

# Measuring the Impact of Active Probing on TCP

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# Outline

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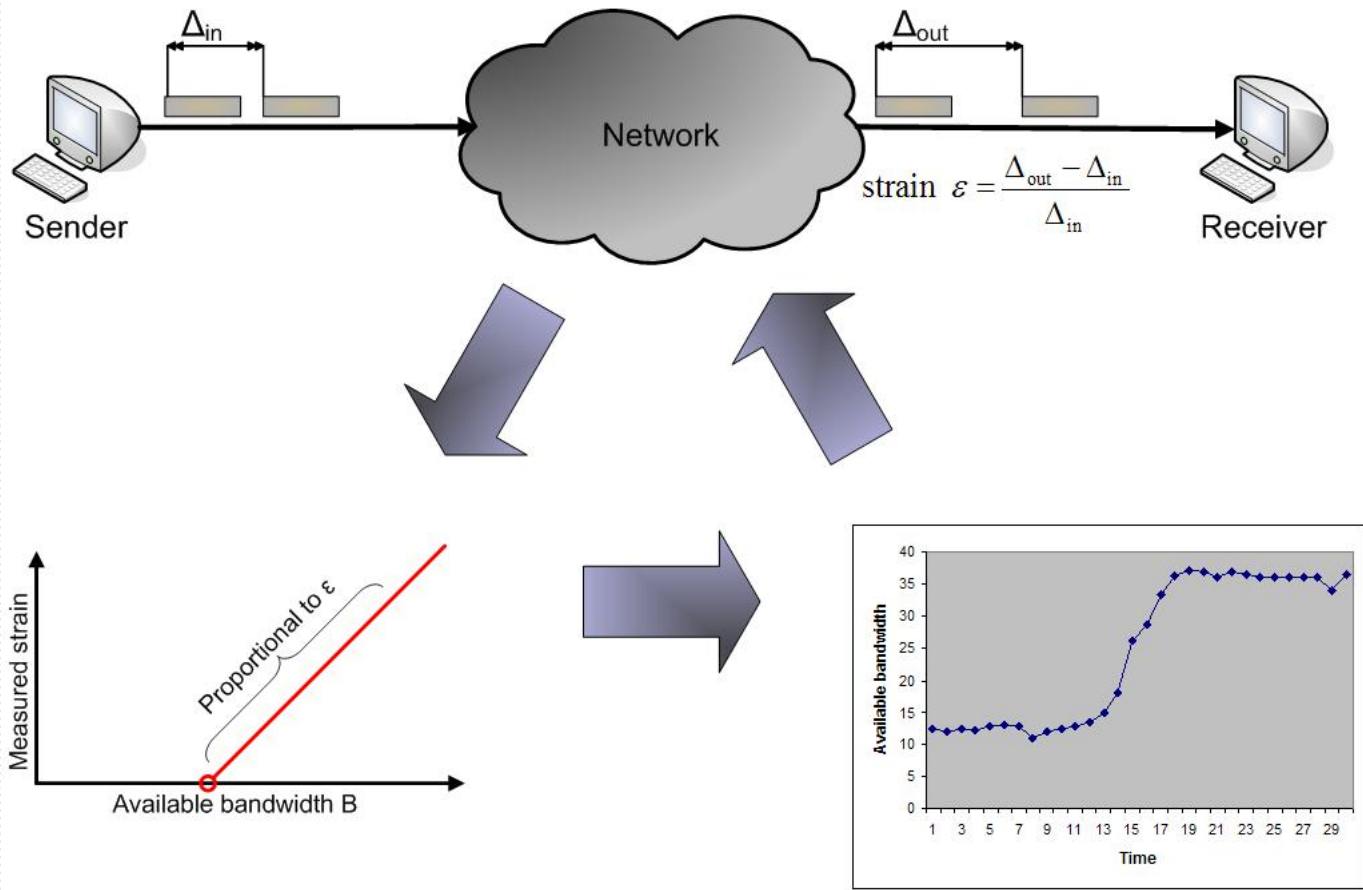
- Available bandwidth
  - Applications
  - Techniques
  - Impact on TCP

# Applications of available bandwidth measurement methods

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- Verify SLA
- Error detection
- Send rate adaptation

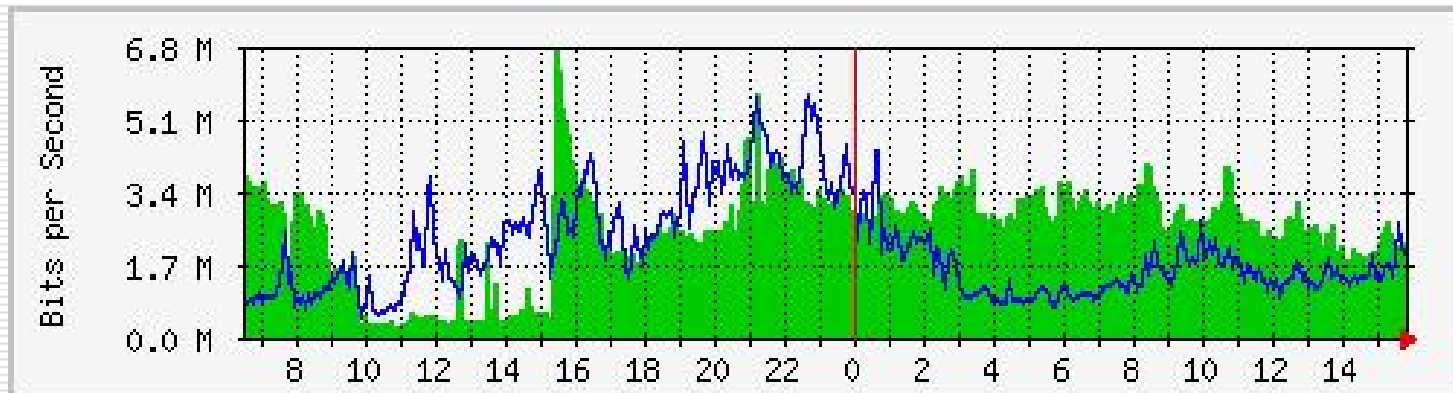
# The essentials of active probing



# What is available bandwidth?

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- Unused portion of the link capacity
  - Changes over time
  - Important to track changes in order to adapt applications to current situations



# Probe packets affect other traffic

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- Probe packets affect network traffic
- UDP perspective
  - Less network capacity to consume
  - The impact is proportional to # probe packets
  - Probe packets does not affect the send rate
- TCP perspective
  - Less network capacity to consume
  - Affect TCP RTT and loss rate → impact the send rate
  - Impact much larger than # probe packets?
  
- **Shown in the paper:**  
Impact close to # probe packets if injecting medium length probe-packet trains

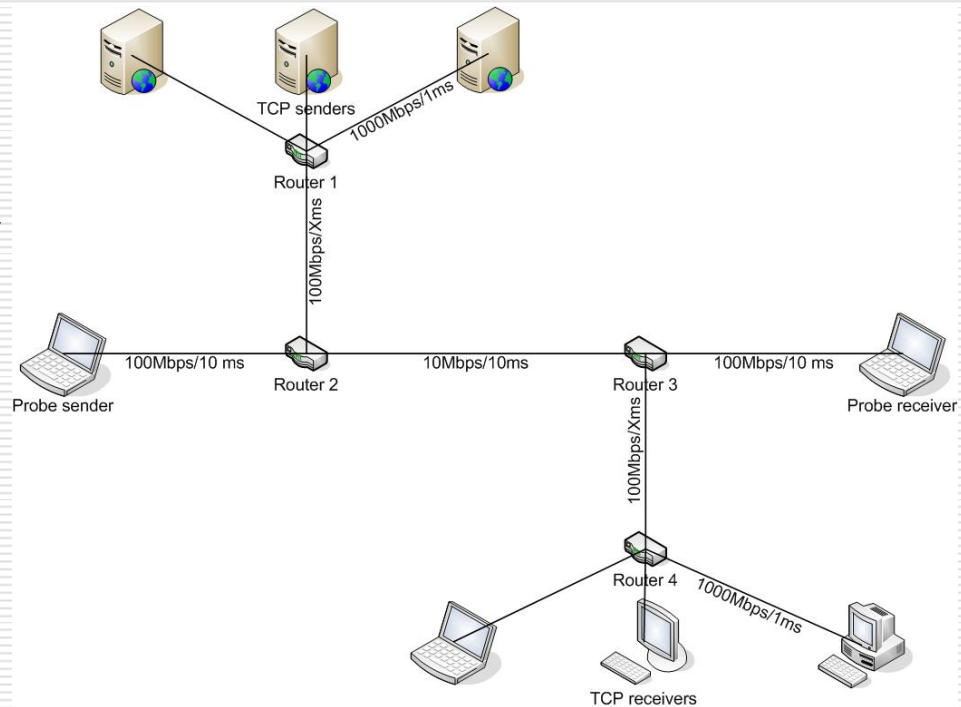
# Research question

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- How does probe packets affect TCP?
  - Can we vary the injection of probe packets in a way to minimize the impact?

# Simulation setup

- NS-2 Topology
  - 1 to 19 TCP senders and receivers
  - Probe sender/receiver
  - 10 Mbps bottleneck
- TCP performance
  - Transferred bits by all aggregated TCP flows during 100 seconds

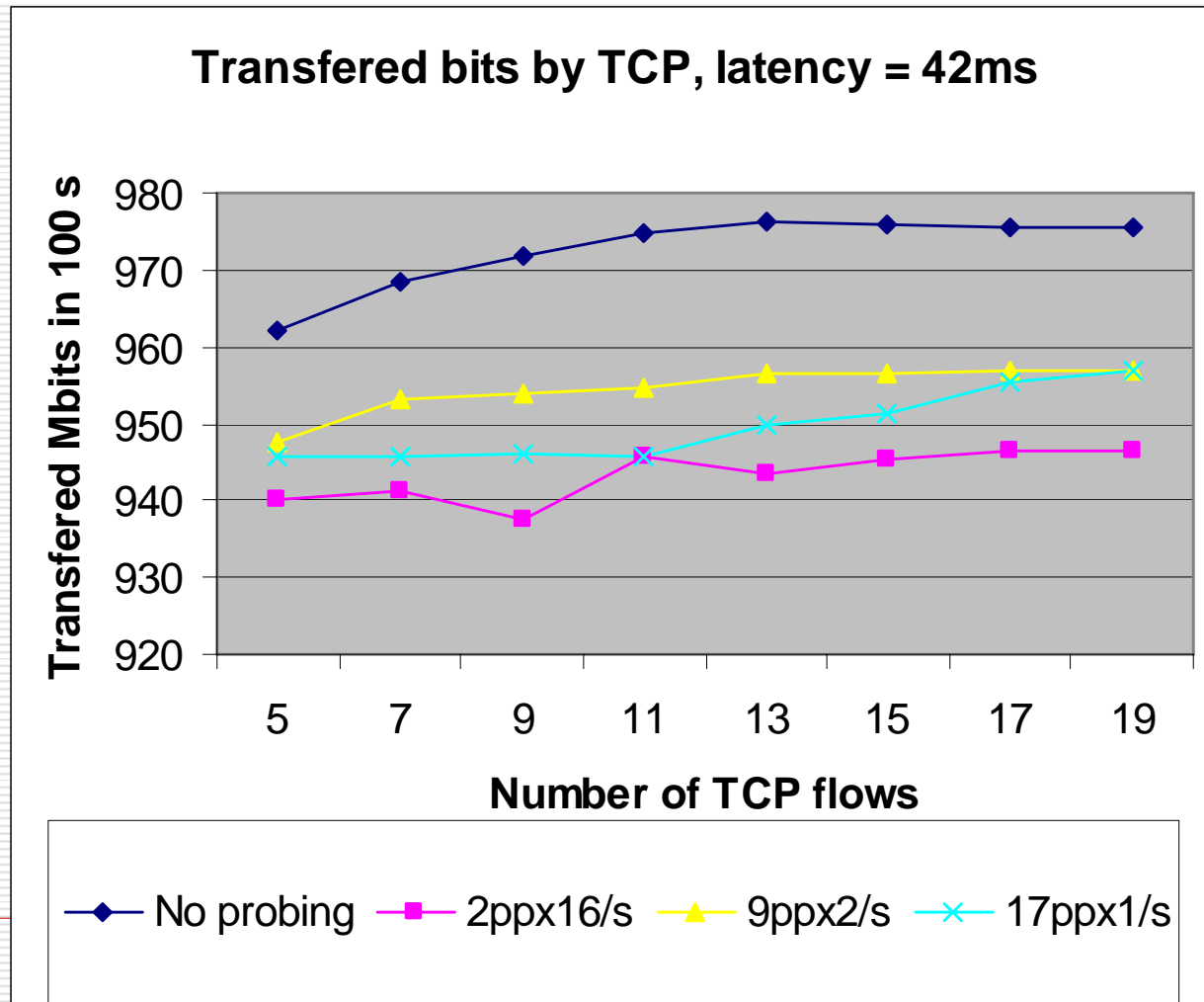


# Simulation setup cont.

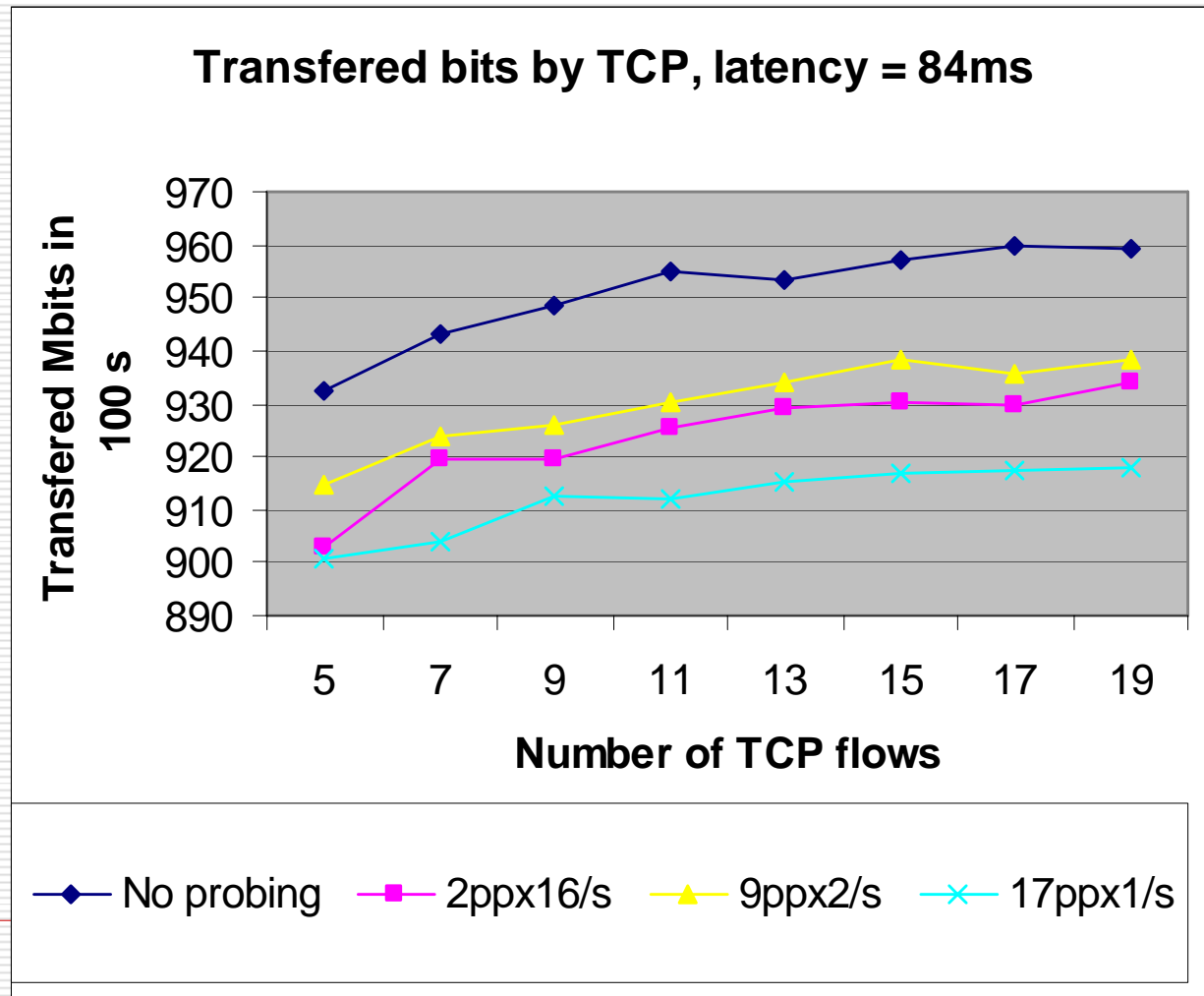
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- Varied the probe-packet train length
  - BART and TOPP give accurate estimates with 16 samples / second
  - Variations of 16 samples
    - Pairs\*16
    - 9 packets \* 2
    - 17 packets \* 1
  - # samples constant
  - Pairs inject more traffic than trains

# The probing affect on TCP



# The probing affect on TCP cont.



# Things that should be explained

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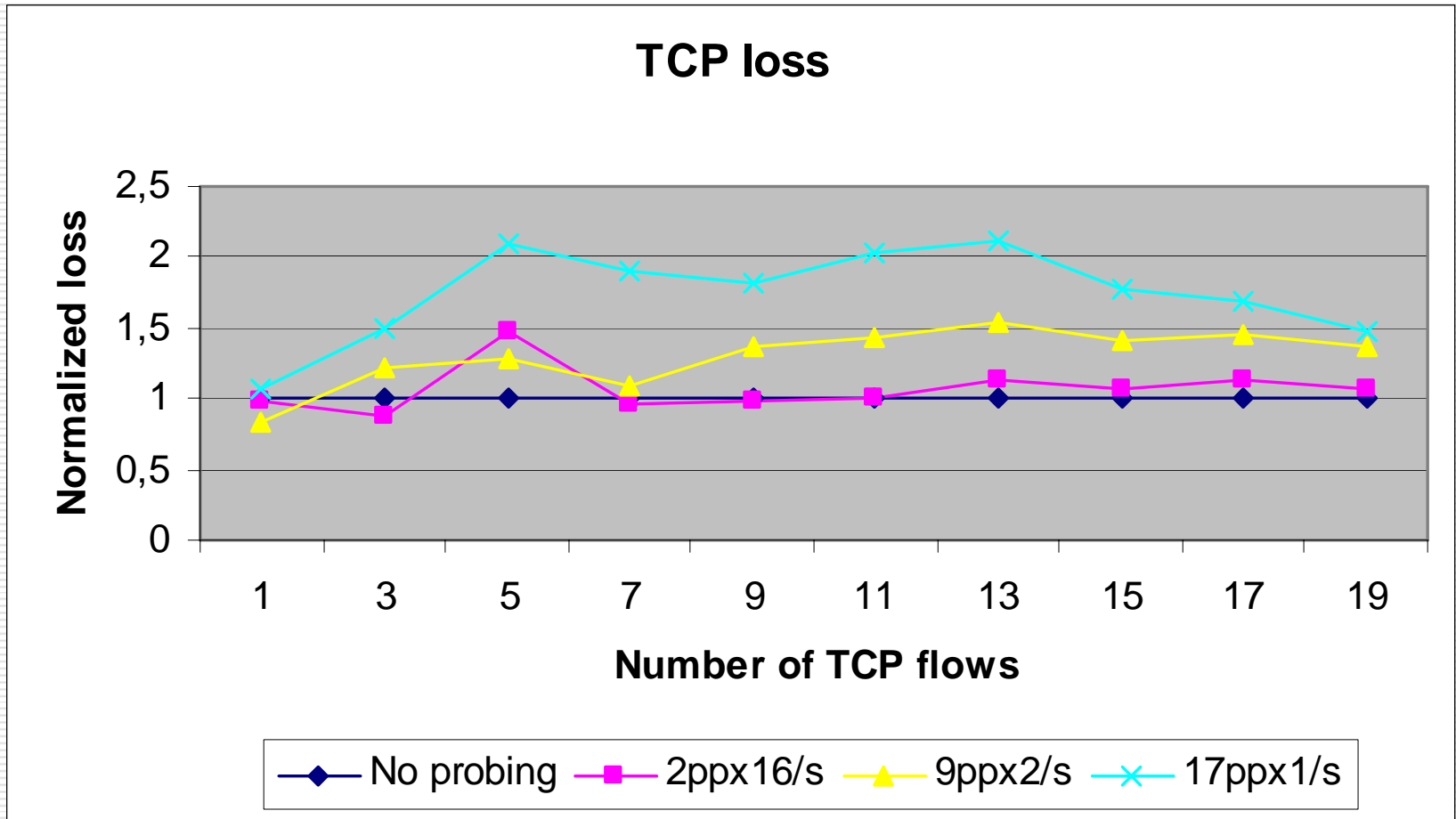
## □ Why

- does the probe packet train length matter to TCP?
- does the latency matter?
- is probe-packet trains/probe-packet pairs worst?

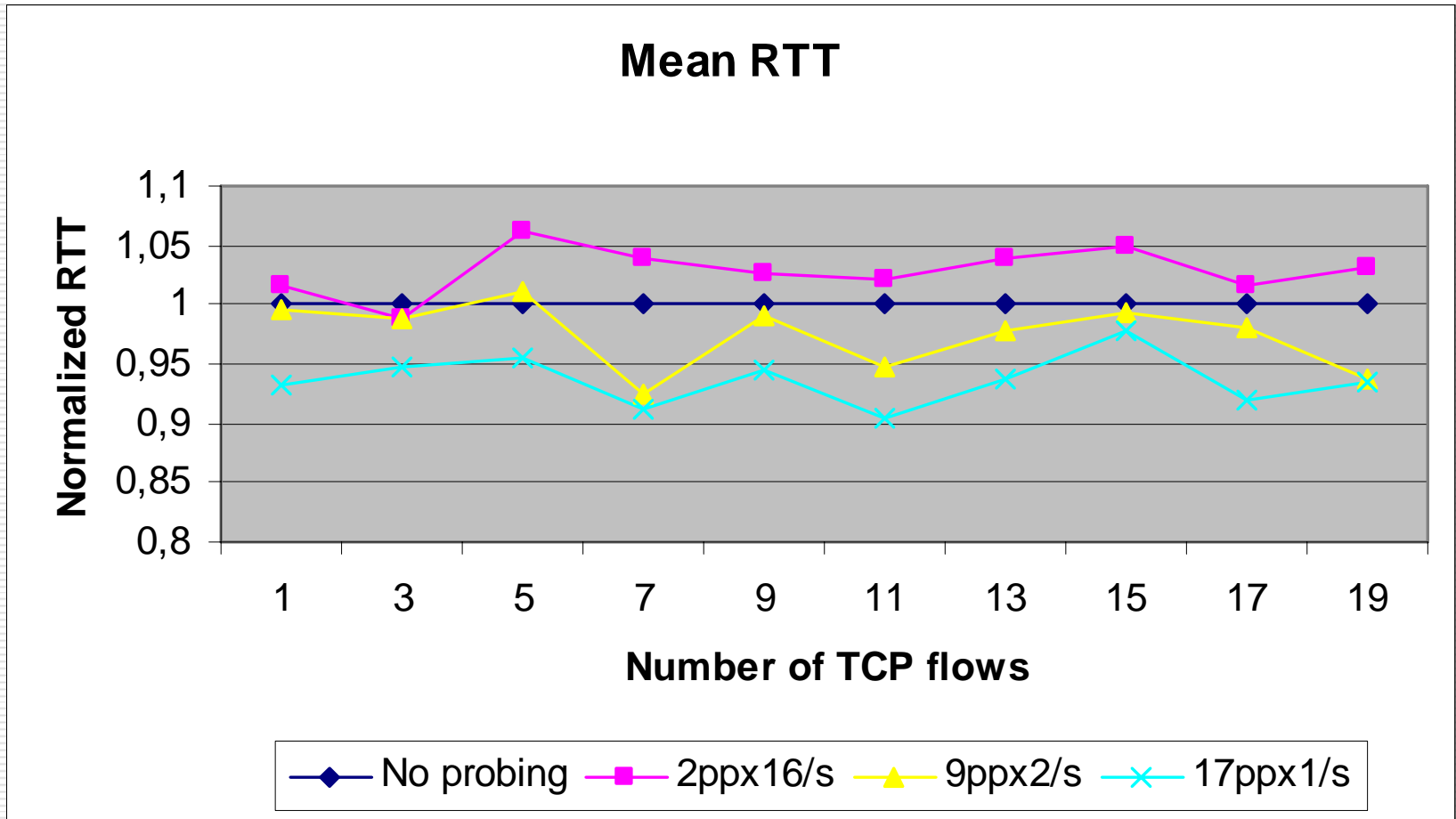
## □ Examine TCP

- loss rate
- mean RTT

# Explanations cont.



# Explanations cont.



# Explanations

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- Both RTT and LOSS affect TCP performance
  - RTT grows with the number of injected probe packets
  - LOSS grows with the probe-packet train length
  - Probe-packet trains of length 9 minimizes the combined impact on RTT and loss

# Conclusions

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- Probe packets affect TCP rtt and loss
  - Decrease tcp performance
  - Overall impact is low
- Use medium sized probe-packet trains