

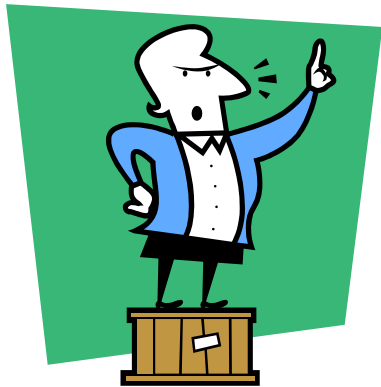


TCP-L: A TCP Modification for Wireless Networks

Stefan Alfredsson

Outline

- Introduction
- Motivation
- Research questions
- TCP-L overview
- Future work

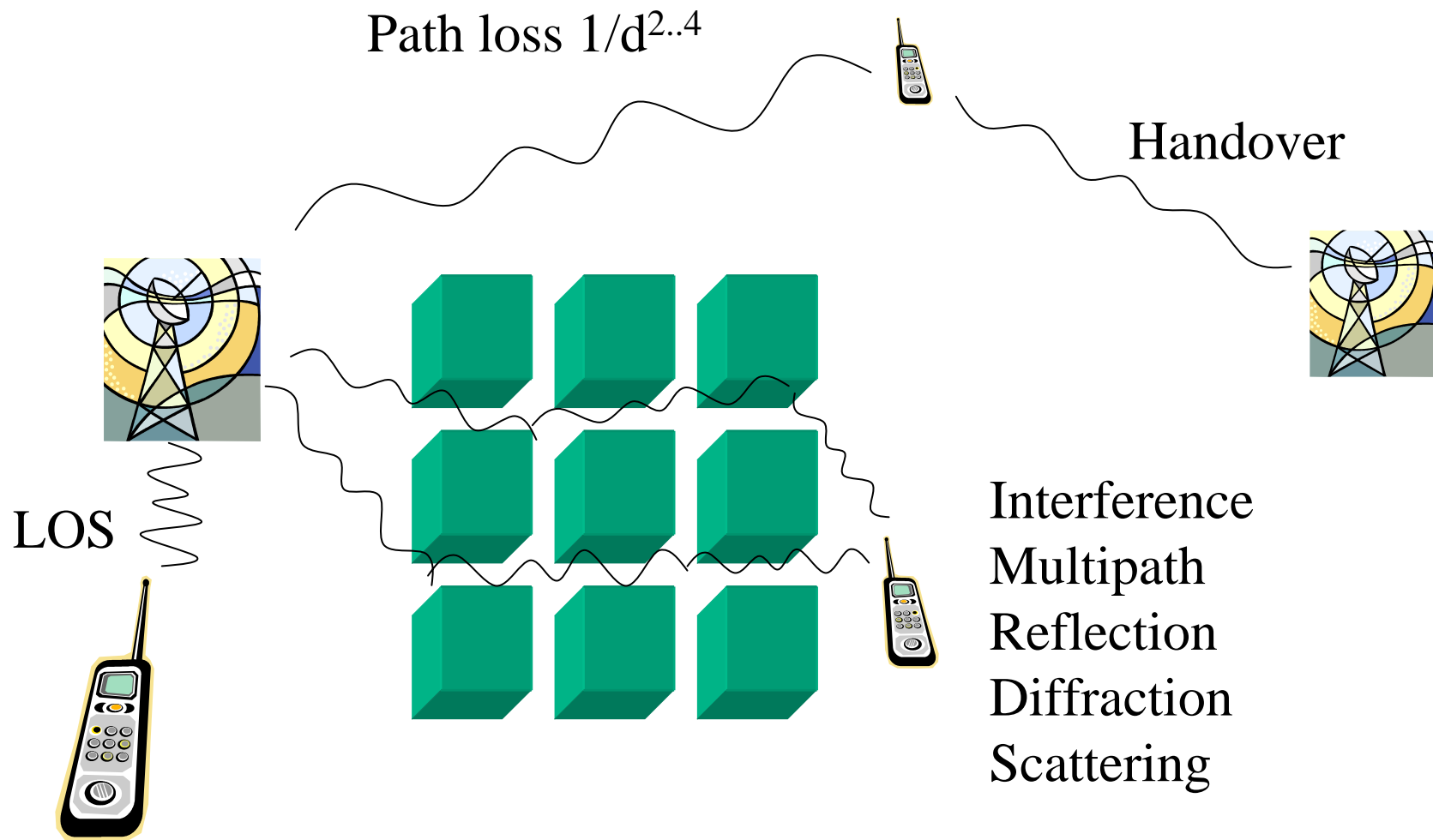


Medium

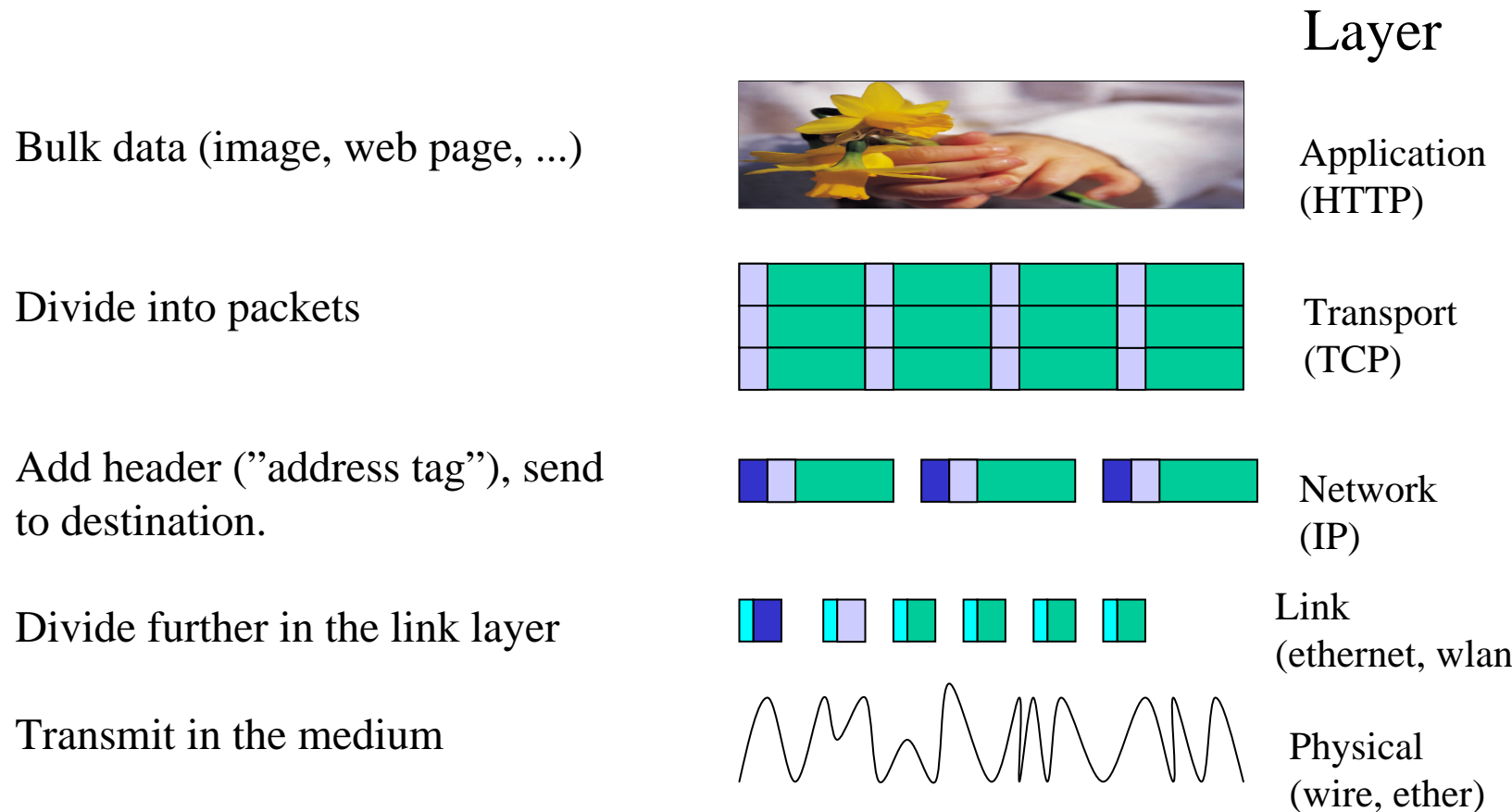


Motivation

- There is a trend of communication going wireless
 - Wireline telegraph -> Transatlantic radio in late 1800's
 - Wireline phone -> mobile phone in the 1980's
 - Ethernet -> Wireless LAN in the 1990's
 - 1G (NMT) -> 2G (GSM) -> 3G (UMTS) -> 4G (?)
- ... and at the same time get the service expected from the wired network
 - Internet connectivity
 - High capacity
 - Low delay
- Challenges!



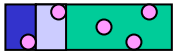
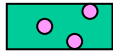
Data transmission



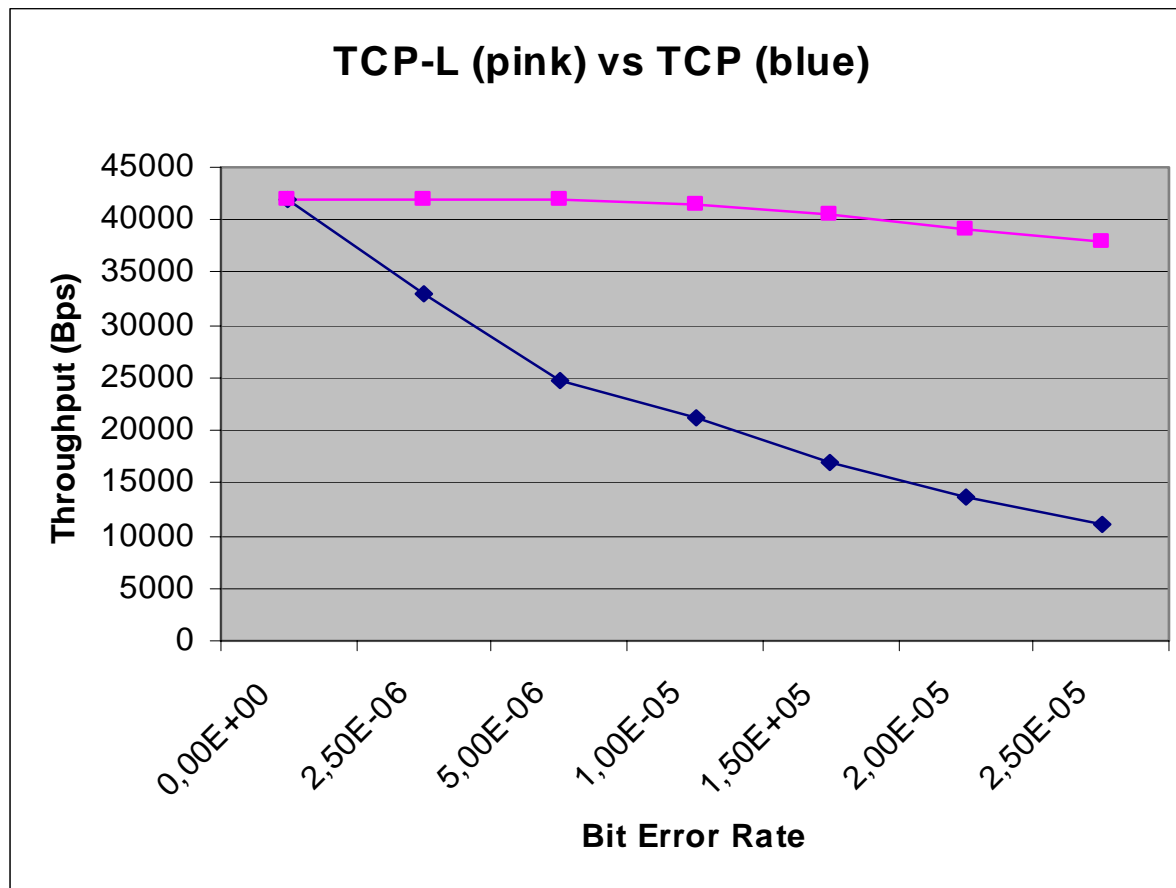
Research questions

- How can performance of the wireless Internet be improved from the transport layer point of view?
- What performance can be expected from a more flexible transport service where reliability may be traded for performance?
- How do the lower layers and the transport layer interact?

TCP and TCP-L

- TCP: Full reliability, retransmission of damaged data
- Some applications may tolerate errors in data, and would like to trade for better performance / "faster download"
 - Multimedia applications seem to be good candidates
- TCP-L: Allows the application to make such a tradeoff
 - Header recovery A diagram of a packet represented as a horizontal rectangle. The left portion is divided into three colored segments: blue, light blue, and green. The right portion is green. There are four pink dots representing data: one in the blue segment, one in the light blue segment, and two in the green segment.
 - Delivery of damaged payload A diagram of a packet represented as a horizontal rectangle. The left portion is light blue and the right portion is green. There are three pink dots representing data: one in the light blue segment and two in the green segment.
 - Receiver-only modification
 - Link/network must deliver damaged packets!
 - Application must handle damaged payload!

Impact of residual bit errors



A more practical illustration

300 kbyte
BMP image
BER = $1.7e-4$
TCP-L: 10s
TCP: 25s

Lena with TCP-L

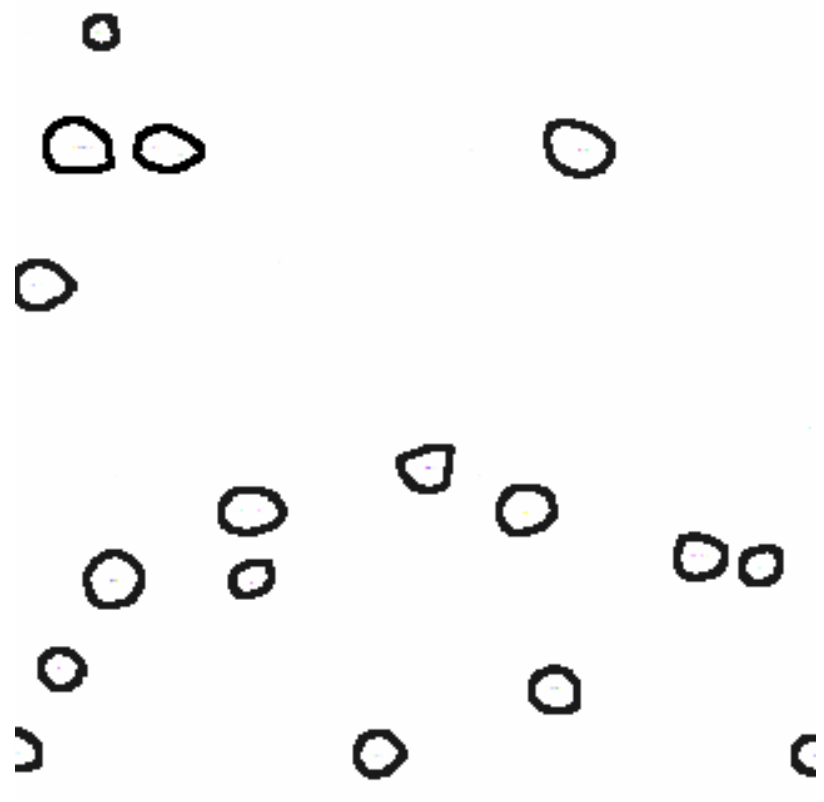
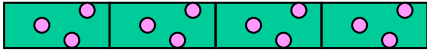


Lena with TCP



300kbyte
BER = 1.7e-4
TCP-L: 10s
TCP: 25s

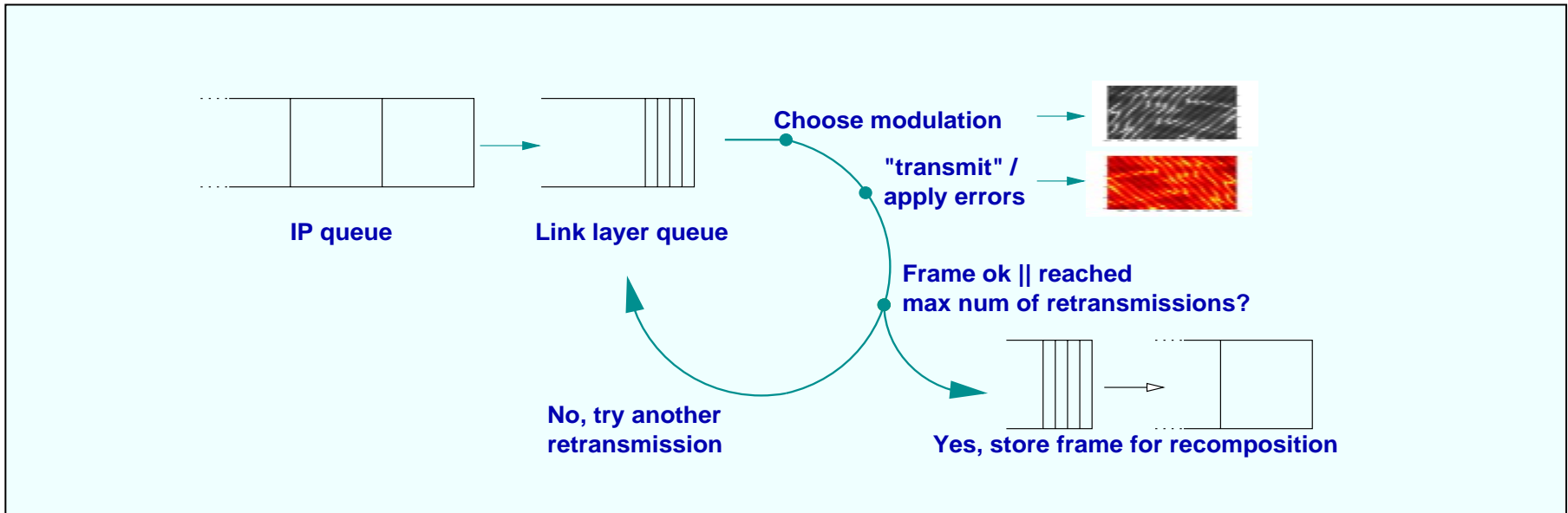
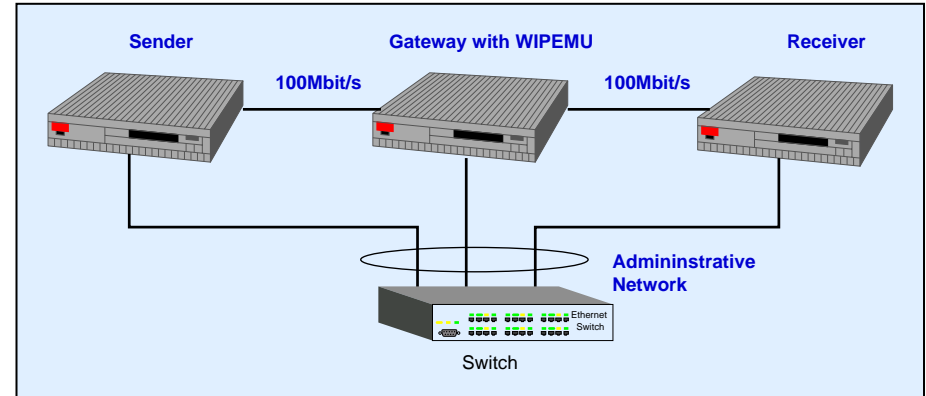
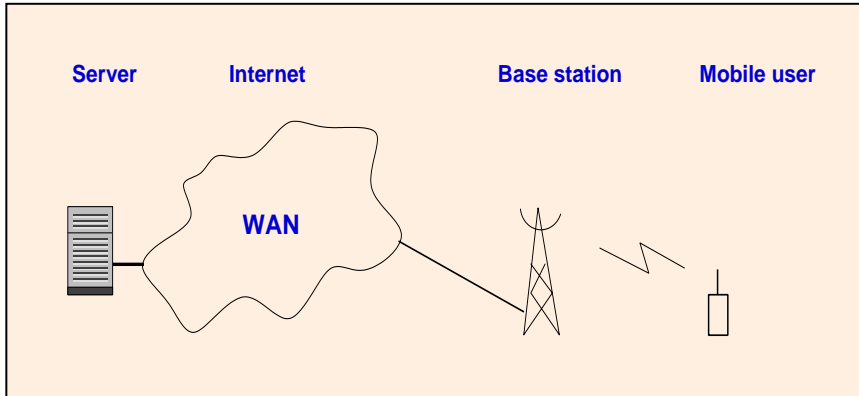
Bit errors revealed



Evaluations

- Network testbeds
 - WIPEMU
 - Emulation of a 4G downlink system proposal
 - OFDM, adaptive modulation, fast link ARQ, channel prediction
 - Loss generation impact on protocol evaluation
 - Precisely placed packet loss and bit errors can reveal protocol phenomena that is usually lost in the averaging of a stochastic loss process

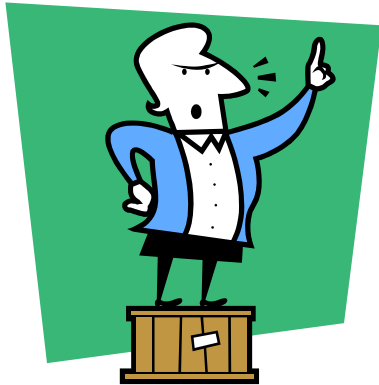
WIPEMU – Overview



Future work

- WIPEMU extensions
- User traffic models and patterns
- Different / new protocols (SCTP, DCCP?)
- Cross layer / soft information

Thanks for your attention!



Details are in the papers available at my homepage, www.cs.kau.se/~alfs
(or google://Stefan Alfredsson)