



# ICN Congestion Control – How handle unknown and varying link capacity?

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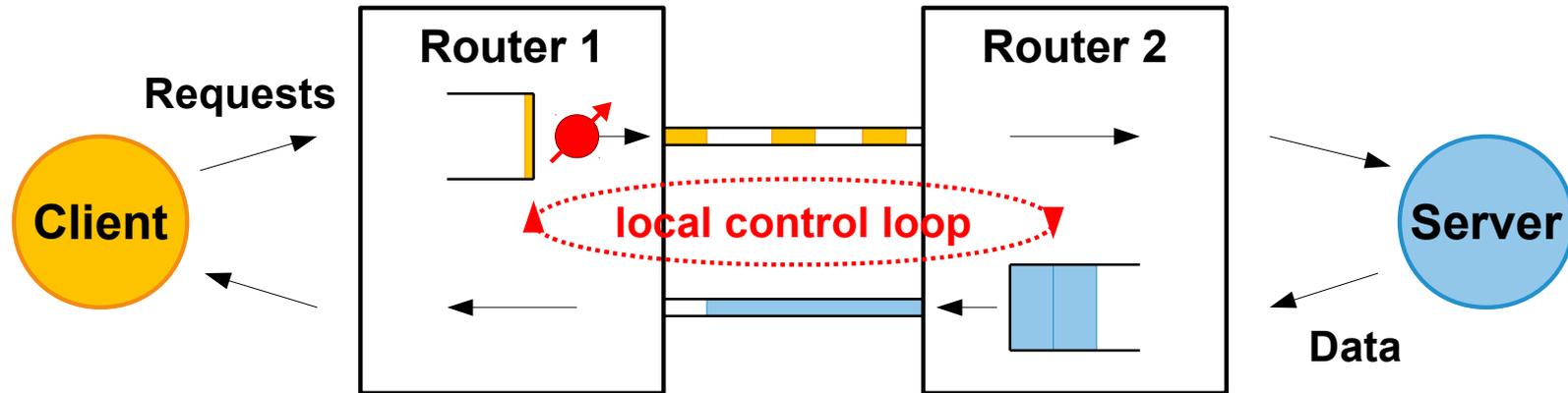
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# Collaboration with...

- Anna Brunström, Karlstad University
- Henrik Abrahamsson, RISE SICS
- Karl-Johan Grinnemo, Karlstad University
- Per Hurtig, Karlstad University

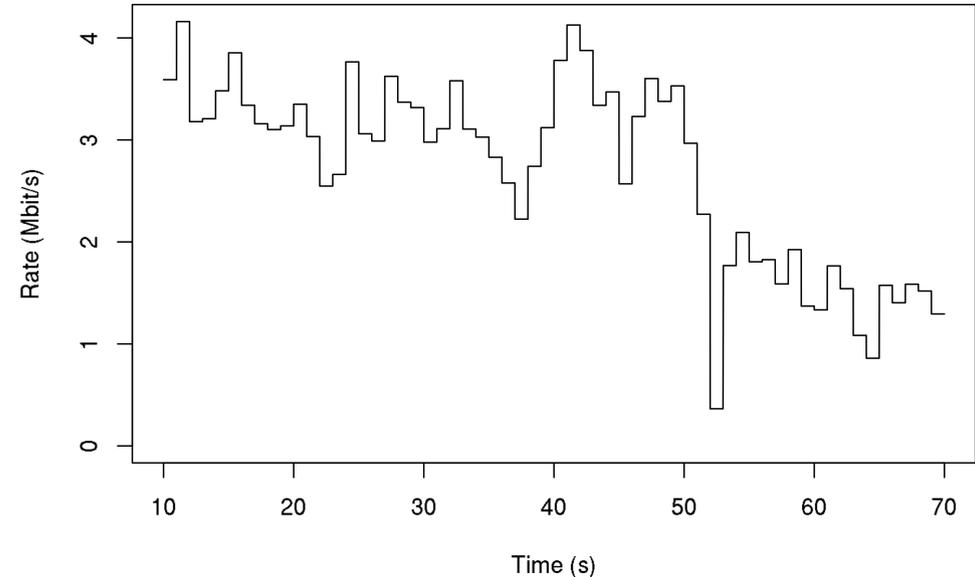
# ICN hop-by-hop congestion control



- Exploit ICN hop-by-hop nature
  - More precise congestion regulation
  - Higher goodput
  - Less queueing => lower latency
  - Integrated multi-path scheduling
  - ...etc...

# Many algorithms assume *known link capacity*

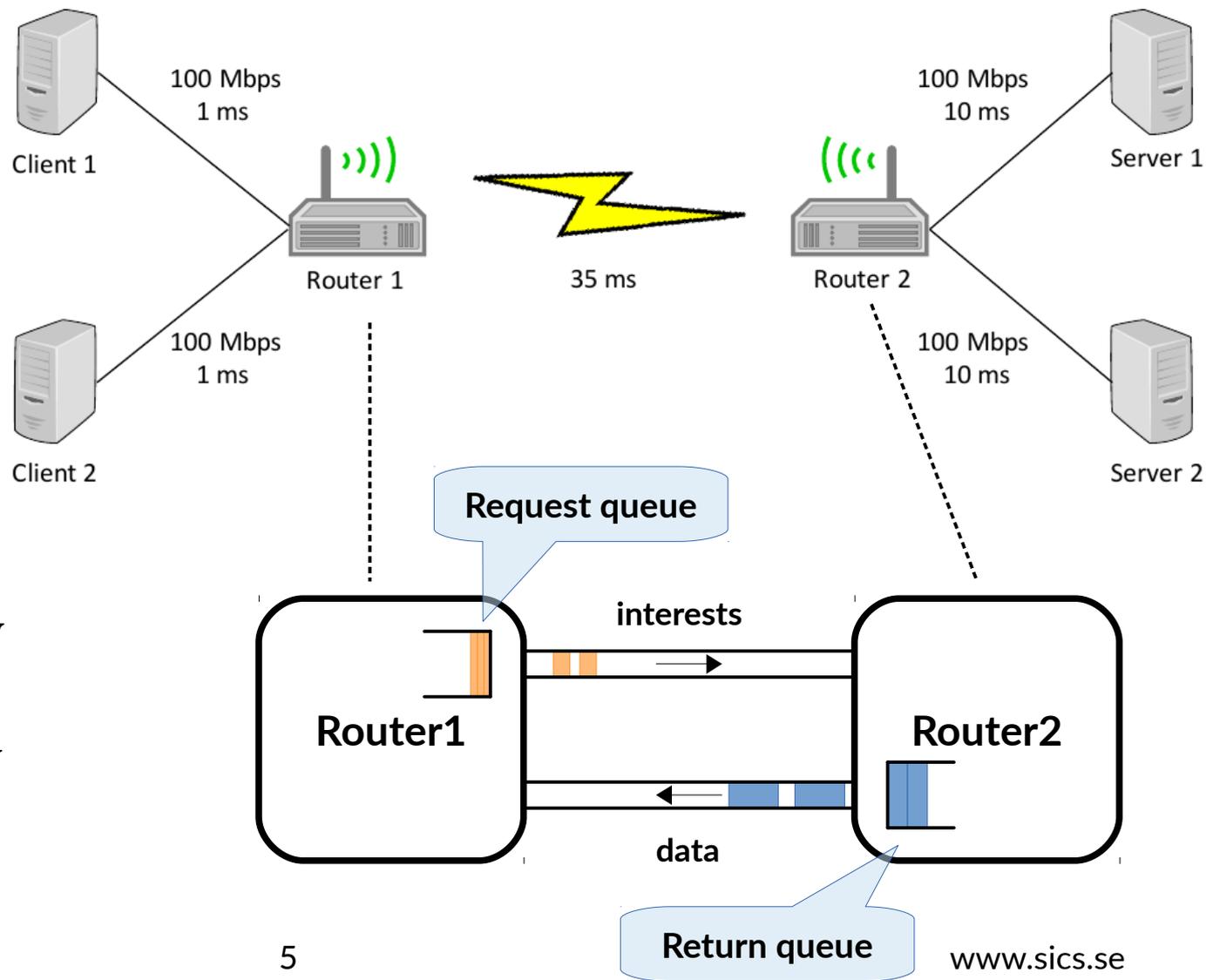
- Elephant in the room...
- Are they possible to implement in real networks?
  - Esp. wireless links have unknown and varying capacity
- More careful look:
  - **not even switched wired Ethernet has known capacity!**



"Ljansbakken-Oslo" 3G capacity trace,  
H. Riiser, et al. "Commute Path Bandwidth Traces from 3G  
Networks: Analysis and Applications," in Proc MMSys, 2013.

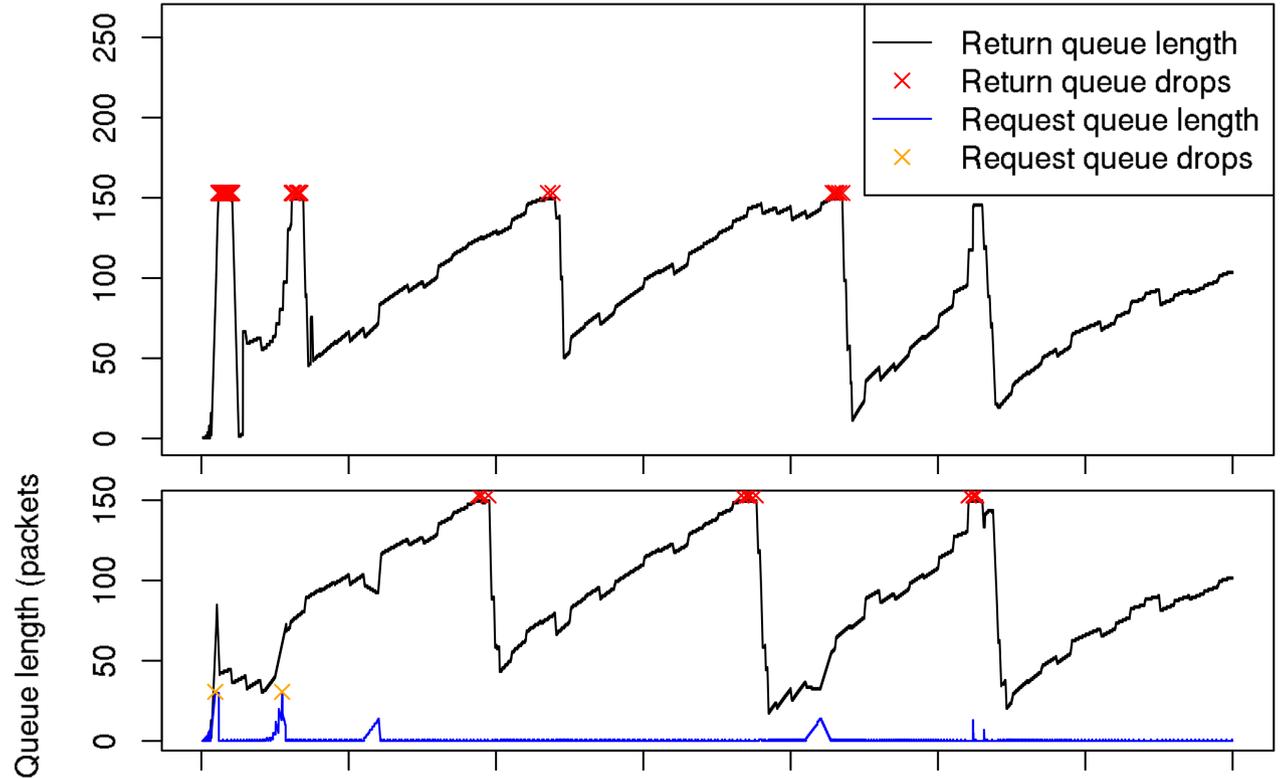
# Example

- Simulation in OMNet++-based abstract ICN simulator
- Simple bottleneck topology
  - Bottleneck capacity from 3G trace
  - “Nominal” capacity = max from trace



# Example

- *Top*: Only TCP-like end-to-end CC
- *Bottom*: Also rate-based HBH controller
- **No practical difference!**

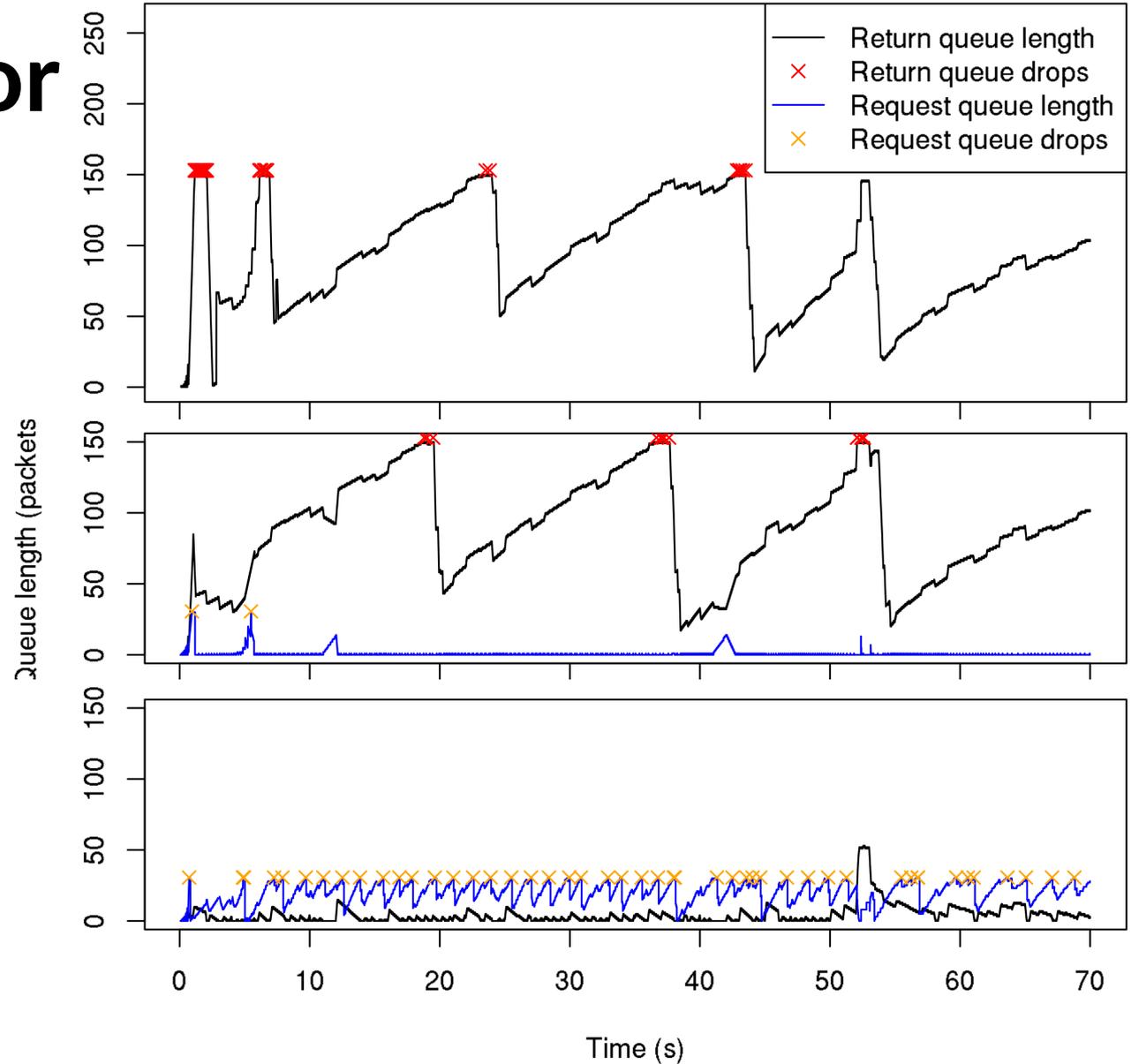


# What options do we have?

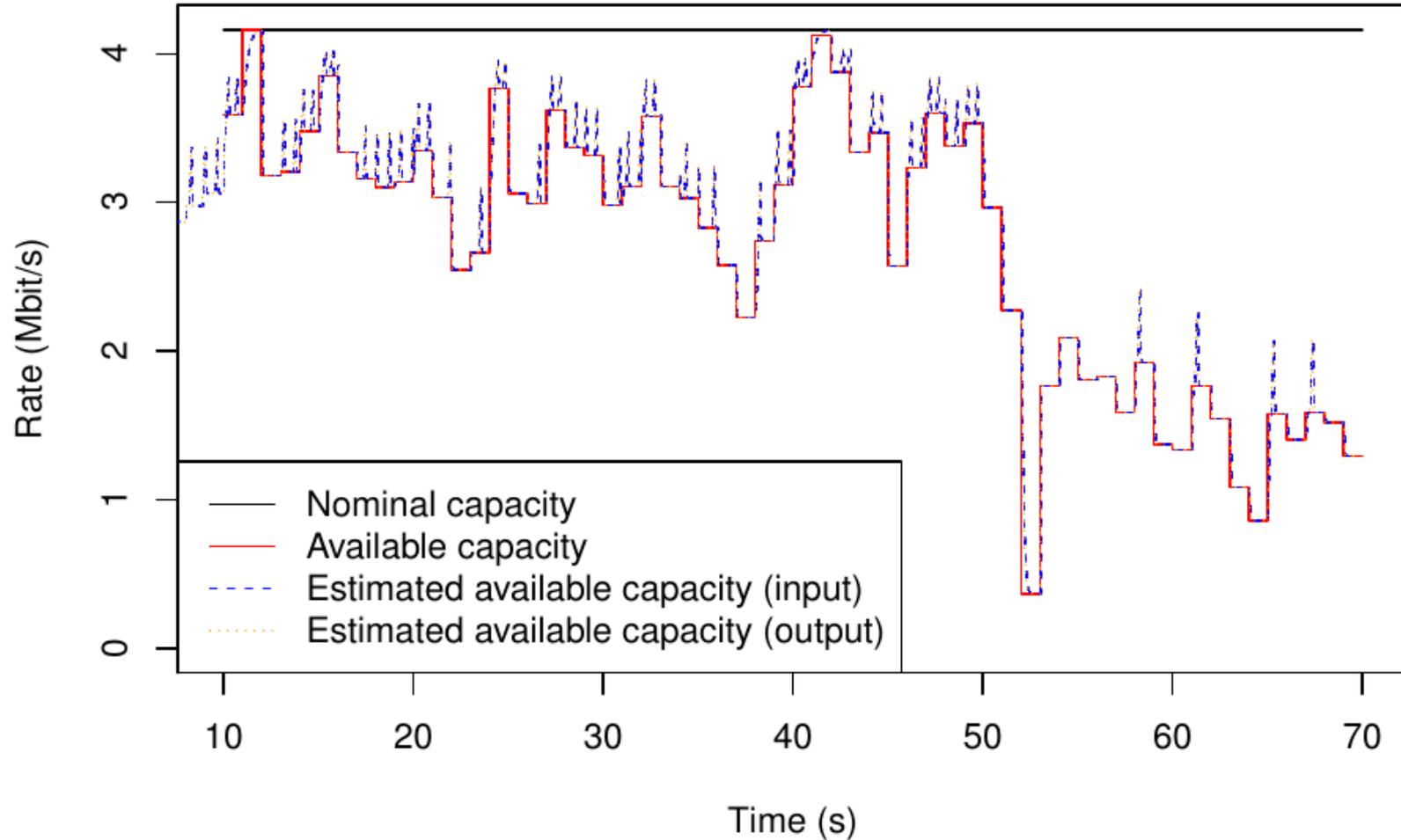
- “Patch” with estimation of available link capacity?
- ...(more in a bit)...

# With estimator

- **Bottom:** with available capacity estimator
- **HBH controller now works as intended!**



# Estimator



# What options do we have?

- “Patch” with estimation of available link capacity?
- **Not** base algorithms on known link capacity assumption:
  - Regulate on queue fill level?
    - But what about overlay links?
  - TCP-like (buffer-filling) hop-by-hop algorithm?
- Different algorithms for different links?
- Combination of algorithms?
  - Resilience in face of incorrect assumptions
- Discussion!