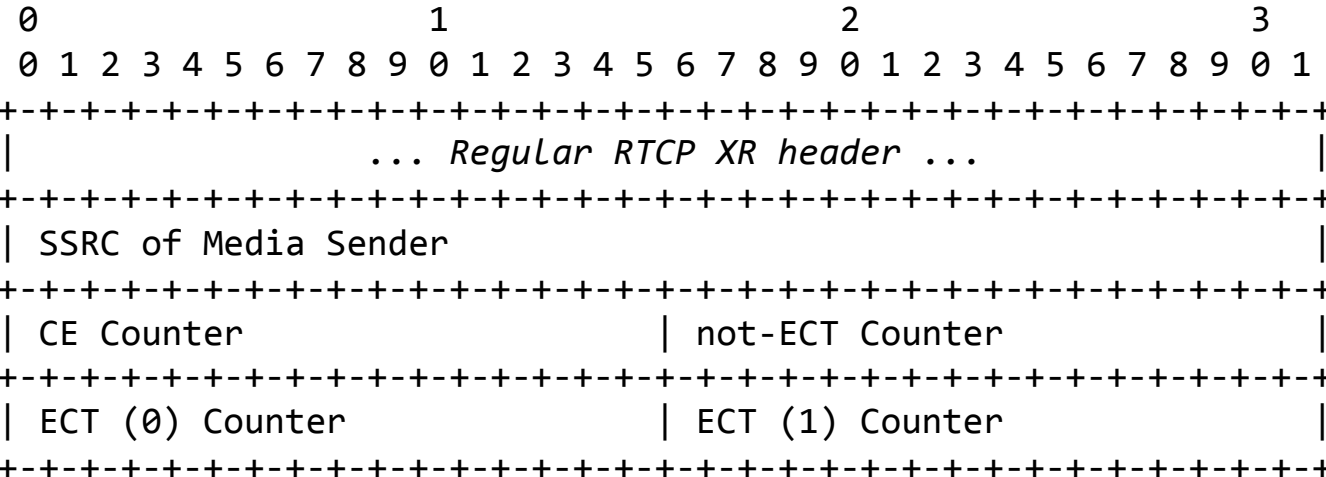
Extended highest sequence number start value unpredictable

Counters are cumulative and start at zero

-> provides some robustness to loss of feedback

-> duplicates included in the count

# Regular RTCP-based Feedback



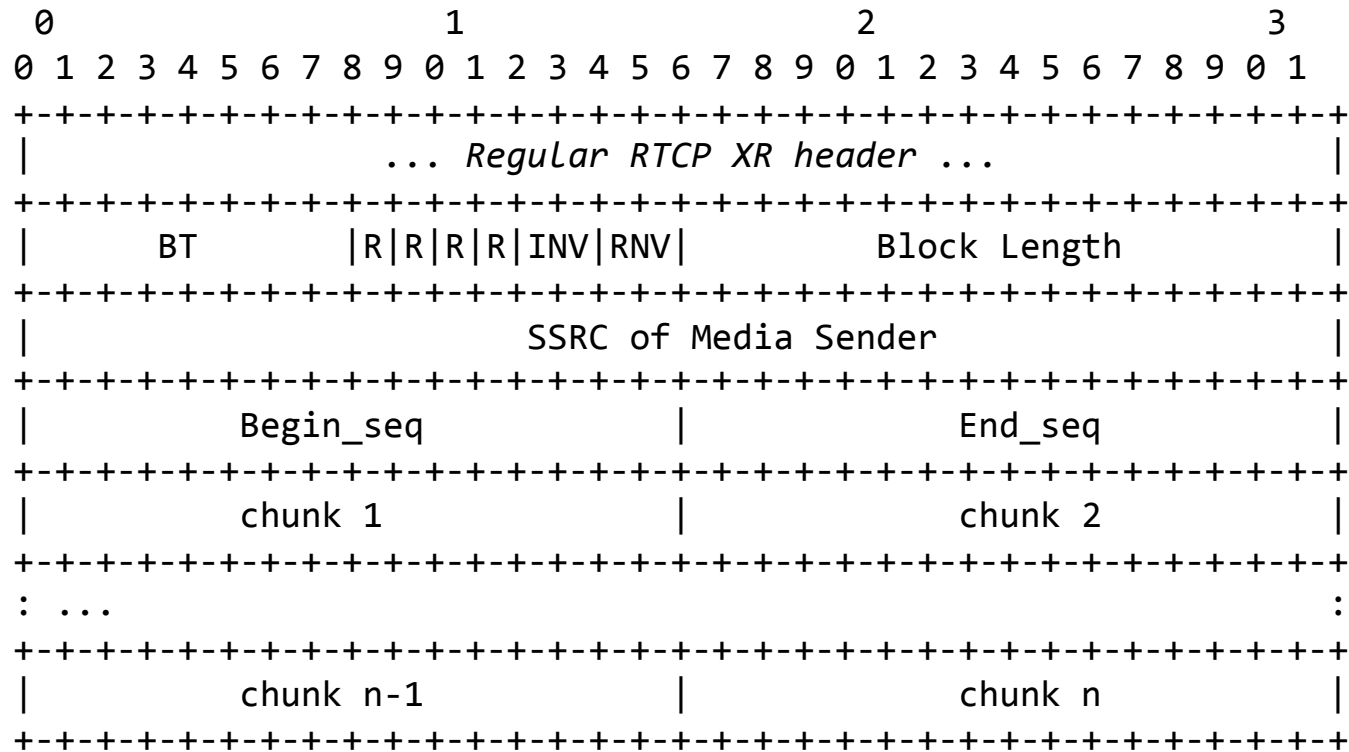
Sent in regularly scheduled compound RTCP packet, with RTCP SR/RR

Same statistics as rapid feedback report, when combined with SR/RR  
 Provides robustness against lost reports

# Handling duplication of RTP packets

- The counters have an issue with packet duplication
  - Each received packet will be counted by receiver => receiver will have counters where sum over them is larger than number sent
  - Duplicate packets may arrive with different markings, for example as ECN-CE and as ECT
  - This creates uncertainty in verification process
    - If number of duplicates are larger than re-marked packets it may not be detected.
    - Sender needs more advanced logic to determine issues
  - Tracking duplication requires substantial receiver state
    - Not done in regular RTCP Receiver reports

# Transport of ECN nonce in RTCP



2-bit Nonce XOR sum; chunks run-length encoded list of lost/CE-marked packets

Use of ECN nonce is OPTIONAL, to detect cheating receivers – regular reports allow detection of non-ECN-capable middle-boxes

# Other Issues

- Consider initiation optimizations to allow for multi-SSRC sender nodes to have rapid usage of ECN

# Actions and Future Directions

- Adopt as AVT work item, with parallel review and last call in TSVWG
  - This draft will continue to focus on how to signal and convey ECN for use with RTP sessions over UDP/IP
  - Detailed congestion response for real-time traffic will not be specified in this draft
    - System must respond to ECN-CE marks in the same way it responds to packet loss (there are a range of solutions)