EcnLD, ECN Loss Differentiation to optimize the performance of transport protocols on wireless networks

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Outline

1. Introduction
   - Objective
   - Why DCCP

2. Loss differentiation

3. Performance measurements

4. Conclusion
Objective

- Improving performance of transport protocols over wireless networks
- Design a new transport protocol suitable for video streaming in wireless networks
DCCP

- New protocol more adapted for multimedia transmissions:
  - Unreliable
  - Choice between two congestion controls
    - TFRC
    - TCP-like
  - Possibility to add its own congestion control
  - Mechanisms indicating to the sender with reliability which packets are received by the receiver
  - ECN utilization
DCCP congestion control

TCP-like

- Similar to the congestion control of TCP
- But:
  - Packet oriented
  - Selective Acknowledgement (SACK)
  - Well suited to multimedia data transport in environments where there are quick changes in network conditions
Outline

1. Introduction
2. Loss differentiation
   - Motivation
   - ECN
   - Methods based on ECN
3. Performance measurements
4. Conclusion
Cause of losses

- Congestion
- Interference, mobility, etc (in Wi-Fi)

Why we need to make a distinction between the two causes?

- Avoid bad reaction when there is a loss
- Not to reduce rate to avoid congestion while it is an interference
  - Therefore: maximize throughput transmitted

Classification methods: Three Categories

- IAT, ROTT or ECN (Our Approach EcnLD)
Cause of losses

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- IAT, ROTT or ECN (Our Approach EcnLD).
ECN (Explicit Congestion Notification)

**ECN principle**

- Notify the sender without losing packets
- A packet ECN compatible is marked on a router before its queue becomes full, otherwise the packet is rejected
EcnLD vs TCP-Eaglet

TCP-Eaglet

- Algorithm: when there are one or more losses,
  - If (Slow Start): halve transmission rate
  - Else (Congestion Avoidance) And ECN:
    - It is a congestion $\Rightarrow$ halve transmission rate

- Problem: No differentiation in the slow start phase

EcnLD, Our approach

- Use RTT in addition to ECN
- Algorithm: when there are one or more losses,
  - If $\text{ECN OR } (n > 0 \text{ AND } RTT_{\text{cur}} > RTT_{\text{ave}} + RTT_{\text{var}})$
    Where: $n$ is the number of losses returned in the acknowledgment
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### EcnLD vs TCP-Eaglet

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Outline

1. Introduction
2. Loss differentiation
3. Performance measurements
   - Simulation topology
   - Simulation results
4. Conclusion
The simulation time is 50 seconds. The sender is s1 and the receiver is m1.
Description of simulation

- **Objective**: compare the performance of EcnLD, TCP-like, and TCP-Eaglet
- **Two scenarios with an wireless error rate varying from 0% to 20%**
  - Without competition
  - In competition with TCP (between s2 and d1. From 1 to 20s And from 25 to 45s)
- **One or two MAC retransmissions**
EcnLD vs TCPlike

First scenario: without competition

**Results**

Improved performance even with increased wireless error rate

EcnLD, ECN Loss Differentiation Method
EcnLD vs TCPlike
First scenario: without competition

Results
Improved performance even with increased wireless error rate
EcnLD vs TCPlike
Second scenario: in competition with TCP

One retransmission

Two retransmissions

Results
Improving performance even in the presence of other traffic in the network
EcnLD vs TCPlike

Second scenario: in competition with TCP

Results

Improving performance even in the presence of other traffic in the network
EcnLD vs TCP-Eaglet

First scenario: in competition on a wireless network of 11Mb/s

Results

Performances are nearly equal
EcnLD vs TCP-Eaglet

First scenario: in competition on a wireless network of 11Mb/s

Results

Performances are nearly equal
EcnLD vs TCP-Eaglet
Second scenario: in competition on a wireless network de 54Mb/s

Results
EcnLD has a high ratio of received/sent packets
TCP-Eaglet has a higher throughput but losses a lot of packets on the network
EcnLD vs TCP-Eaglet
Second scenario: in competition on a wireless network de 54Mb/s

### Results

EcnLD has a high ratio of received/sent packets  
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### Results

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**TCP-Eaglet** bad classification results in a higher throughput but less network friendly.
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Conclusion and perspectives

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- EcnLD has a very high rate of received packets, which designed to improve performance on wireless networks
- EcnLD carries a very high packets reception rate, which makes it suitable to streaming multimedia

Perspectives

- Improving our contribution in wireless networks to design a new multi-radio protocol
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Thank you for your attention

Questions ?