QoS-types for Effective Calculation and Distribution of Bandwidth Information

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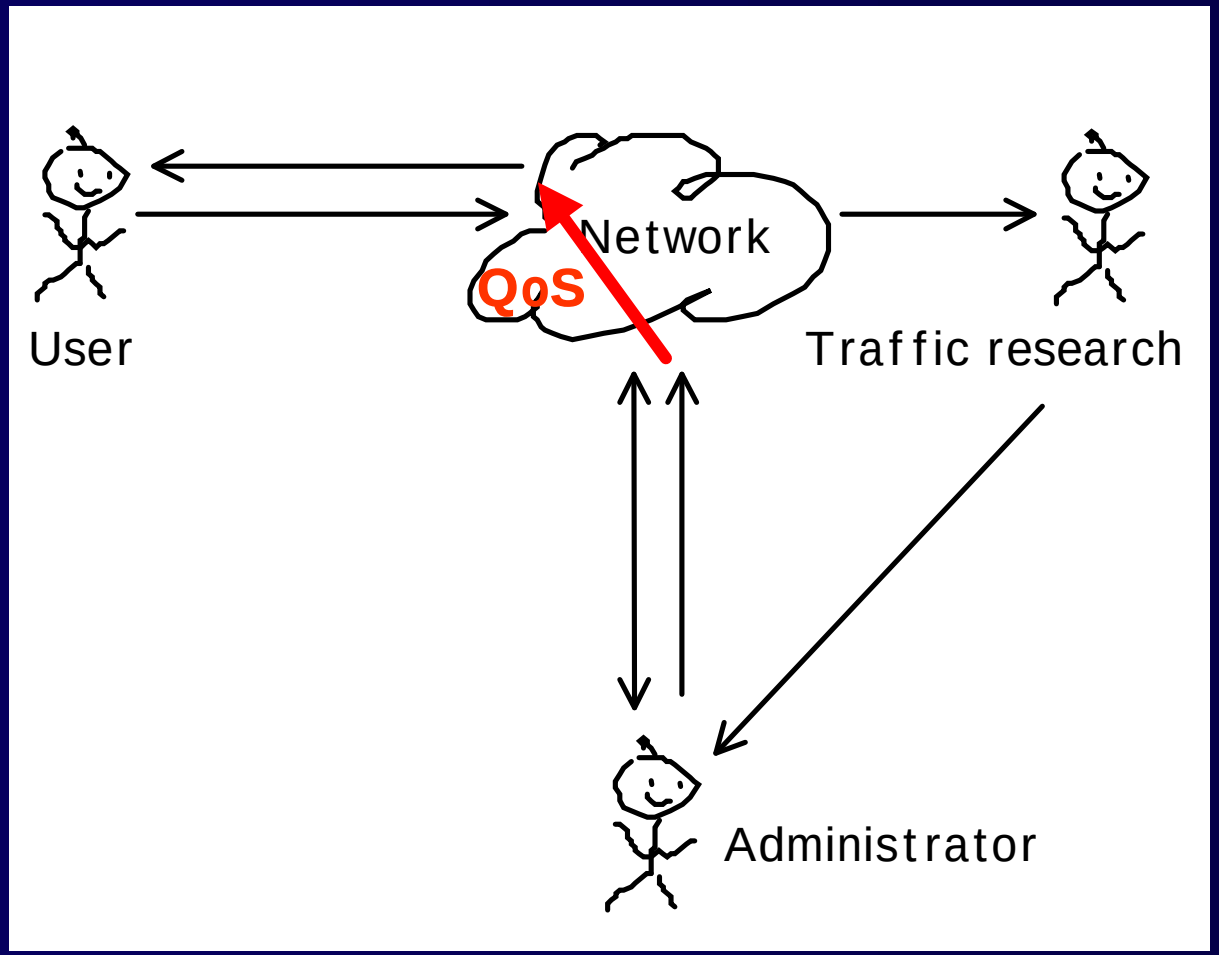
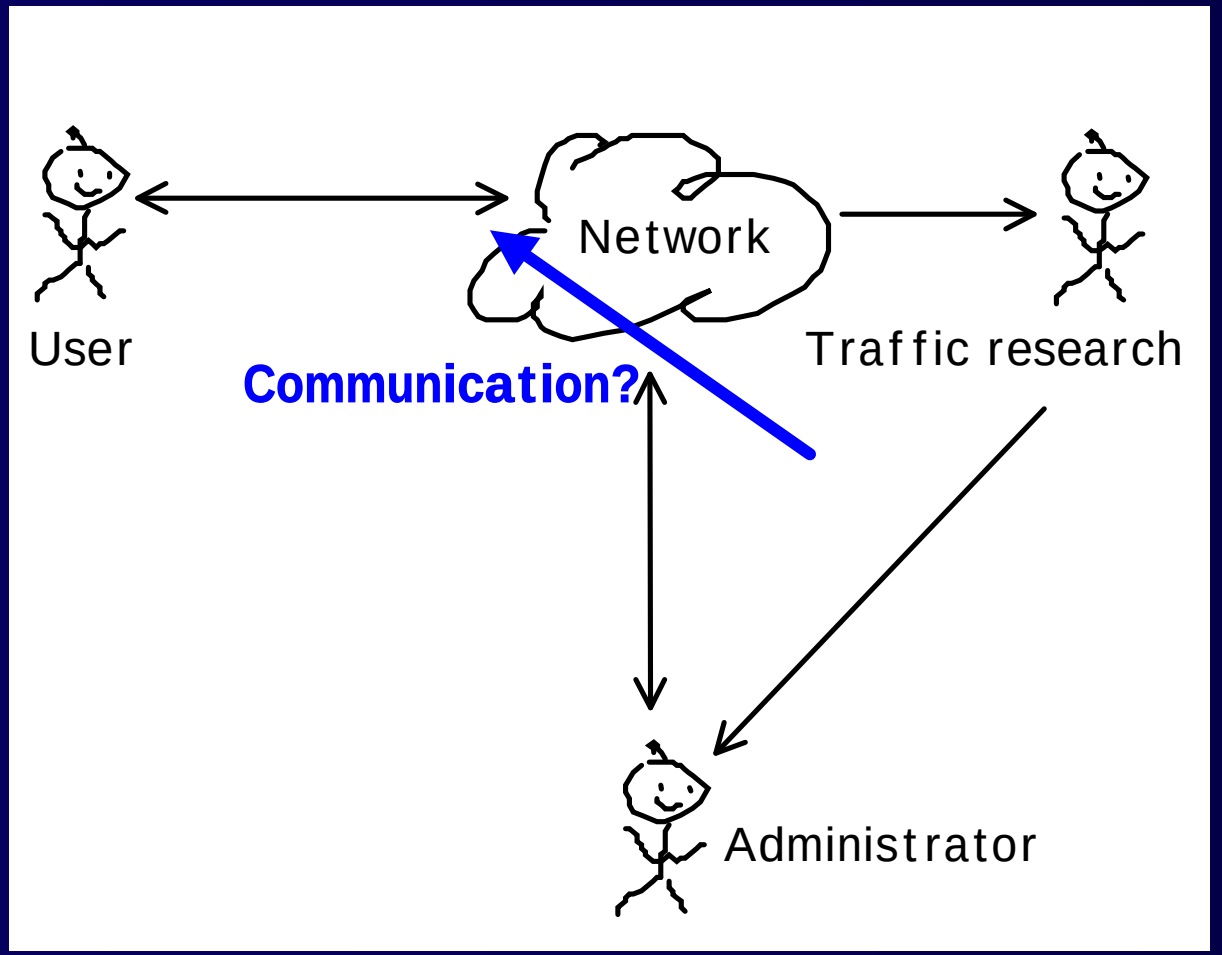
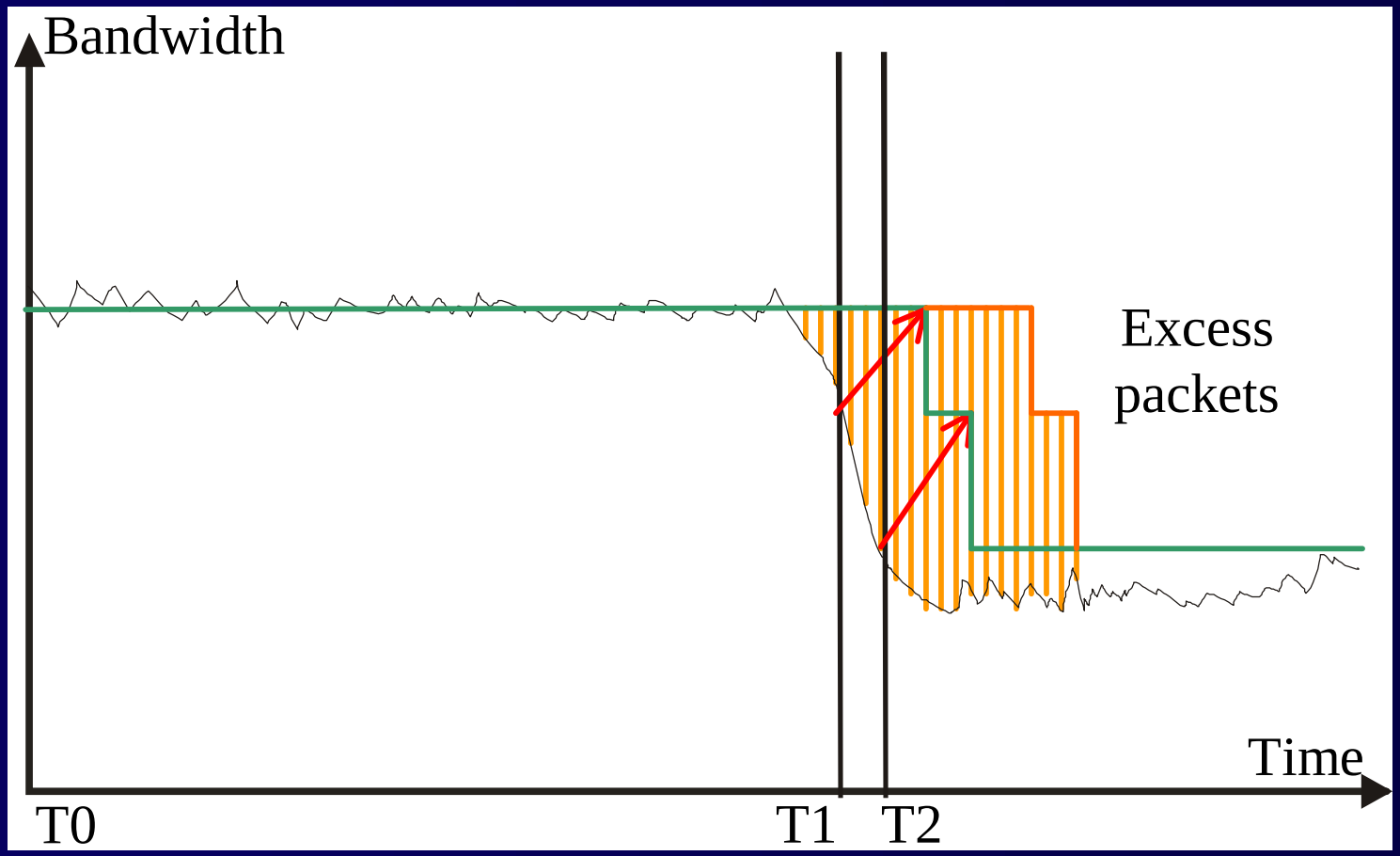
ATM: One world



The (traditional) Internet: Two worlds



Traditional adaptation: Possible scenario



How bad this really is

- Excess packets...
  - can be delayed
  - can delay other packets (including the feedback!)
  - can cause other packets (including the feedback!) to be dropped
  - can be dropped (delayed if retransmitted)
- What if the available bandwidth rises?
- Efficient adaption is crucial for providing QoS!

Adaptation: The history of layer 3/4 communication

- 1986: Collapse
- 1988: Congestion Avoidance and Control (Jacobson/Karels)
- 1993: RED
- 1999: ECN
- BECN...

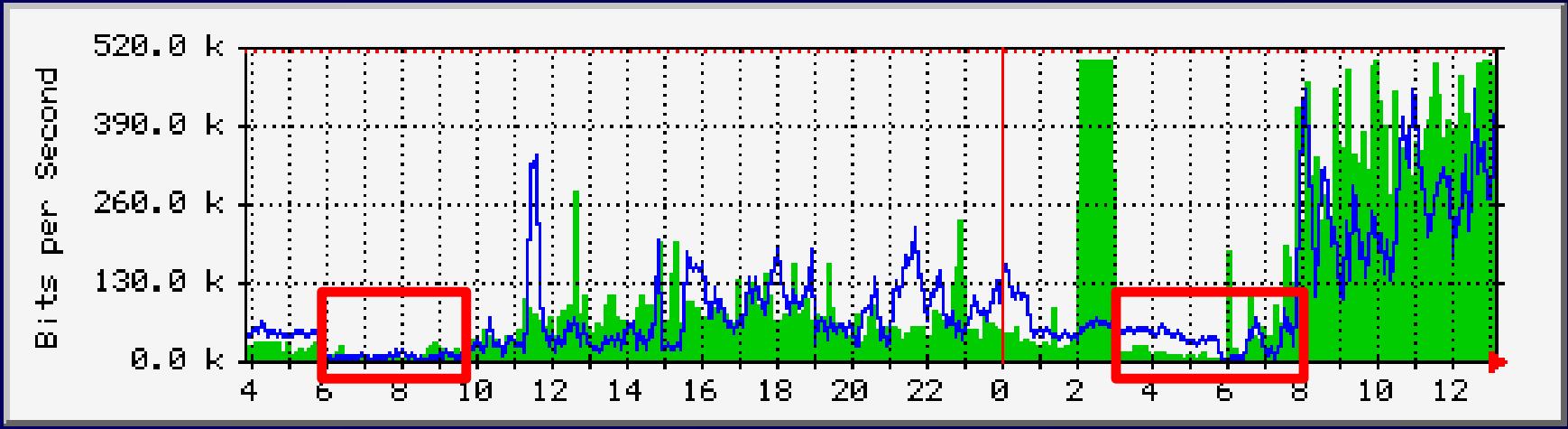
PTP: The Performance Transparency Protocol (draft-welzl-ptp-01.txt)

- Transparency: You can look ***into*** the black box
- "Generic" ECN / BECN
- Currently supports nominal bandwidth, ***available bandwidth*** and PathMTU
- Only every 2nd router needed for full functionality
- If less routers support it, the results serve as an adaptation starting point

Available bandwidth determination

- Currently supported by PTP through the MIB-II "if(In/Out)Octets" object(s)
- Determination up to the application (similar to **MRTG**)
- Problem: No history available from the beginning!
- Solution: Average bandwidth calculated by routers
- How do we define "average bandwidth"?

Example MRTG trace



http://www.switch.ch/lan/stat/peerings/linkeunet.html, 11. 10. 99, 13:05

- Internet traffic is not similar to a Poisson process, there is no “flattening“ towards a mean
- “Average Bandwidth“ is not ideally calculated over the longest possible interval!

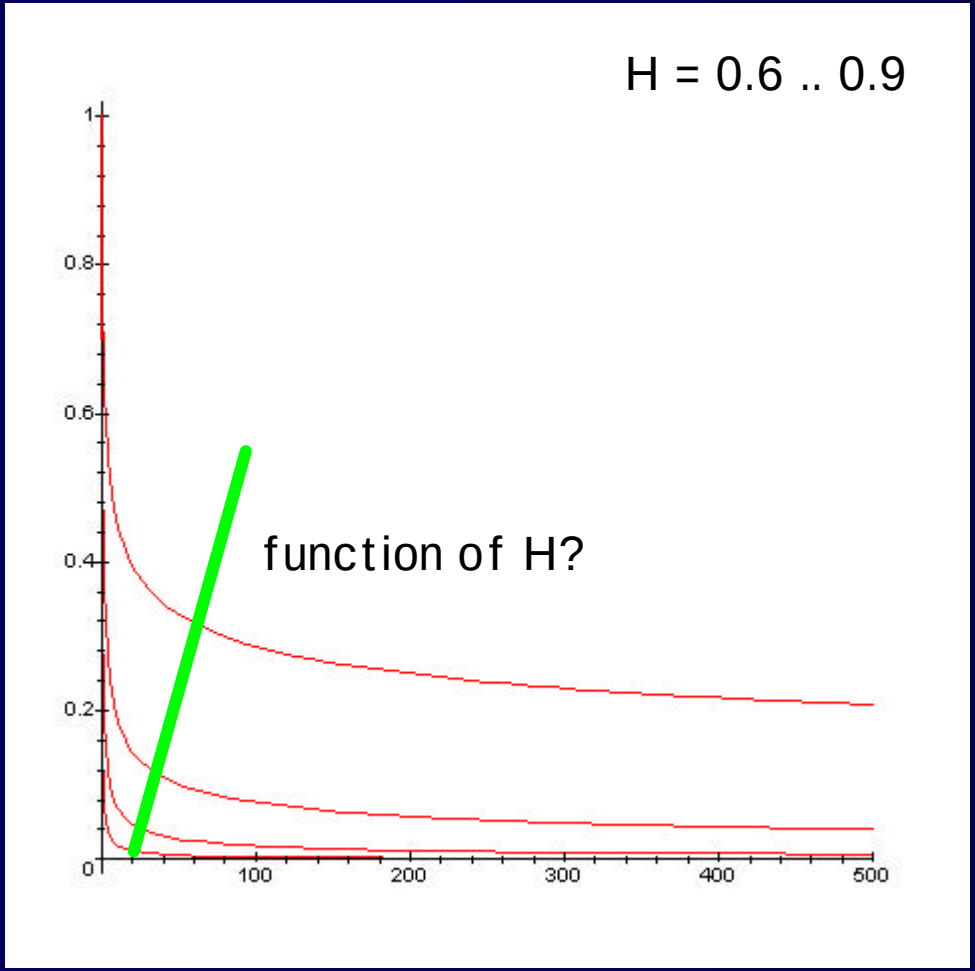
Two QoS-types

- A different QoS model: QoS is not provided or denied, only information is exchanged according to QoS requirements
- **Short Term Expected Average:**
  Expected to change soon but show few fluctuations
- **Long Term Expected Average:**
  Expected to last longer but show more fluctuations
- Could also be two subclasses of ATM RT-VBR, but not ATM QoS parameters!
- Very vague definition: What is soon? What is longer? What are many fluctuations?

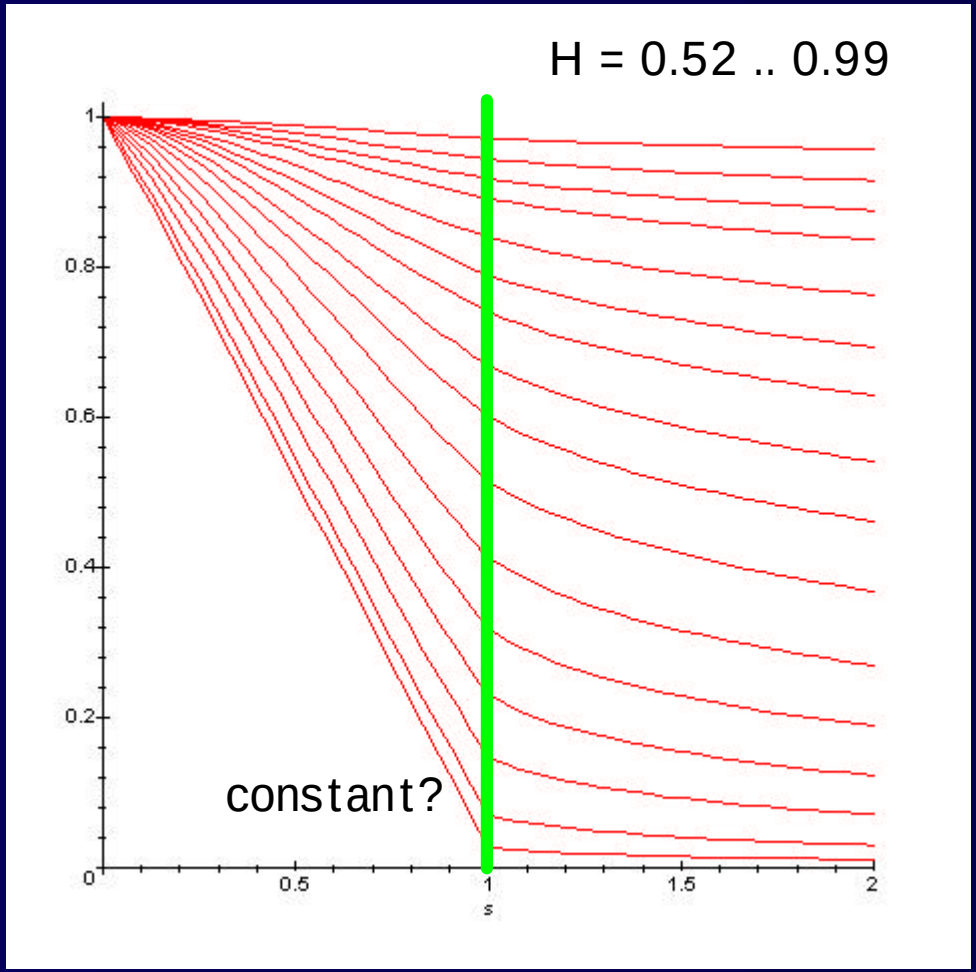
How to calculate

- Not quite clear yet
- Intuitively right method: Moving Average
- Other methods: Self-similar modelling
  - discrete fractional Gaussian noise (dfGn)
    - Hurst parameter estimation
  - fARIMA models
  - Wavelets

dfGn Autocorrelations



dfGn acfs: Zooming in



Perspectives

- Very exhaustive - a problem for routers. Moving Average better?
- May even depend on the router!
- Field trials necessary
- QoS-types are a “framework“ for network traffic research
- Possible implementation using Active Networks ?!