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

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LIFC

Outline

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

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)**.

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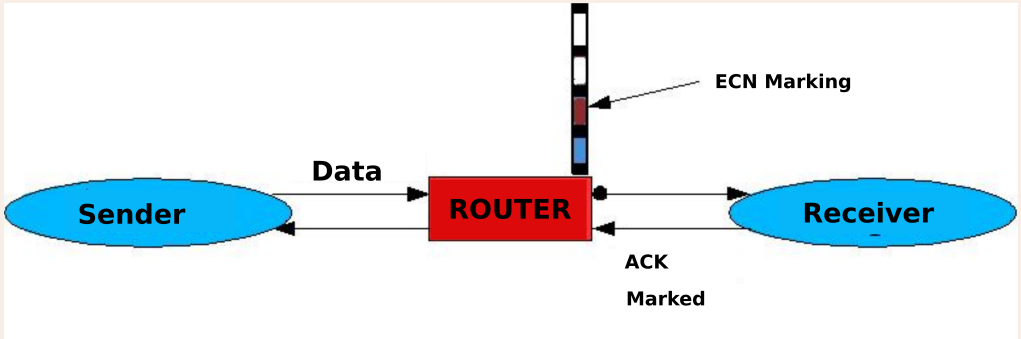
ECN *(Explicit Congestion Notification)*

ECN principle

- Notify the sender without losing packets
- A packet ECN compatible is marked on a router before its queue to 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 ECN OR ($n > 0$ AND $RTT_{cur} > RTT_{ave} + RTT_{var}$)
    Where : n is the number of losses returned in the acknowledgment
    - It is a congestion $\Rightarrow$ halve transmission rate

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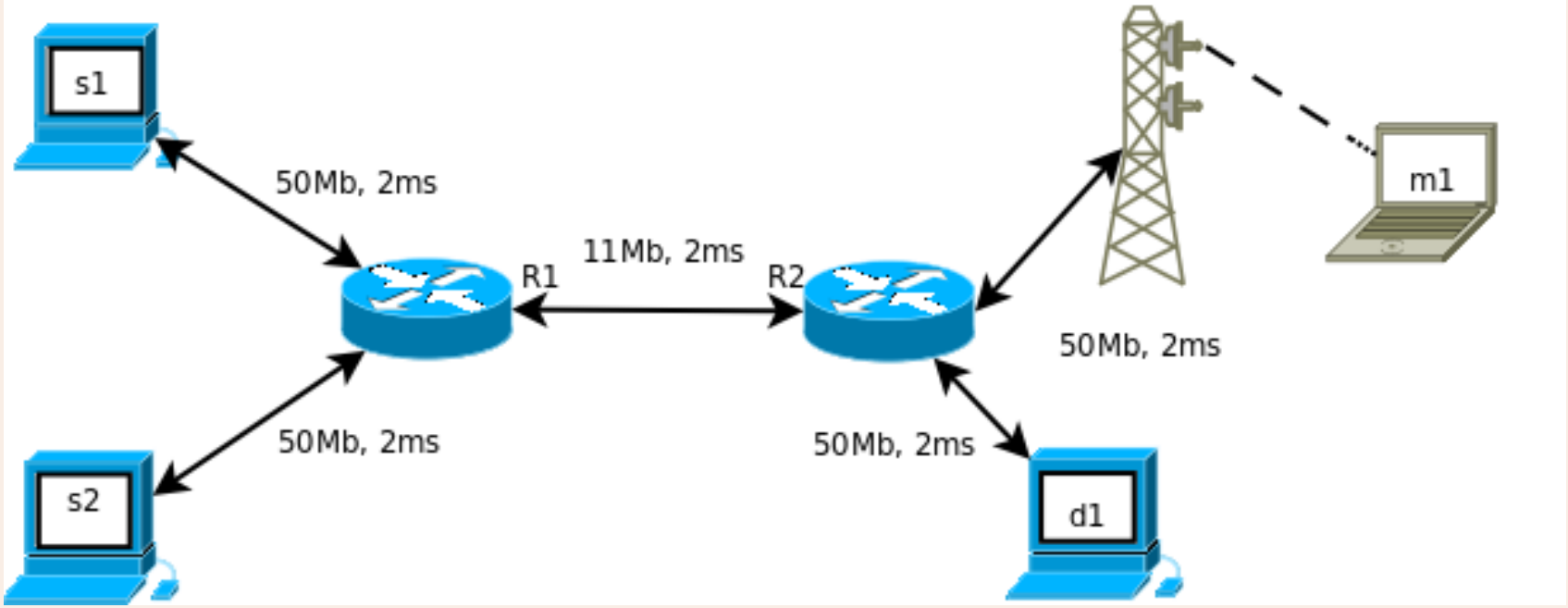
Network used to perform simulations



The simulation time is 50 seconds. The sender is s1 and the receiver is m1

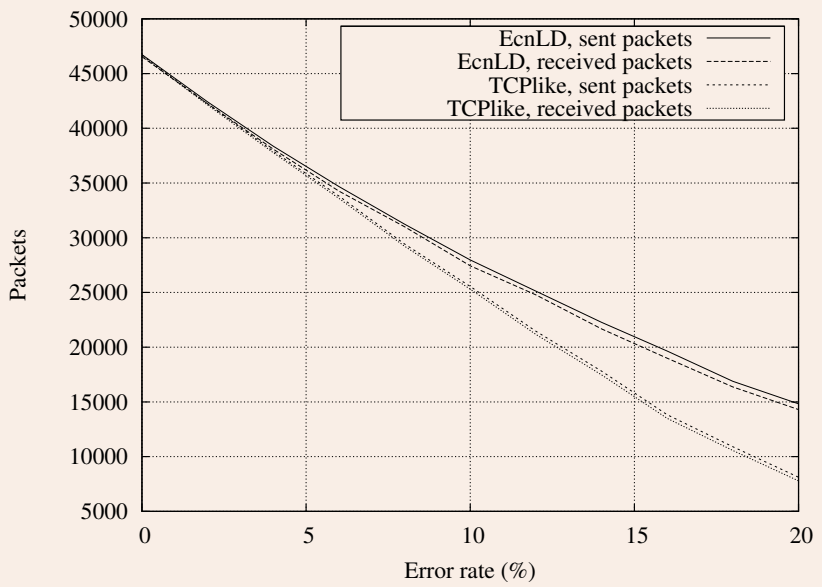
Description of simulation

- Objective : compare the performance of EcnLD, TCPlike 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

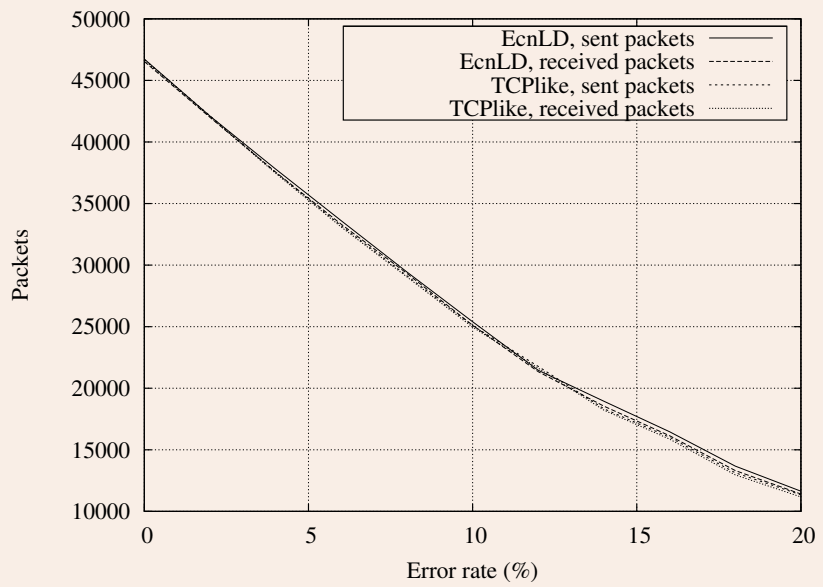
EcnLD vs TCPlike

First scenario : without competition

One retransmission



Two retransmissions



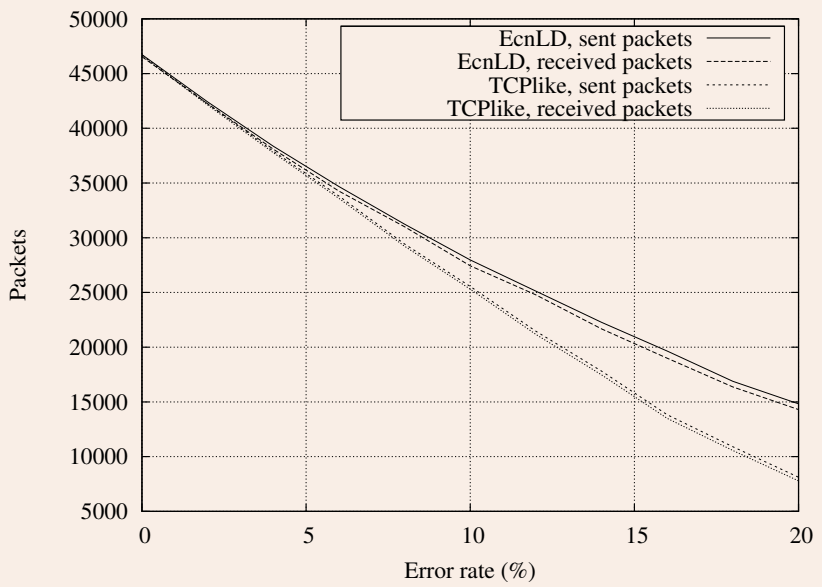
Results

Improved performance even with increased wireless error rate

EcnLD vs TCPlike

First scenario : without competition

One retransmission



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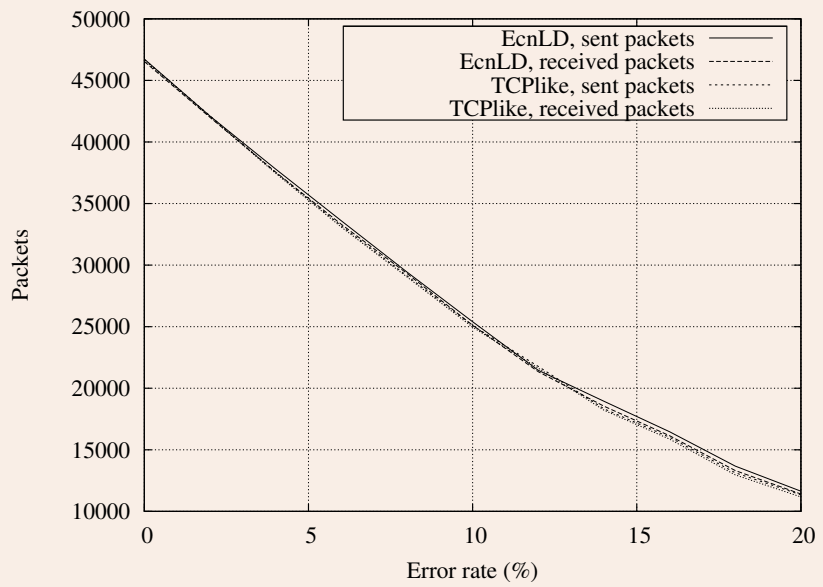

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Second senario : in competition with TCP

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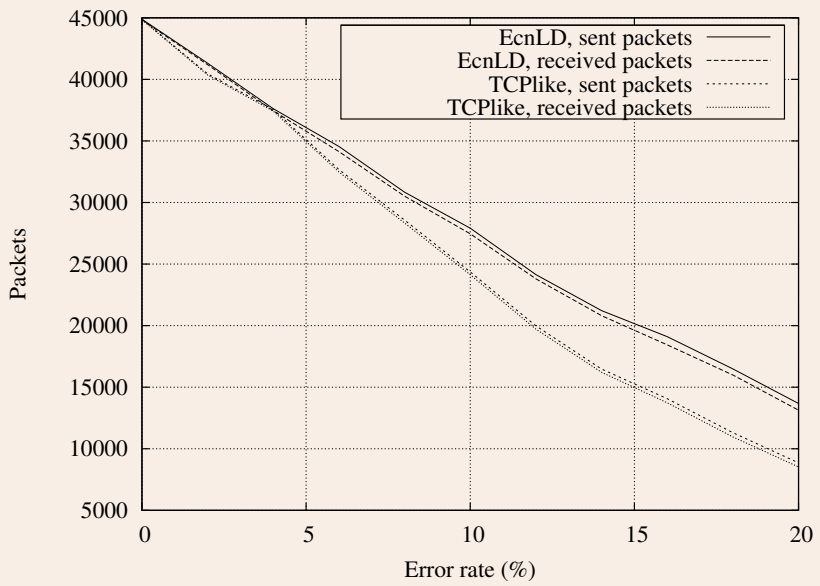

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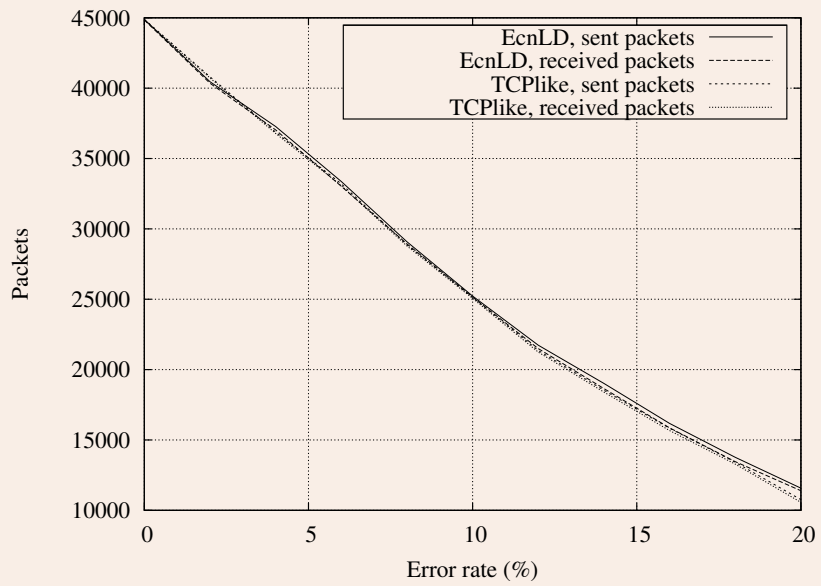

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Improving performance even in the presence of other traffic in the network

EcnLD vs TCPlike

Second senario : in competition with TCP

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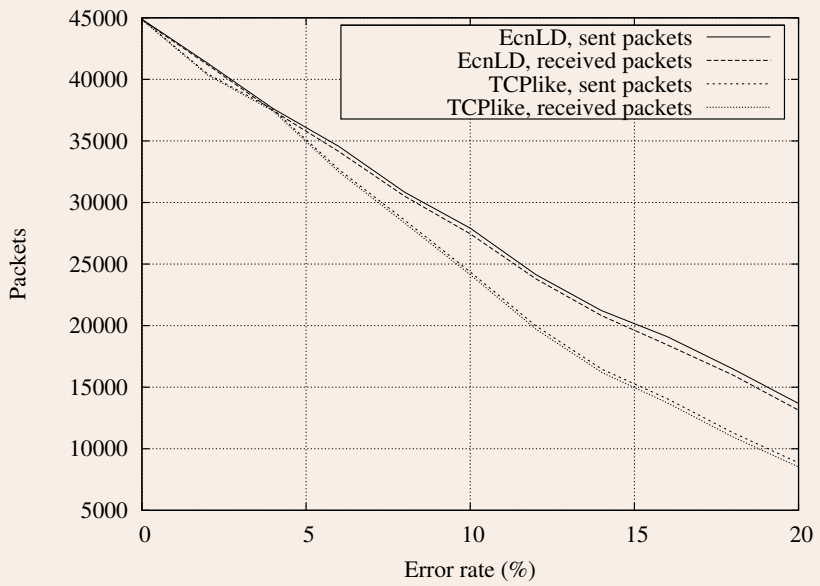

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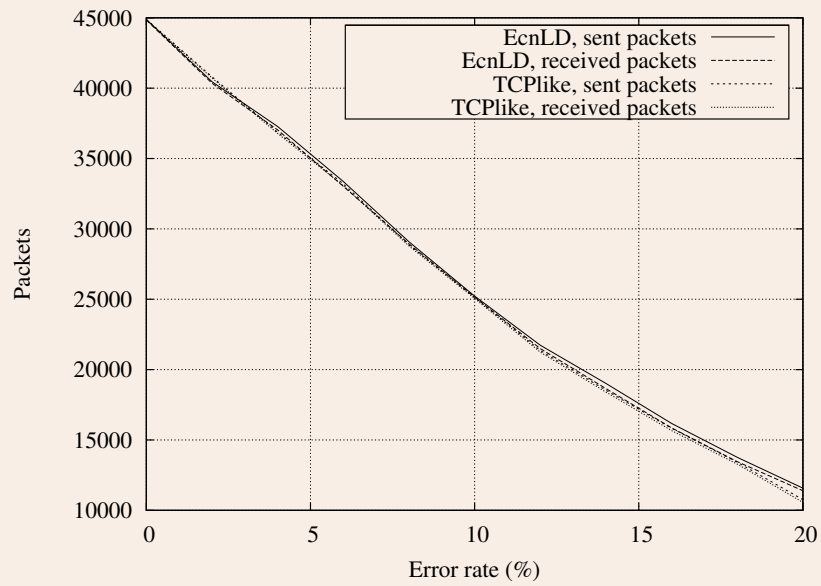

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Improving performance even in the presence of other traffic in the network

EcnLD vs TCP-Eaglet

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

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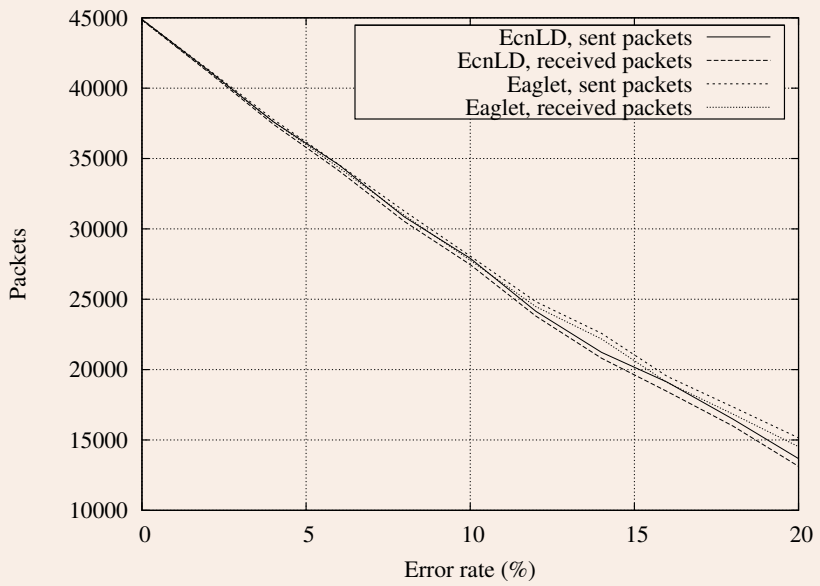

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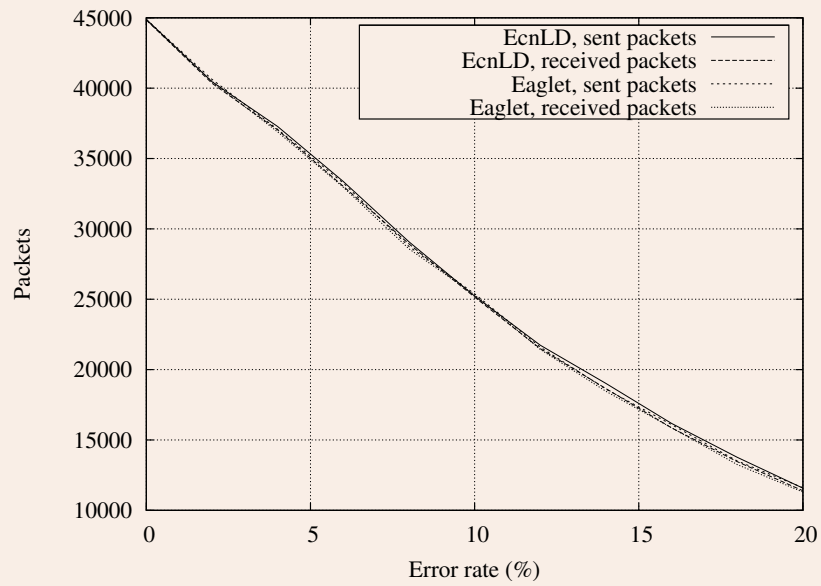

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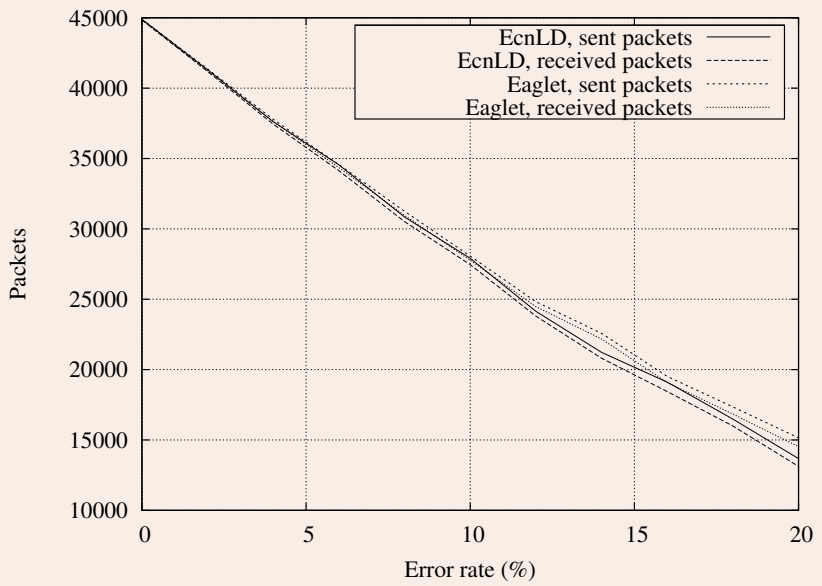

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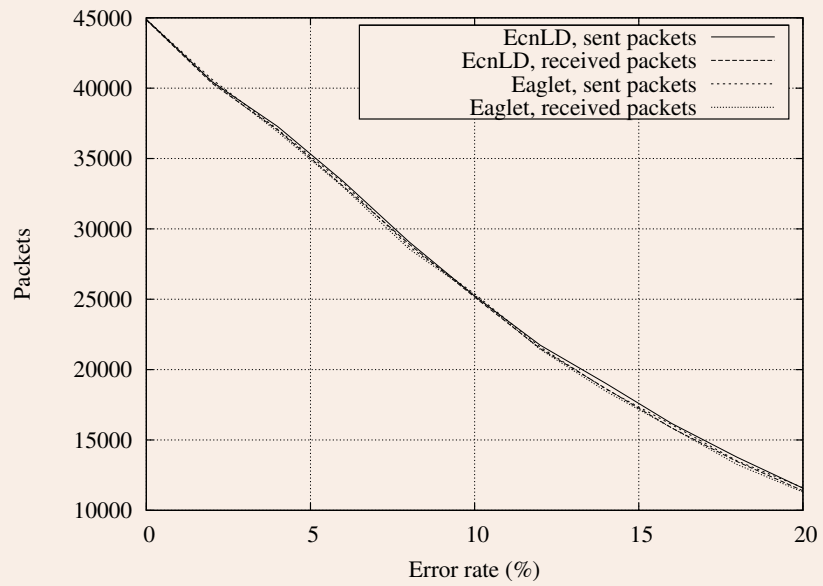

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Second senario : in competition on a wireless network de 54Mb/s

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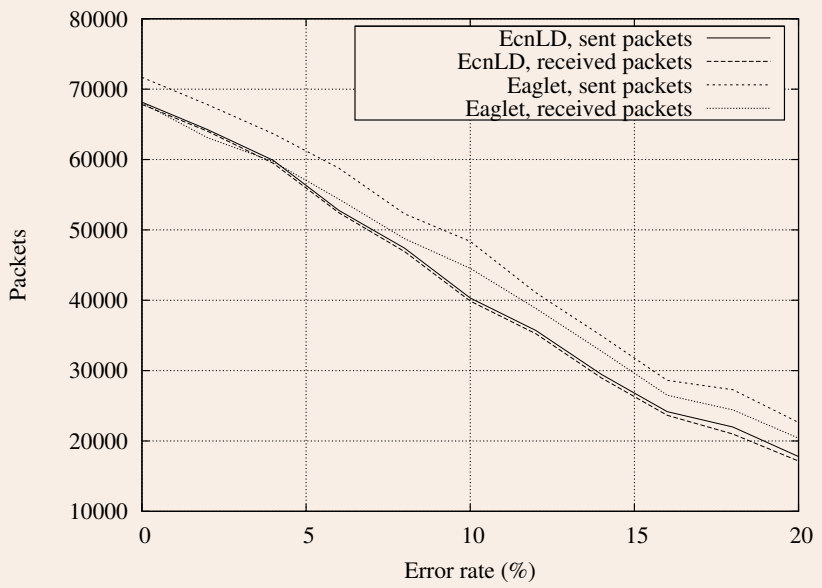

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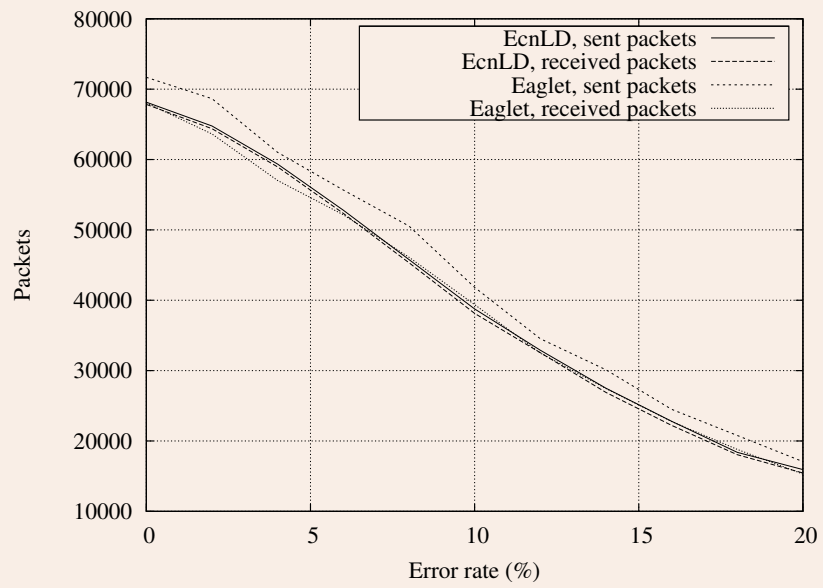

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EcnLD has a high ratio of received/sent packets

TCP-Eaglet has a higher throughput but losses a lot of packets on the network

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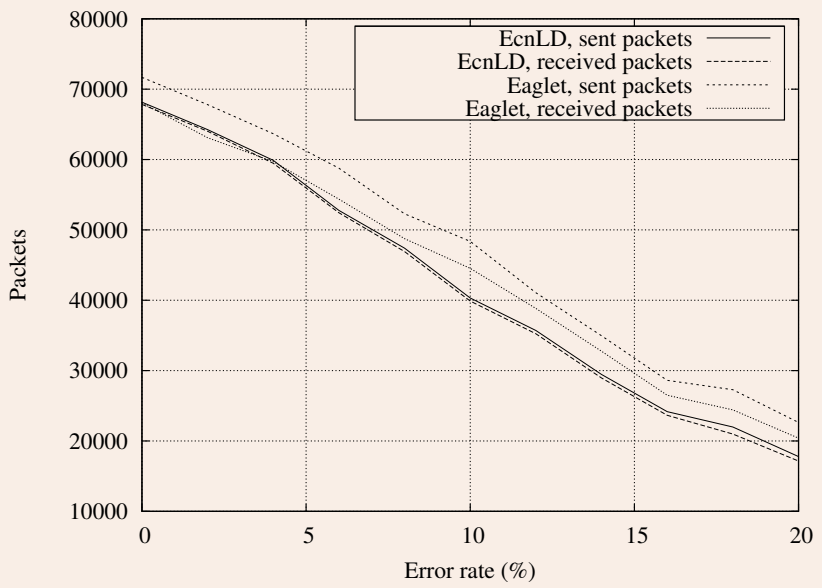

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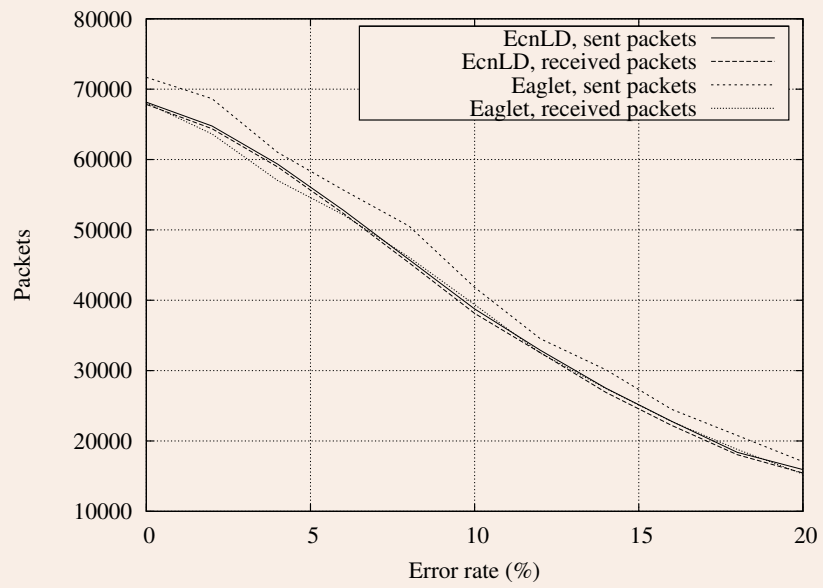

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EcnLD vs TCP-Eaglet : Loss classification percentage

One retr. 11Mb/s	0%	4%	8%	12%	16%	20%	Avg
EcnLD	100%	79%	68%	68%	67%	69%	72%
Eaglet	100%	84%	86%	90%	89%	88%	86%

Two retr.	0%	4%	8%	12%	16%	20%	Avg
EcnLD	100%	76%	63%	51%	72%	81%	73%
Eaglet	100%	50%	50%	79%	51%	54%	64%

One retr. 54Mb/s	0%	4%	8%	12%	16%	20%	Avg
EcnLD	40%	53%	64%	75%	73%	72%	64%
Eaglet	4%	4%	10%	26%	33%	41%	18%

Two retr.	0%	4%	8%	12%	16%	20%	Avg
EcnLD	41%	34%	25%	66%	48%	53%	43%
Eaglet	3%	2%	2%	9%	10%	16%	6%

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- EcnLD carries a very high packets reception rate, which makes it suitable to streaming multimedia

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Thank you for your attention

Questions ?