

MULTIPATH

Sebastian Siikavirta

sebastian.siikavirta@tkk.fi

Comnet, HUT



Gautam Raj Muktan

gmuktan@cc.hut.fi

Comnet, HUT



Antti Jaakkola

atjaakko@cc.hut.fi

Comnet, HUT



What is our idea of multipath?

What is multipath?

- Protocol to use multiple path simultaneously
- Logical connection
- Hides physical interfaces

Research target

- Real implementation: Windows, Linux, Unix
- Innovate new use cases for new business opportunities.
- To deploy this protocol in a real environment

Use multipath for mobile devices

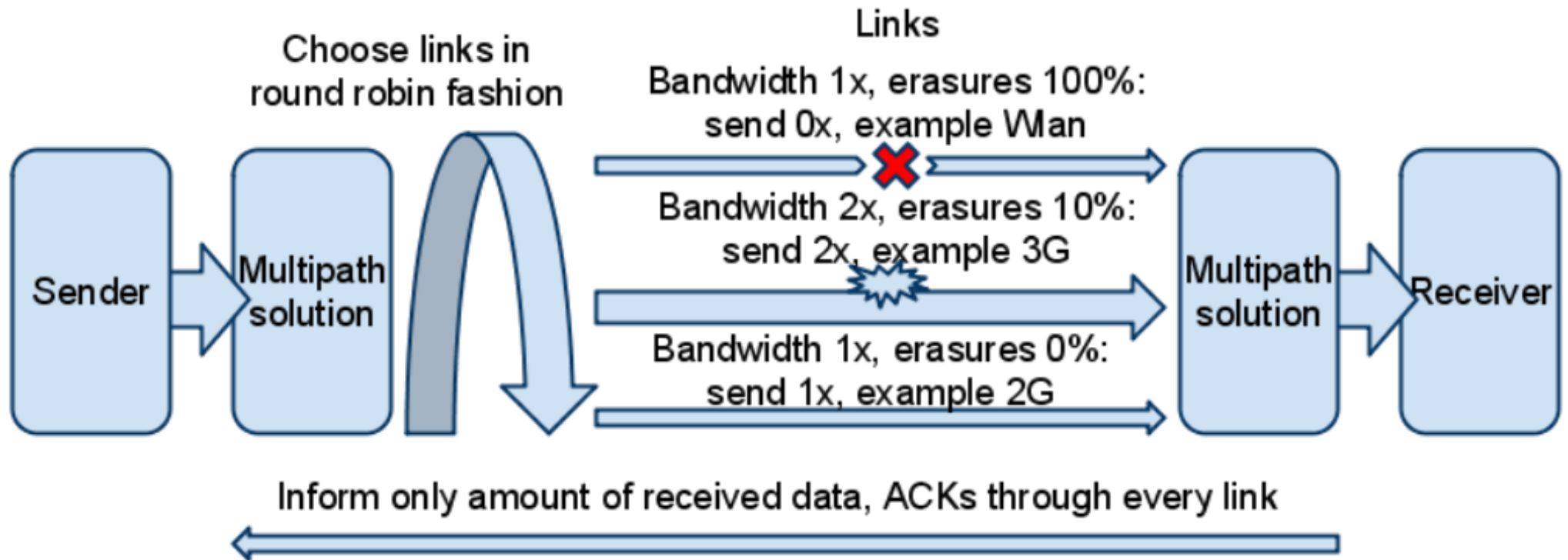


3G/HSDPA
2G/GPRS



- +Take benefit of every link.
- +Increased bandwidth and reliability
- +Seamless connection change.

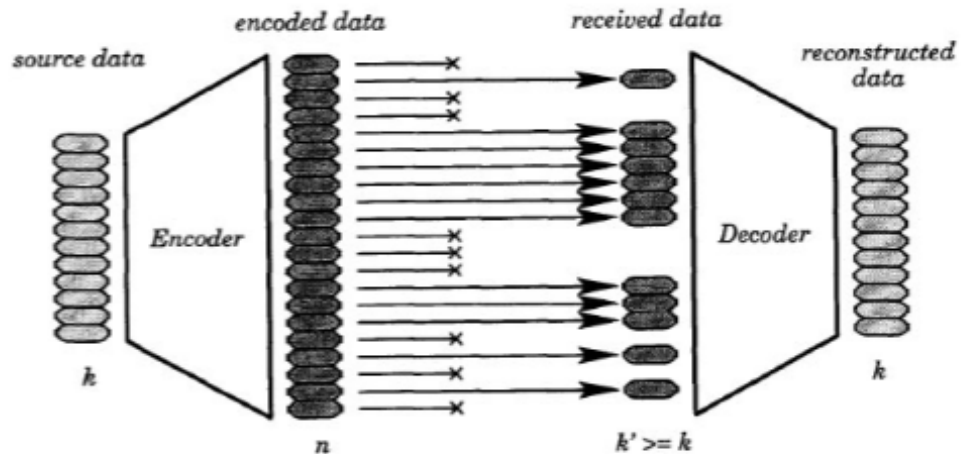
Multipath implementation problems



Problems:

- How to know which packets are lost?
- Which path to use for retransmission?
- Retransmission takes long time.

Solution: Forward Error Corrections



- Encode data before sending.
- No need to keep track of lost data .
- Only the received amount matters.
- Lot of different FEC algorithms:
 - Reed-Solomon, LT, Raptor, ...

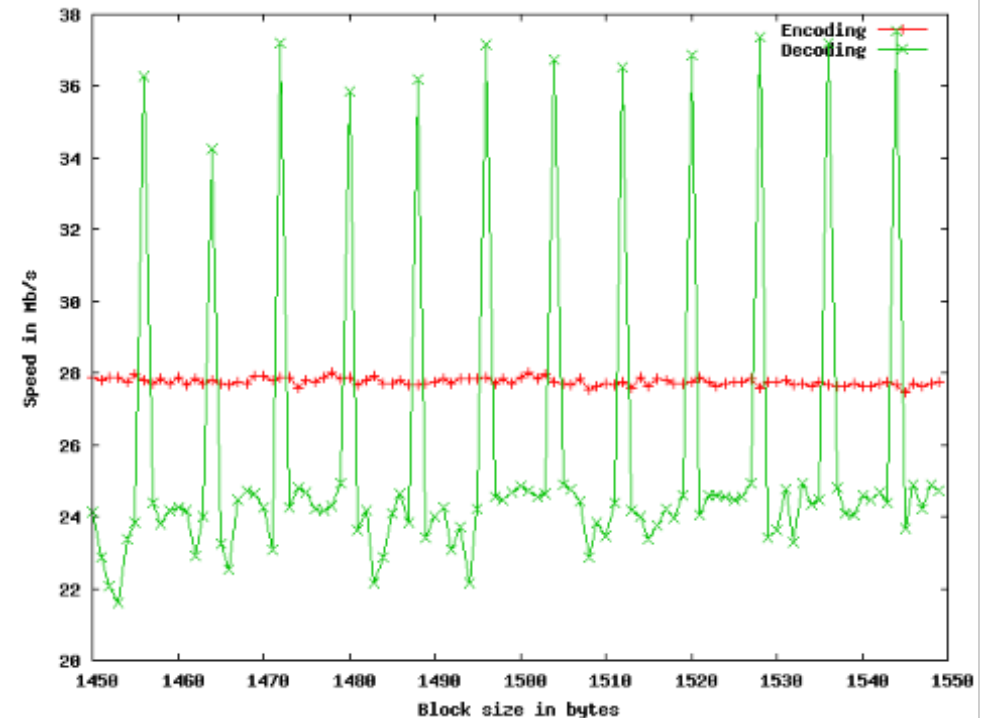
Measurements

Average results with N800:

- encode 30Mbit/s
- decode 24Mbit/s

With 2Ghz modern PC:

- encoding >200Mbit/s
- decoding ~200Mbits/s



Energy(J)	Run time(s)	Watts
7.428	8.970	0.828
7.496	8.989	0.834
7.632	9.056	0.843
6.819	8.931	0.763
6.617	8.975	0.737
6.683	9.010	0.742
6.797	8.920	0.762
	average	0.787

N800 energy consumption:

- 0.79 watts
- About 1/3 whole device energy usage.

Issues:

Interoperability With Current Internet

Because of NAT-traversal the protocol is build on top of the UDP. This version of the Protocol is actually a library that uses UDP with no modification to the UDP header.

Congestion control

The first version of the protocol uses no congestion control. However solution build on top of DCCP over UDP is considered. The problem with current congestion controls is that they are designed for single path and also not to recover from total link loss.

FEC-algorithms

New fast rateless codes such as LT- and Raptor codes are patented. Reed-Solomon Is not, but the problem lies with block coding; There is a limit how much erasures Reed-Solomon can deal with certain speed.