

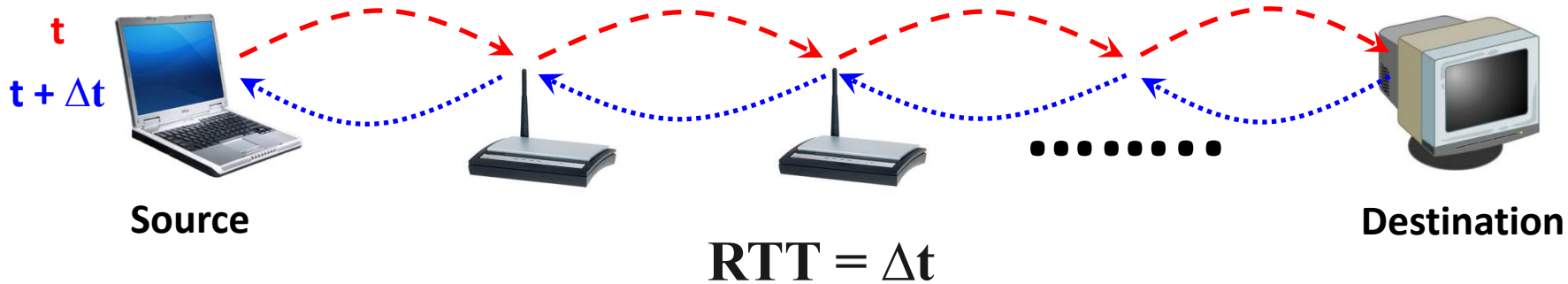
Some Alternatives for ns-3 Project

CSE 322

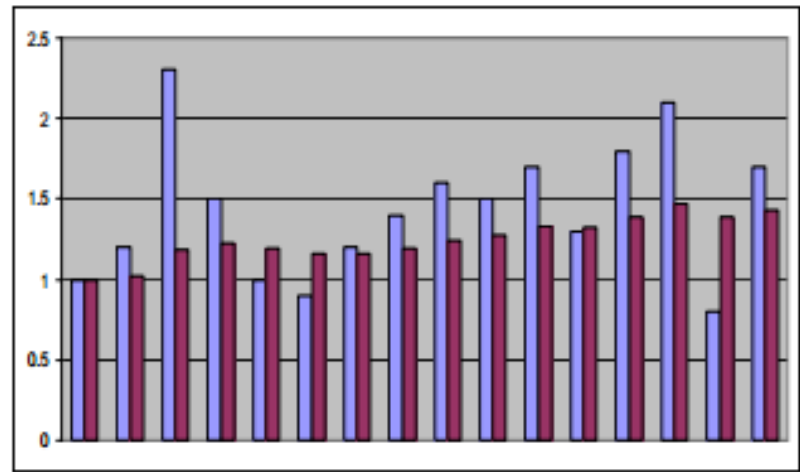
In The Spec ...

- Modified mechanism for **RTT** calculation
- Modified mechanism for **congestion control** in TCP
- Modified mechanism of **routing**
- Modified **MAC** layer protocol

RTT Calculation



- Round trip times exponentially averaged:
 - New RTT = α (old RTT) + $(1 - \alpha)$ (new sample)
 - Recommended value for α : 0.8 - 0.9
 - 0.875 for most TCP's



- Retransmit timer set to $(b * RTT)$, where $b = 2$
 - Every time timer expires, RTO exponentially backed-off

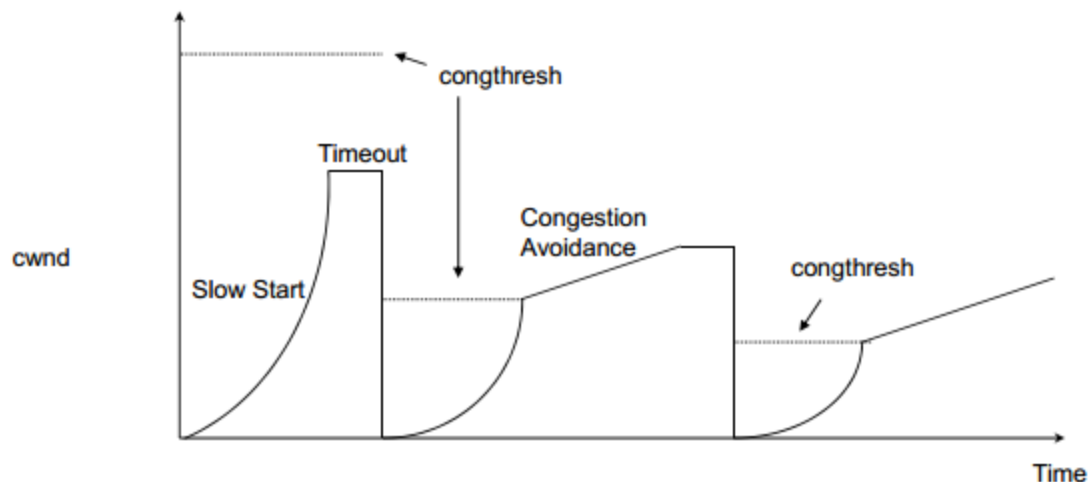
Different Methods of RTT Calculations

- Jacobson
- Karn et al.
- Fallon et al.
- QRTT
- So on ...

Congestion Control in TCP

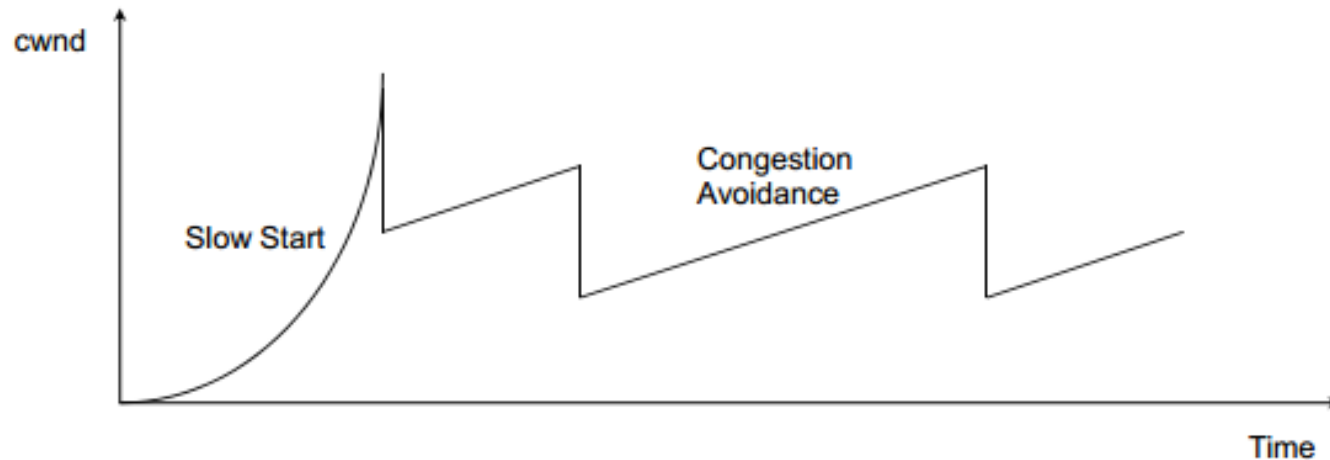
- TCP Tahoe

- Congestion Window (cwnd): Initial value is 1 MSS (=maximum segment size) counted as bytes
- Slow-start threshold Value (CongestionThreshold = congthresh)
- slow start ($cwnd < congthresh$)
 - Exponential increase of cwnd
- congestion avoidance ($cwnd \geq congthresh$)
 - Incremental increase of cwnd



Other Alternative of Congestion Control in TCP – TCP Reno

- Fast Retransmit and Fast Recovery



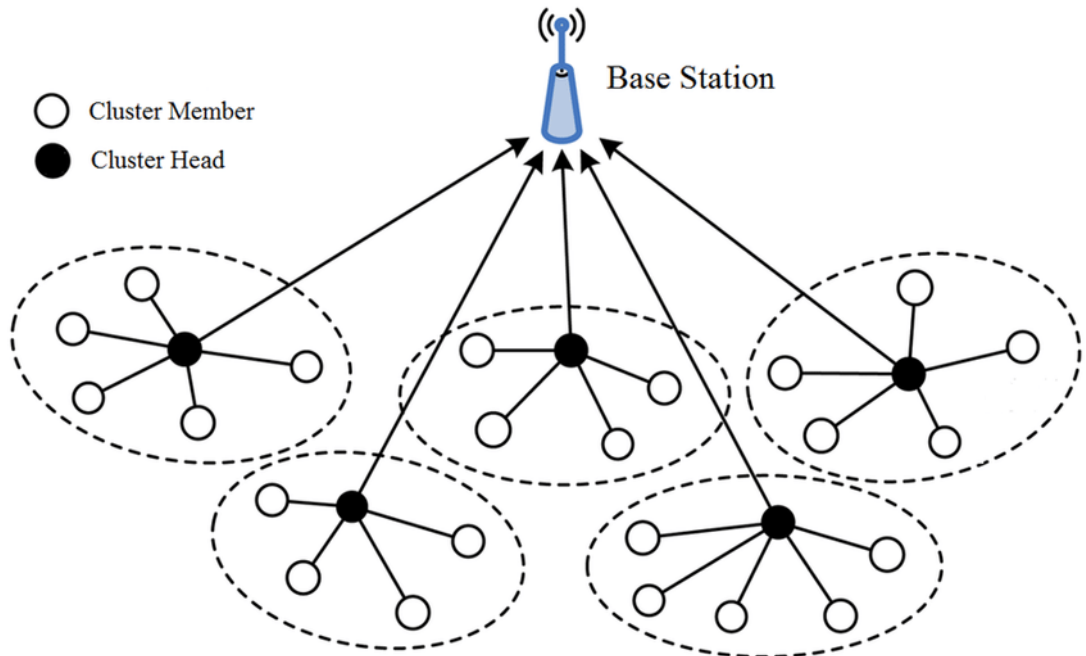
- Retransmit after 3 duplicate ACKs
 - prevent expensive timeouts
- Slow start only once per session (if no timeouts)
- In steady state, *cwnd* oscillates around the ideal window size.

Other Alternative of Congestion Control in TCP

- TCP NewReno
- TCP Vegas
- iTCP
- So on ...

Routing Alternatives

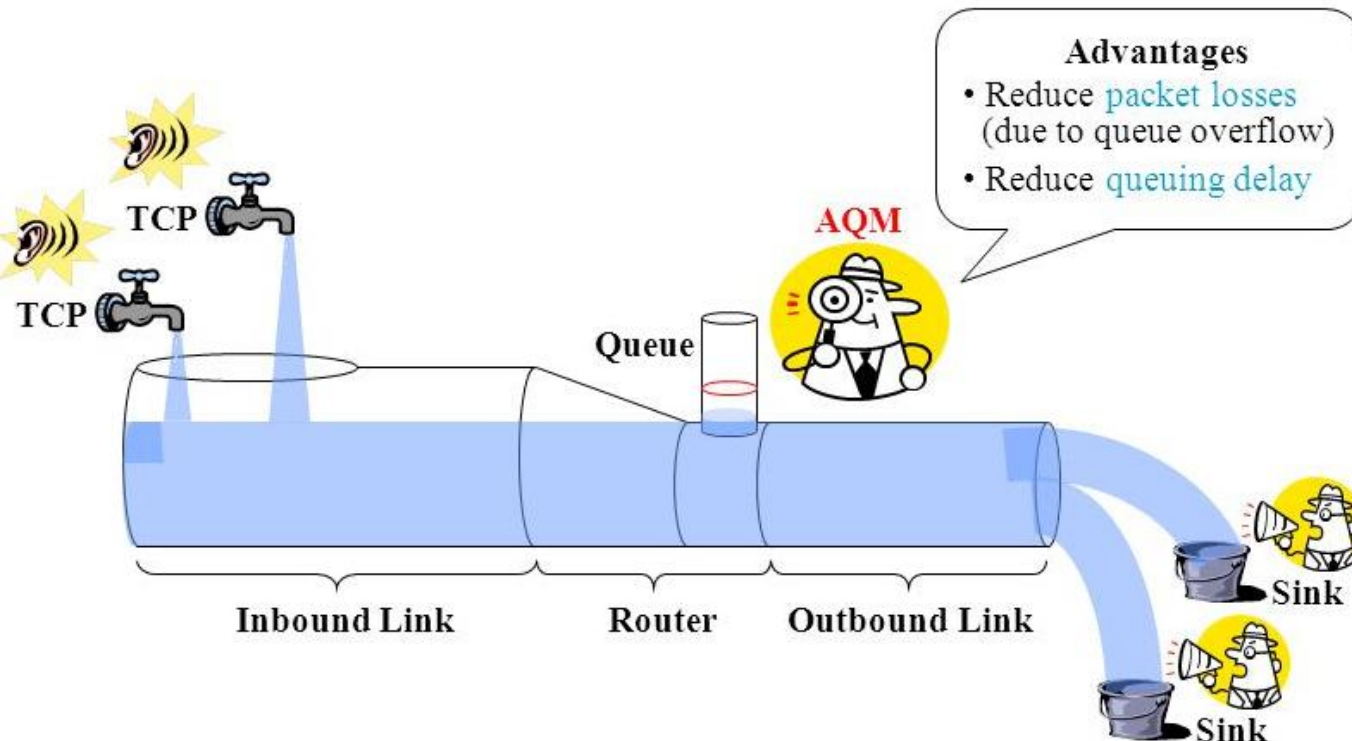
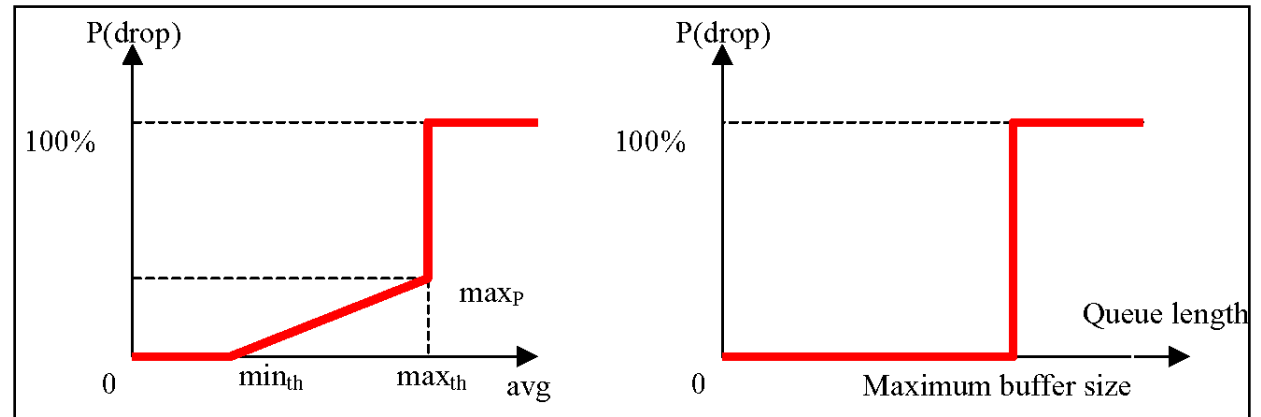
- Known routing techniques
 - DVR: IGRP
 - LSR: OSPF
- Other ones
 - BGP
 - Clustering



MAC Alternatives

- Known techniques
 - 802.11
 - 802.15.4
- Other alternatives
 - B-MAC from Berkeley
 - D-MAC (Dynamic or Directional)

Active Queue Management



5G and 6G

Features	5G	6G
Frequency Bands	<ul style="list-style-type: none"> • Sub 6 GHz, • mmwave for fixed access 	<ul style="list-style-type: none"> • Sub 6 GHz, • mmwave for mobile access exploration of THz bands (>140 GHz), • Non-RF bands (e.g. optical, VLC) etc.
Data rate	1 Gbps to 20 Gbps (Downlink Data Rate - 20 Gbps, Uplink Data Rate - 10 Gbps)	1 Tbps
Latency (End to End Delay)	5 ms	< 1 ms
Traffic Capacity	10 Mbps/m ²	1 to 10 Gbps/m ²
Reliability	10 ⁻⁵	10 ⁻⁹
Localization precision	10 cm on 2D	1 cm on 3D
User experience	50 Mbps 2D everywhere	10 Gbps 3D everywhere

Some Resources ...

- RTT, CC, Routing, and MAC
 - <https://drive.google.com/drive/folders/17OfpS2kklbUTW5ZGDgrojLI6Vgg8sBz?usp=sharing>
- AQM
 - <https://drive.google.com/file/d/1oEiv5RiH3tEwjVyiYNFnF-hj6I54kMSY/view>
- 5G and 6G
 - <https://www.rfwireless-world.com/Terminology/Difference-between-5G-and-6G.html>
 - <https://apps.nsnam.org/app/nr/>
- Other sources of ns-3 based projects:
 - https://www.academia.edu/Documents/in/Ns-3_Simulator
 - <https://www.nsnam.org/research/wns3/wns3-2016/accepted-papers/>

Guidance and Caution ...

- Try to do the tweaking work COMPLETELY at your own
 - Improvement in performance is not a requirement
 - Your (understanding + work) are the requirements
- Any identification of copying/cheating (from any source – web, classmate, or else) at any stage of evaluation: Double negative marking

Thank You

Questions are Welcome ...