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Optimizing Mobile Communication using a TAPS system

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ICCRG Meeting — Prague — 2017-07-17

Per Hurtig, Stefan Alfredsson, Anna Brunstrom, Kristian Evensen, Karl-Johan Grinnemo, Audun Fosselie Hansen, and Tomasz Rozensztrauch. 2017. A NEAT Approach to Mobile Communication. In Proceedings of MobiArch '17, Los Angeles, CA, USA, August 25, 2017.

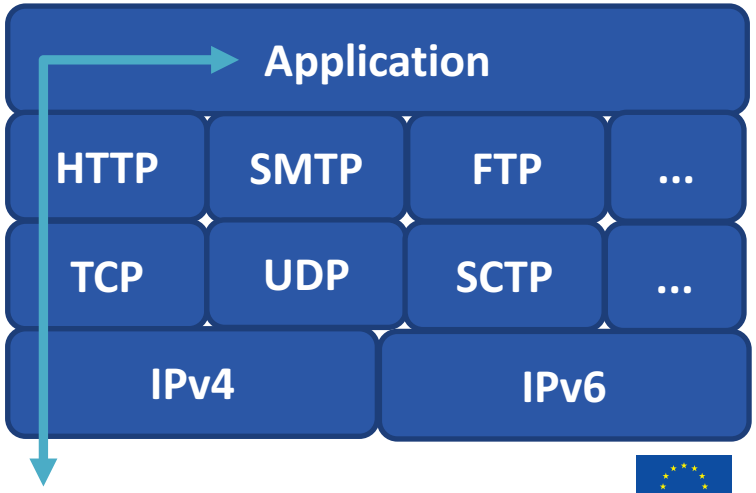
Horizon 2020
European Union funding
for Research & Innovation

Outline

- An Ossified Internet
- NEAT — A Transport Services (TAPS) Implementation
- Example: NEAT for Mobile Communication
- Conclusions

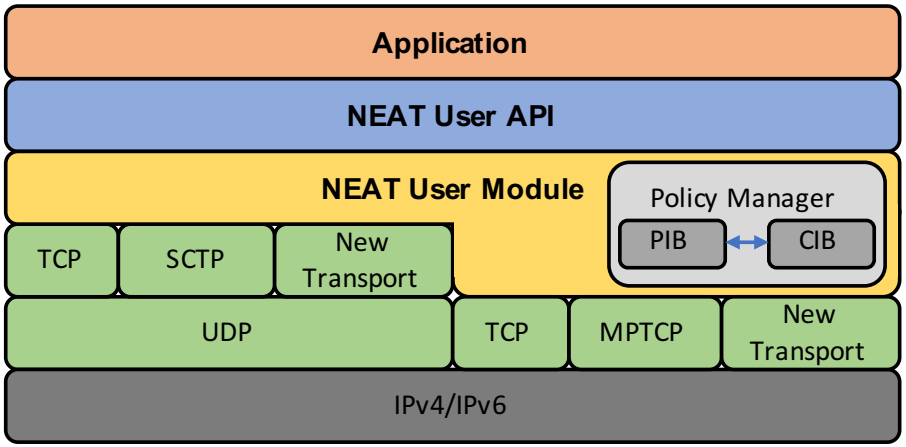
An Ossified Internet

- The design of the Internet is a tremendous success
  - scaled from a few users to global use in under 40 years
- In particular, TCP over IP is one of Internet's greatest success stories
  - permits reliable, congestion controlled data transmission over "any" link
- However, TCP over IP has contributed to ossification
  - works good ⟹ everyone uses it
  - everyone uses it ⟹ infrastructure adapts
  - adapted infrastructure ⟹ no room for innovation



NEAT – A Transport Services (TAPS) Implementation

- NEAT enables the use of transport services rather than protocols
  - i.e., an implementation of TAPS
  - example services may include e.g., reliable transfer, multi-path communication
- NEAT maps application requirements to services
  - if asked for e.g. ”low latency” NEAT will try to create such a service
  - the mapping is transparent to applications
- NEAT tries to fight ossification by
  - providing a more expressive API;
  - using local and remote info to make well-informed decisions;
  - using Happy Eyeballs to ignore the existence of middle-boxes



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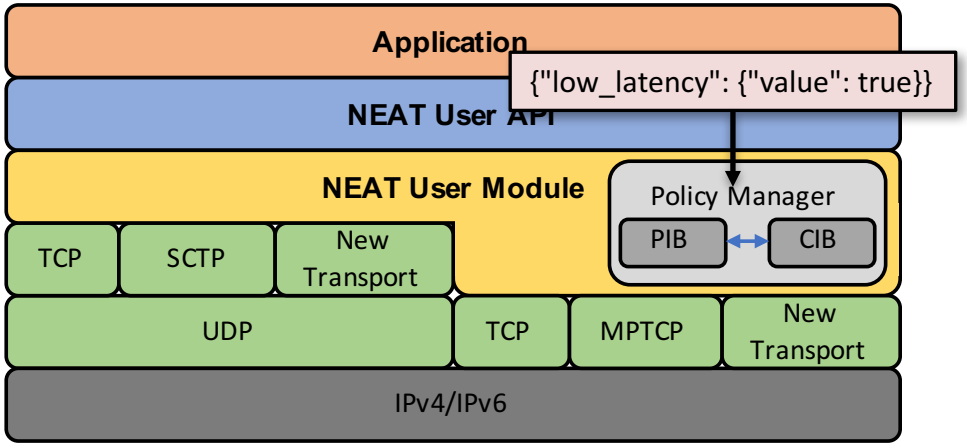
NEAT – Service Example



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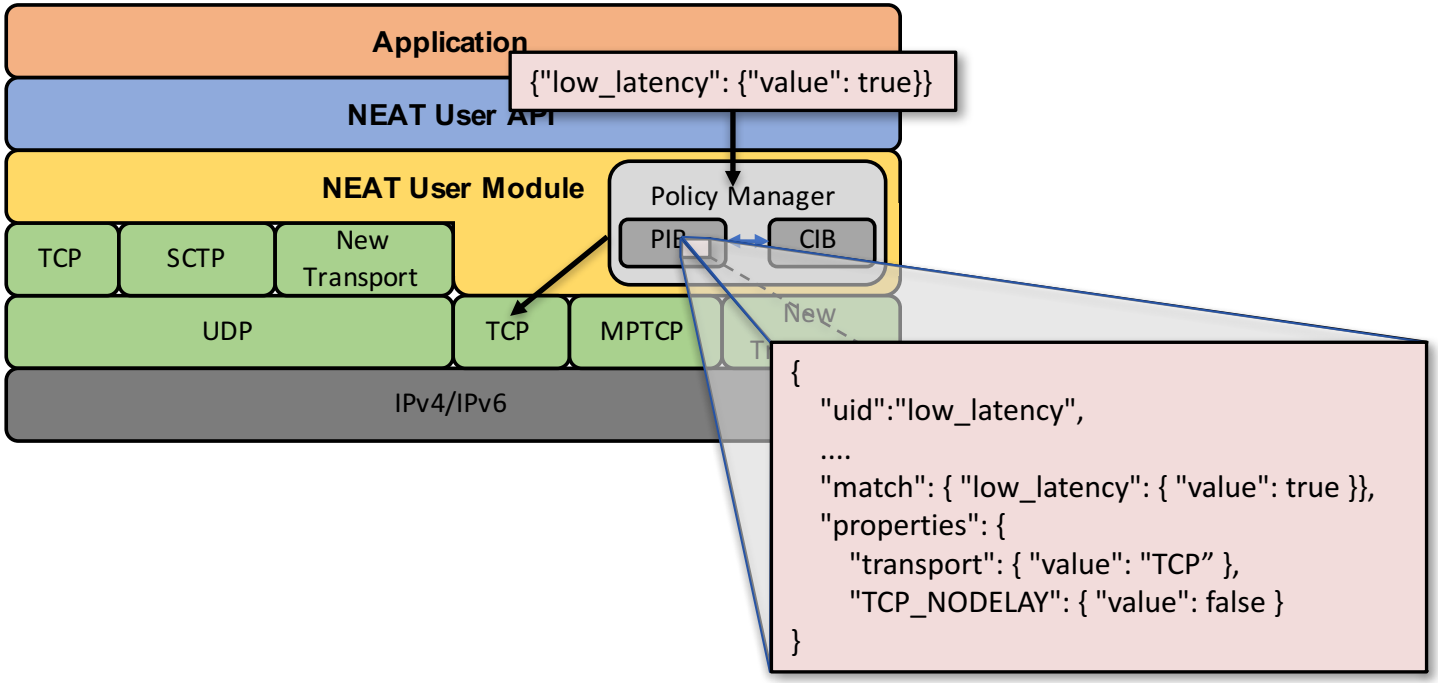
NEAT – Service Example



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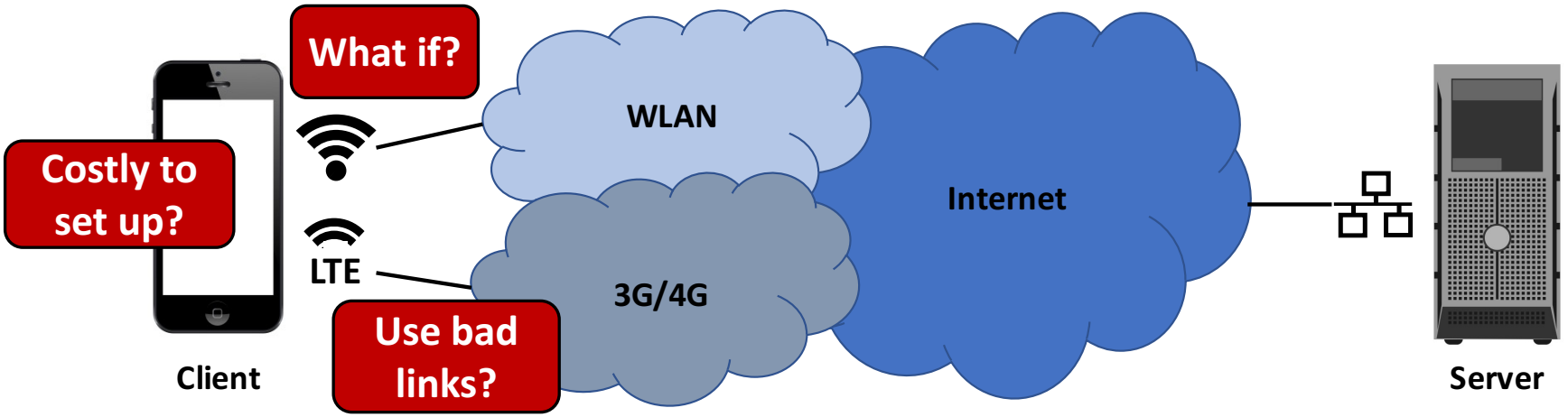
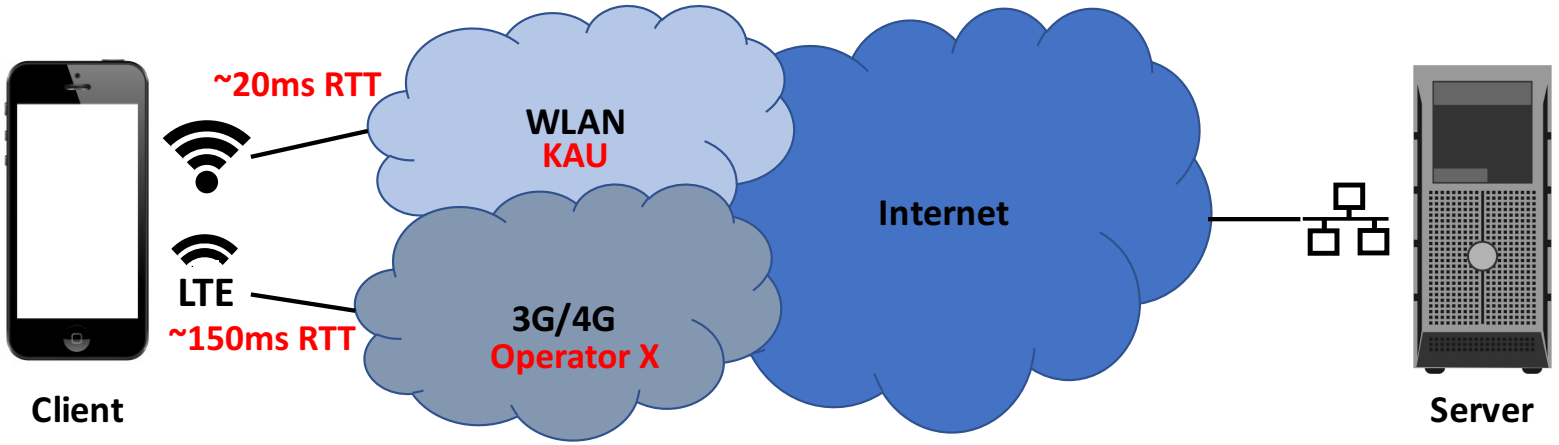
Example: NEAT for Mobile Communication

- Multi-path transports can enable mobile communication
  - handover/failover between interfaces
  - transmission over multiple interfaces (load-balancing/resilience)
- MPTCP is an IETF solution for multi-path transport
  - focus on compatibility (to deal with ossification)
- MPTCP is not optimally designed for mobile communication
  - general transport protocol
  - path-management and default settings are not suitable
- Can NEAT build good mobile transport services using MPTCP?
  - Let's see...

Example: NEAT for Mobile Communication



Experimental Setup



MONROE node
(running Linux with NEAT and MPTCP)

Regular server
(running Linux with MPTCP)

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Experimental Setup

~2

LTE

~150

Client

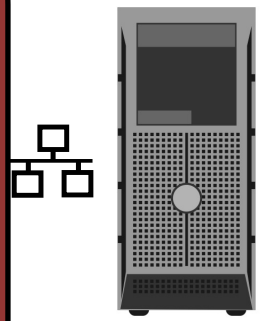
MONROE node
(running Linux with N
and MPTCP)

Experiment: The client downloads a set of files from the server using TCP, MPTCP, and NEAT.

TCP: Only WLAN interface is used.

MPTCP: Both WLAN and LTE are used.

NEAT: Uses service based on TCP or MPTCP depending on file size and quality of WLAN/LTE.



Server

Regular server
(running Linux
with MPTCP)

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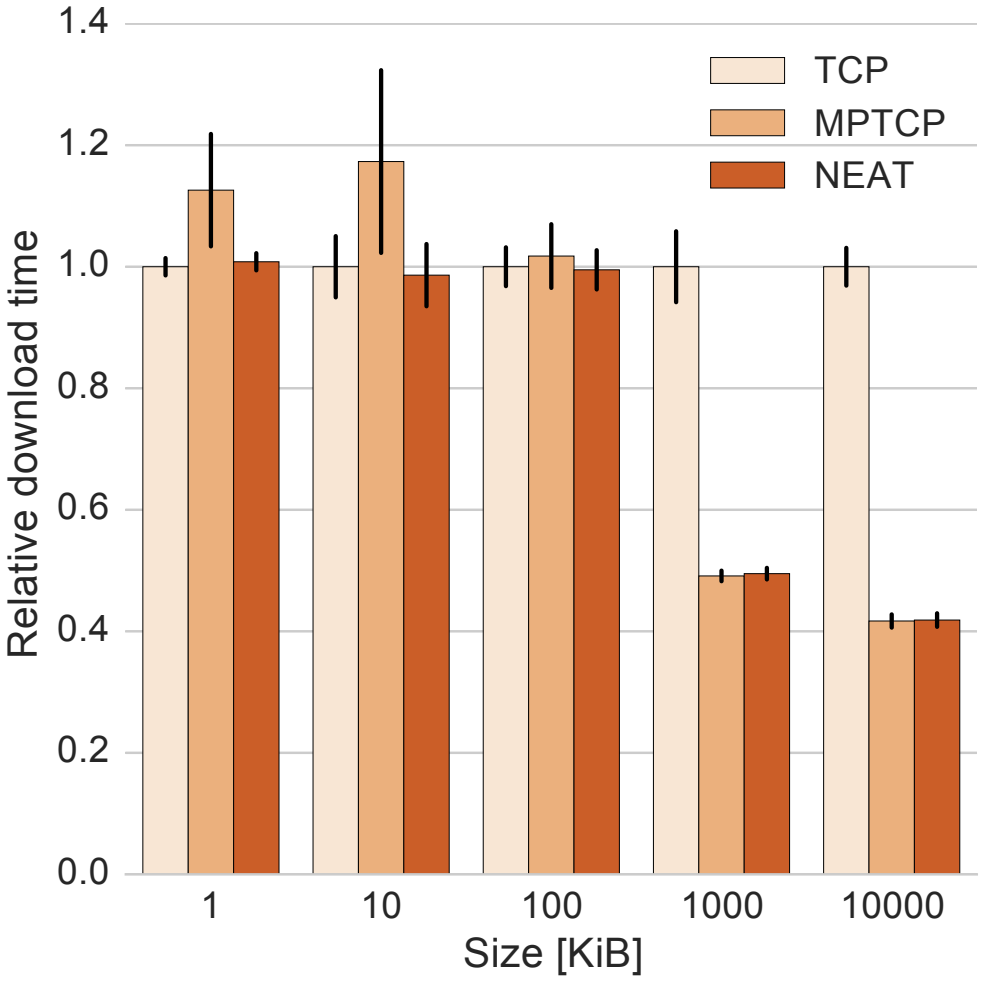
Costly to set up?

- Short flows do not gain from multi-path
- Significant gain for long(er) flows
- NEAT is able to select the correct protocol for its transport service
  - How is this done?



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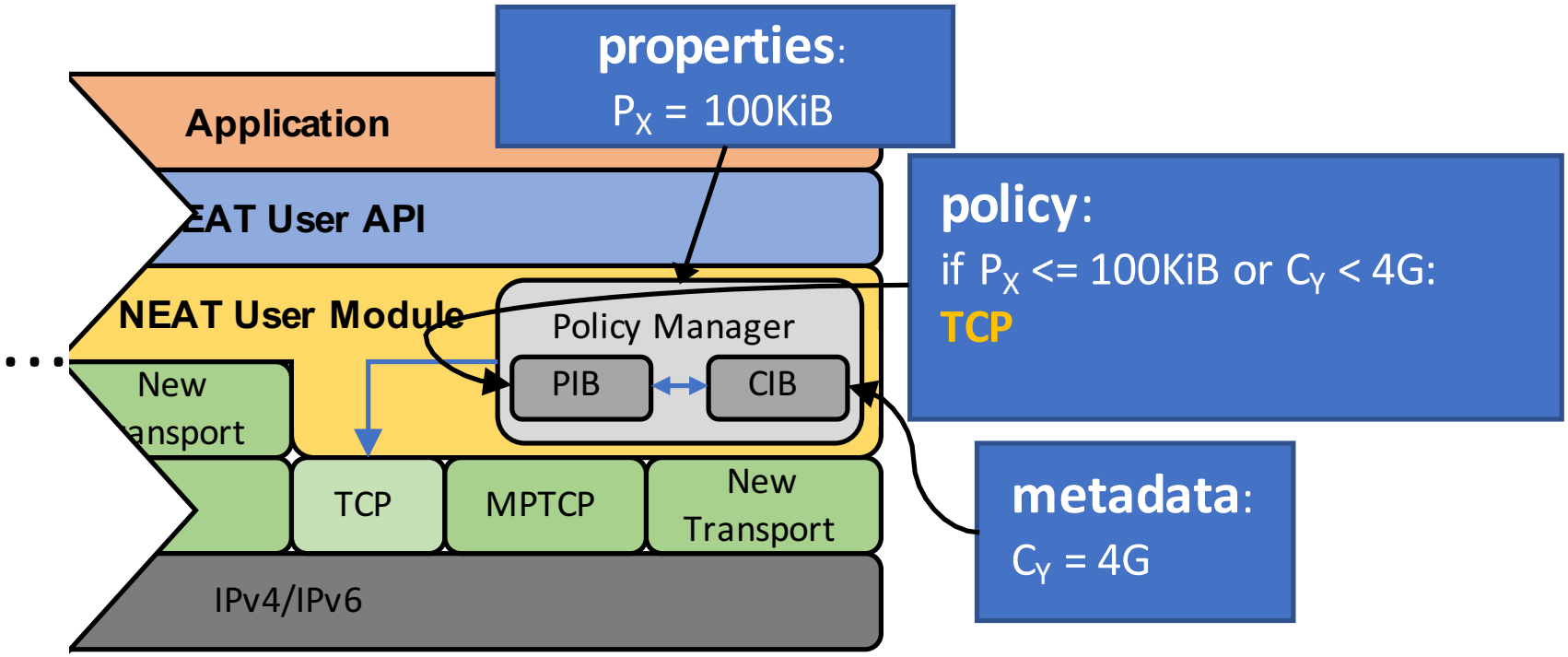
NEAT – Policy Manager



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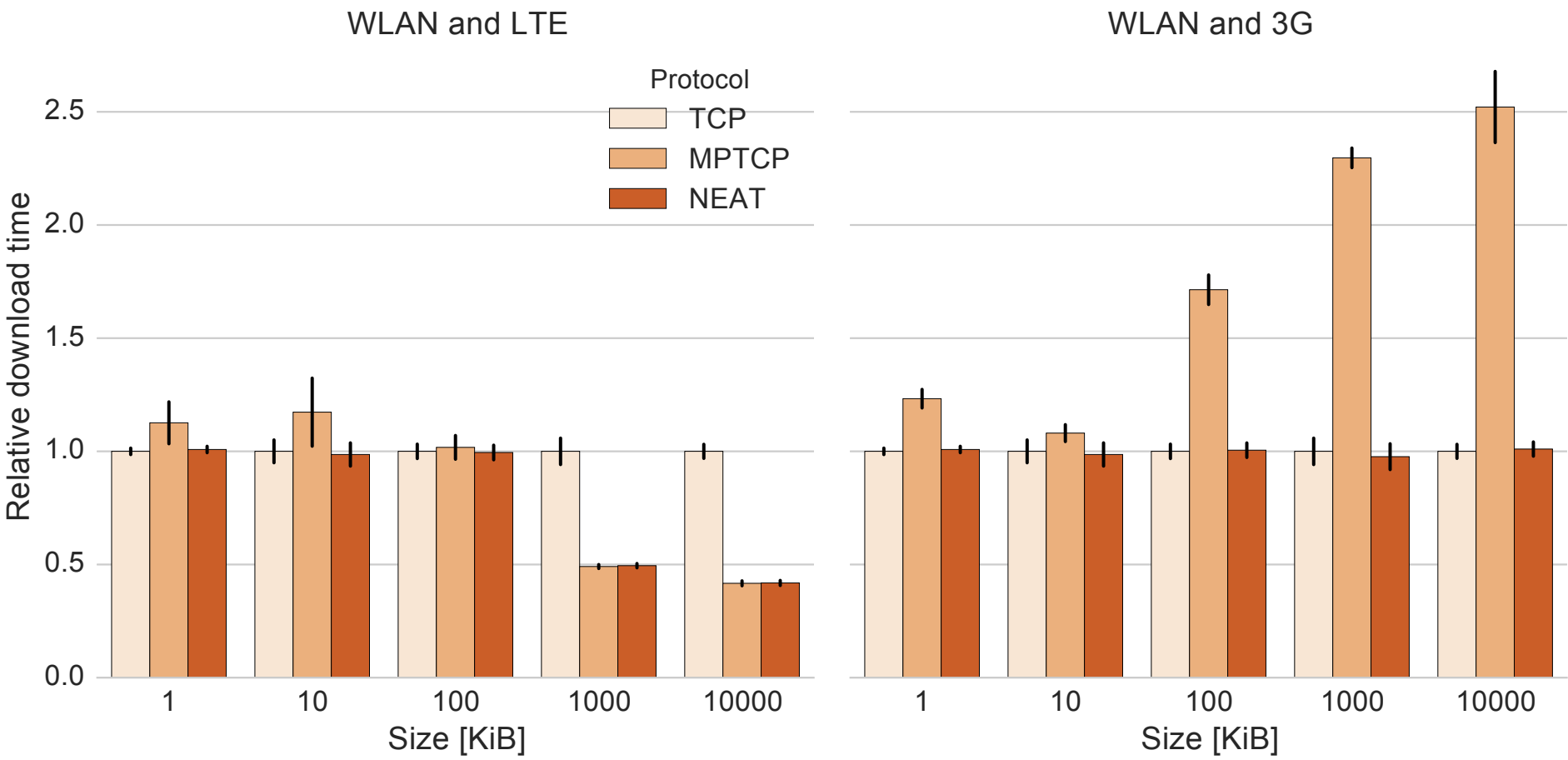
Use bad links?



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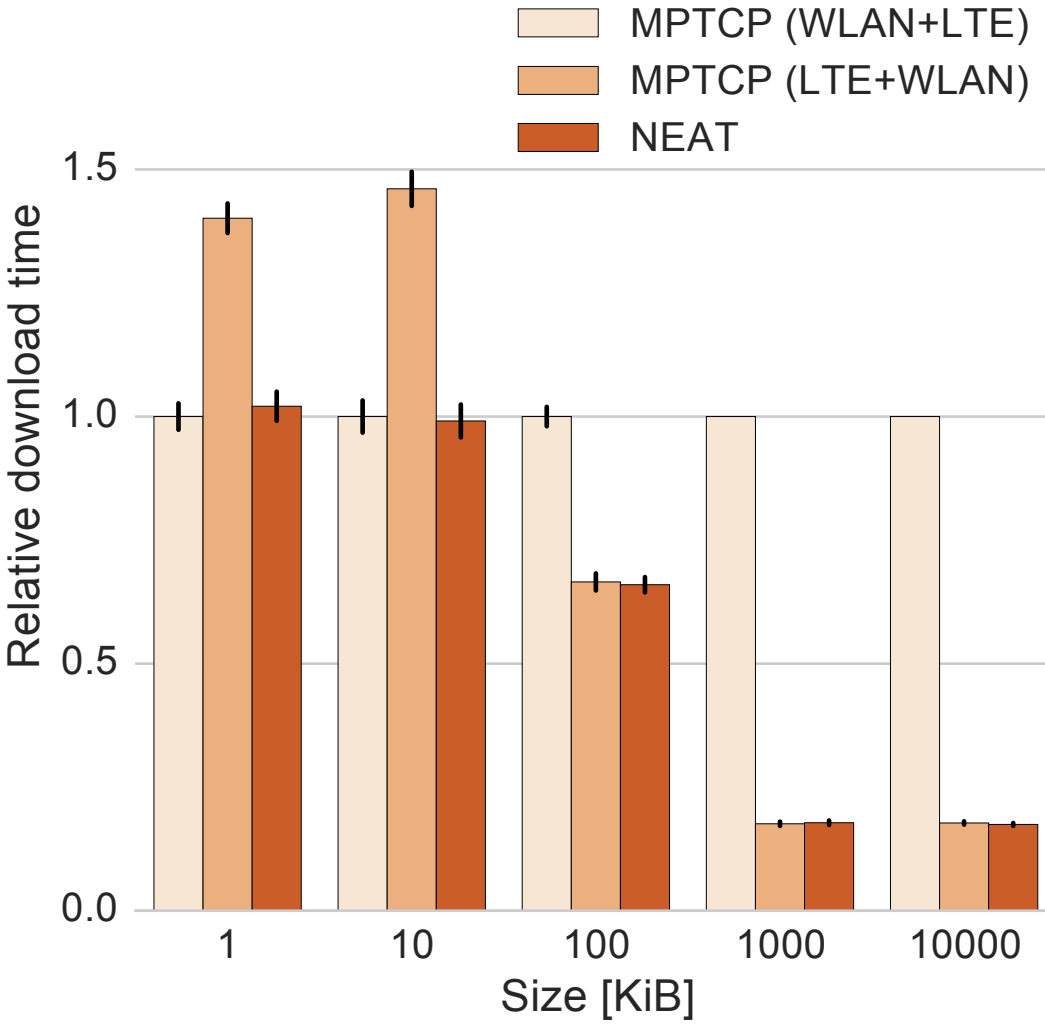
What if?

- The choice of “initial” interface is very important
- In this experiment, WLAN quality was very poor
  - measured in library during exam week
- NEAT used link quality metrics to configure protocol



Conclusions

- NEAT is an implementation of TAPS
  - composes transport services based on application requirements
- NEAT fights ossification by
  - considering application requirements
  - using all available information (both local and remote) to make that happen
  - making sure to get through obnoxious networks
- This presentation exemplified the use of NEAT, in a “mobile” scenario

More material on NEAT

- Library [https://github.com/NEAT-project/neat]
- Docs [http://neat.readthedocs.io/en/latest]
- Project [https://www.neat-project.org]