Measuring ECN++
Good News for ++, Bad News for ECN over Mobile

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Motivation

- Provide initial data for the ECN++ experiment defined in draft-ietf-tcpm-generalized-ecn
- In particular, learn if ECN-marked TCP control packets, Pure ACKs are treated differently to ECN-marked TCP data packets
- Measure how ECN-marked data packets are treated as a baseline and measure ECN-marked control packets and pure ACKs to compare.
Measurement platforms

11 MBB ISPs:
- Vodafone (IT)
- TIM (IT)
- WIND (IT)
- Orange (ES)
- Yoigo (ES)
- Movistar (ES)
- Telia (SE)
- Telenor (SE)
- Three (SE)
- Telia (NO)
- Telenor (NO)

54 Plantelab nodes in 25 ASes in 22 countries.
Experiments

• TCP SYN, Data pakts, Pure ACKs and FINs
• All possible ECN (IP and TCP) flag combinations in ECN, ECN+, ECN++ and AccECN
• Tracebox from clients to Alexa 100k
  – Tracebox is similar to traceroute but verifies changes between the sent pkt and the returned one
• Between clients and our servers
  – In this case, we can also test SYN/ACKS
Measurement campaign

• Between January and May 2017
• Port 80 and port 443
• 26 million end-to-end communications
• 6.5 million different paths
Findings

• ECN clearing
  – 7 out of the 11 mobile providers clear the ECN field in the IP header for packets from client in both ports by the first hop
    • A few tests in other 7 mobile providers and found 3 of them clearing ECN (making 10 out of 18)
  – 1 mobile provider clears ECN in port 80 and not in port 443 (proxy)
  – No evidence of clearing ECN in the traffic from the servers to the client
  – For the other 3 mobile providers 0,53% of clearing ECN deeper in the network (5 hops away)
  – For fixed providers, 0,23 % clearing ECN deeper into the network
ECN and ECN++

- ECN and ECN++ possible packet/flag combination (both IP and TCP header flags) do NOT cause packet drop

- **ECN++ support is the same as ECN support**
  - ECN++ are not discarded, cleared, bleached more often than ECN packets

- 61% of Alexa top 500k supports ECN
  - 3.51% support ECN+ but NONE of them respond as defined in RFC5562
Other stuff

- All the 158K servers of the Alexa top 500k servers that we were able to test for ECN respond to a ECE flag in the same way the respond to 3 dup ACK
- Initial window of the top 500k Alexa
  - 51% IW=10
  - 9,2% IW=2
  - 9,3% IW=4
  - 14% N/A
  - 0,4% IW>10!!!!
    - 1121 servers deliver the whole file in the first RTT (maximum seen of 585 packets in the first RTT)
Final remarks

• ECN++ seems as safe as ECN so far.
• More work needs to be done in ECN still.
• Evidence of ECN clearing found, does it matter?
  – if other links precede the cellular hop (e.g. a home router or bus/train connected over cellular), any CE-marking introduced in the home or vehicle network would be wiped, which would fool ECN sources into overrunning their local network.
• Paper can be found at:
  http://www.it.uc3m.es/amandala/ecn++/
  ecn_commag_2018.html