Spurious TCP Timeouts in 802.11 Networks

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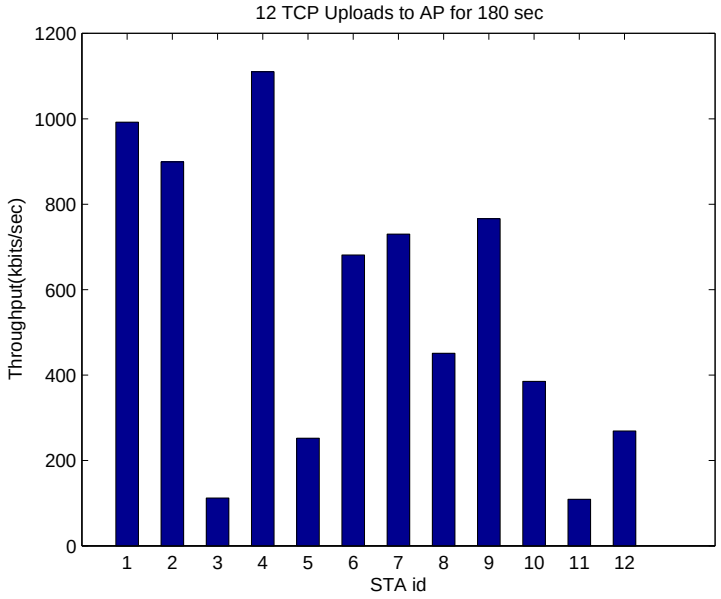
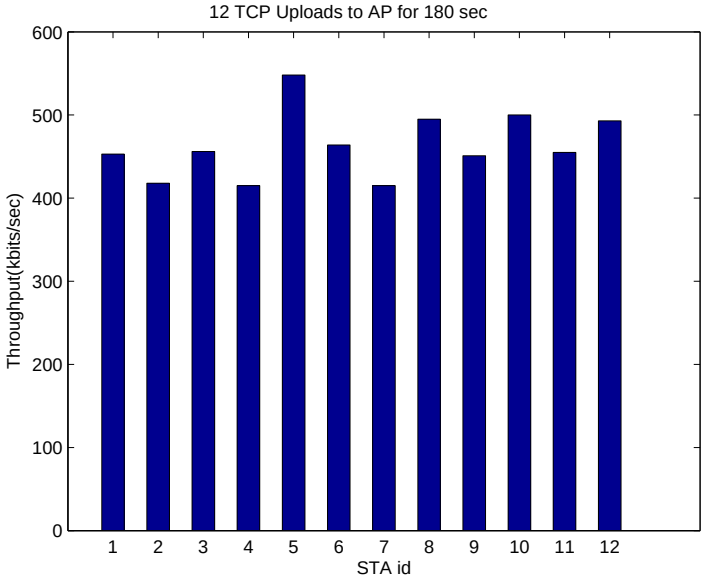
TCP over WLAN Woes

12 uploads



fixed 12 uploads



Spurious Timeouts?

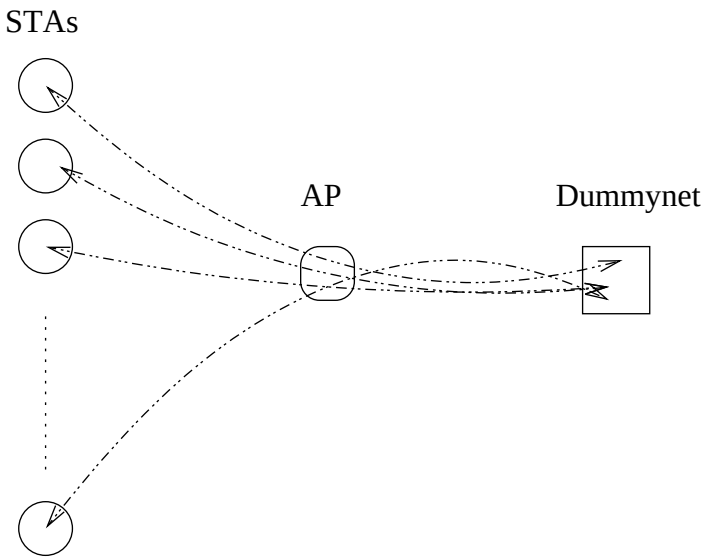
- Believed that spurious timeouts a problem.
- Once AP fixed, don't see many problems.
- Fully understand out fix.
- Investigate if there are spurious timeouts.
- What sort of tweaking needed?
- Office/hotspot usage.

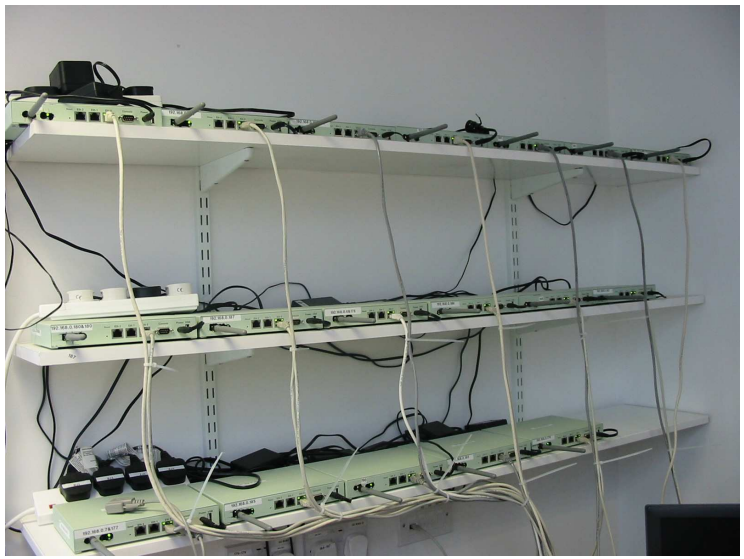
Previous Work

- Gurtov (01): delay spikes (radio coverage, handover, prio).
- Korhonen (01): Problems in early GSM/GPRS/...
- Fotiadis (05): Test delay spikes in 802.11.
- Vacirca (06) and Ricciato (07): Modern GPRS/3G.

Fixes: drive up RTO, Eifel Algorithm, F-RTO.

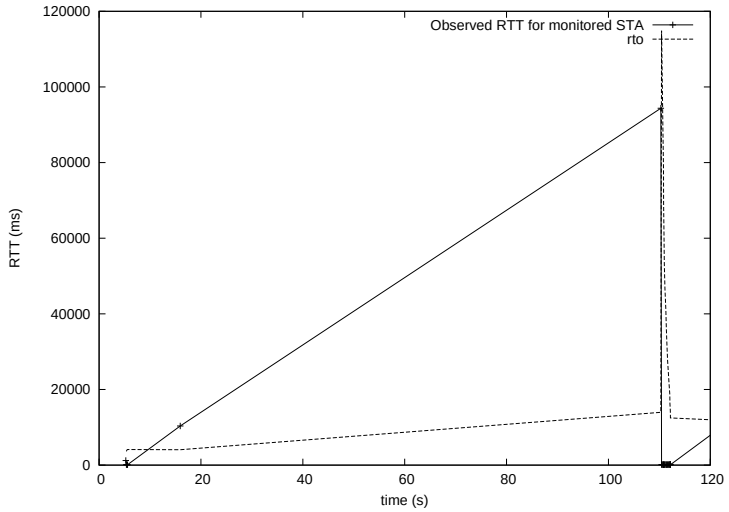
Testbed

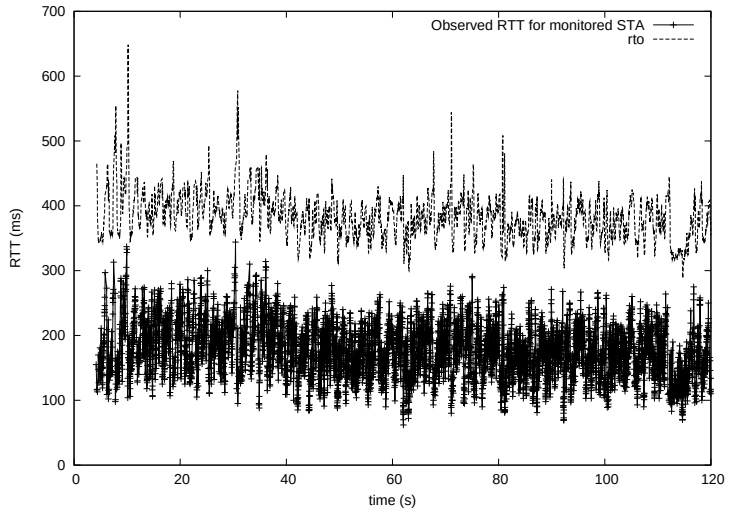




Uploads, WLAN Buffer 20+19, retries 11, fixed rate, long preamble, fast ACKs.

Busted Case: 4 Uploads

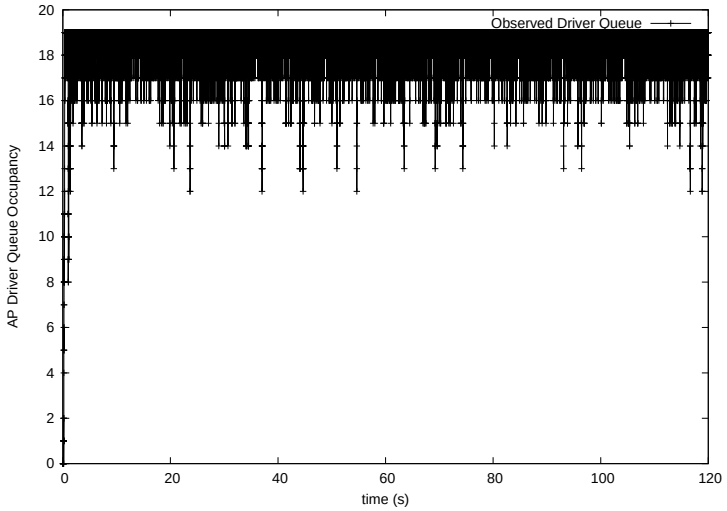


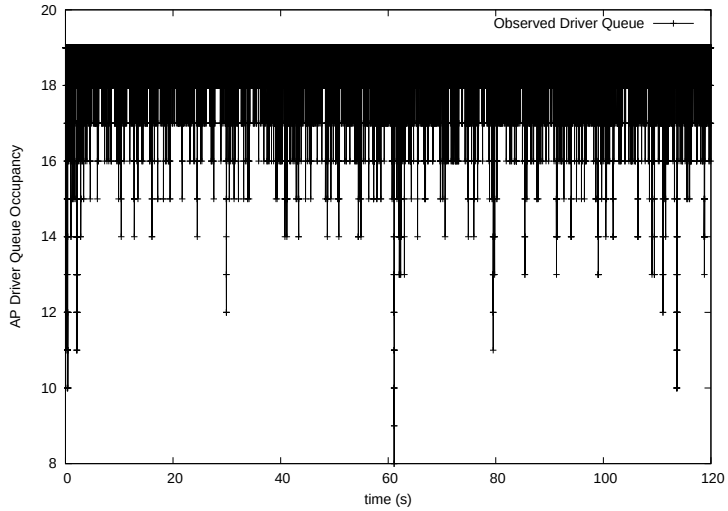


$$RTO = \text{srtt} + max(200\text{ms}, 4\text{rttvar})$$

Basically no MAC losses.

Busted Case: AP Queue

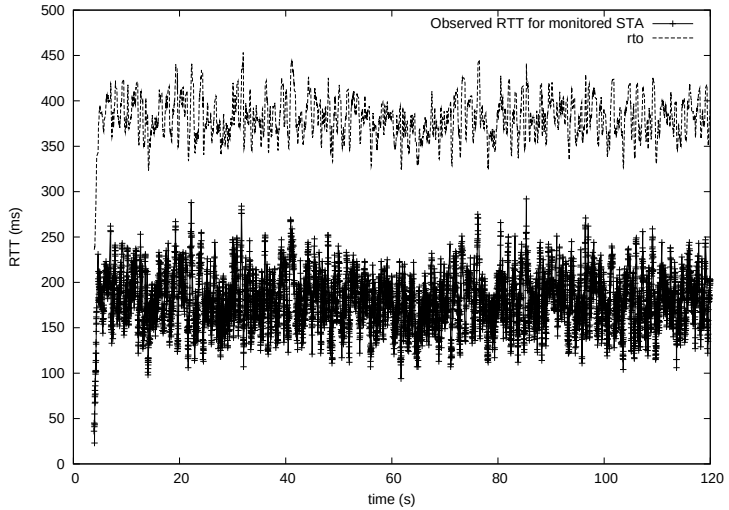


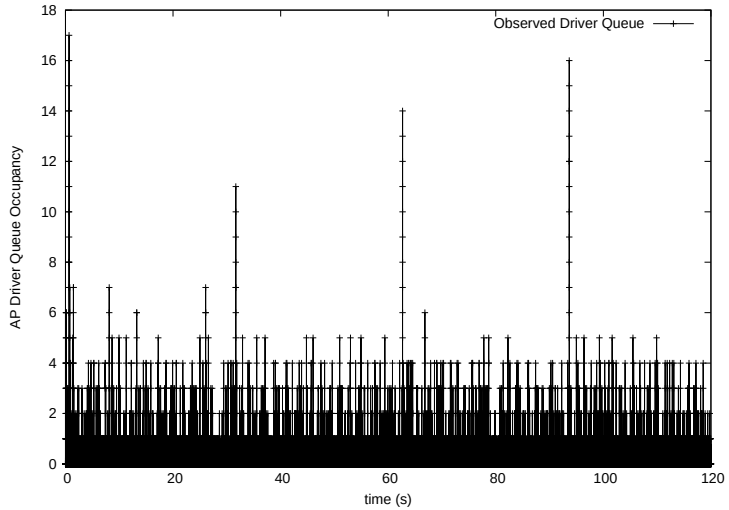


Lost whole flights of ACKs.

Hard for Eifel/F-RTO to help.

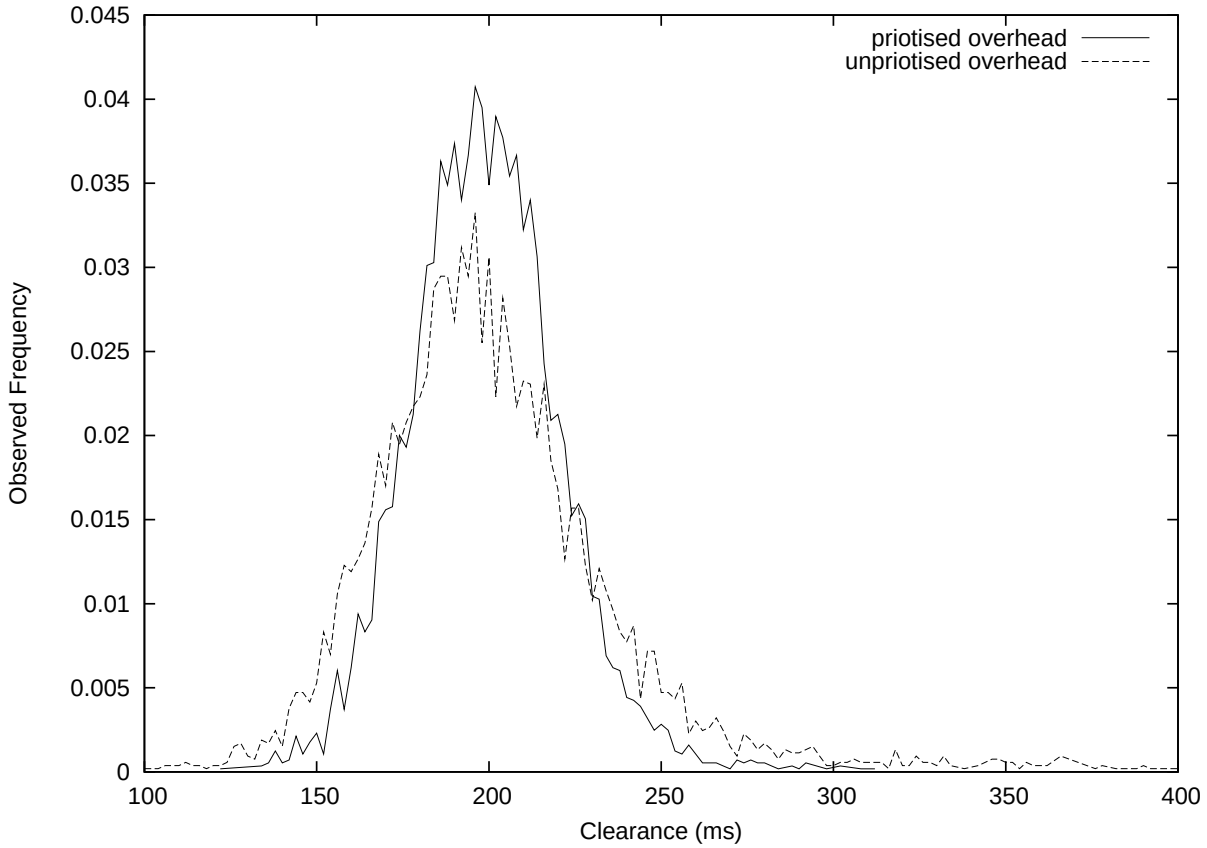
Fixed Case





No timeouts, still basically no MAC losses. Less variable?

Clearance



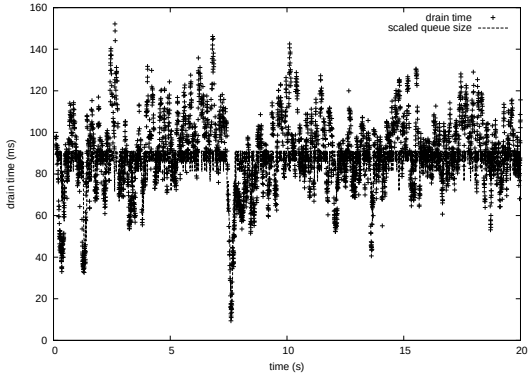
Both safely positive.

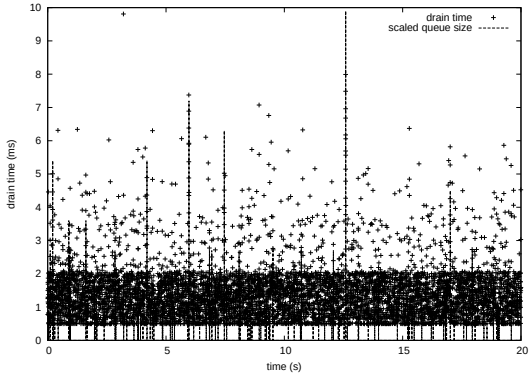
Trade-off between STA and AP draintimes.

noprior

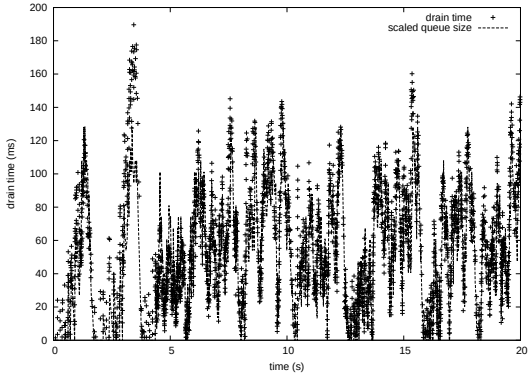
prior

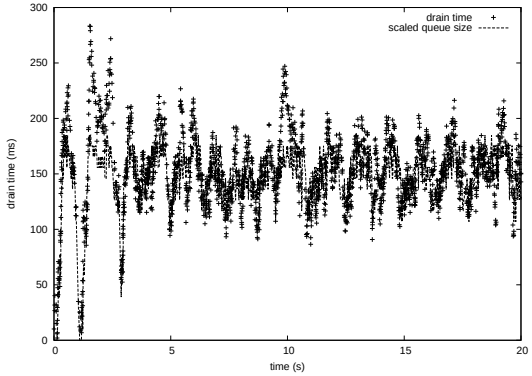
AP





STA



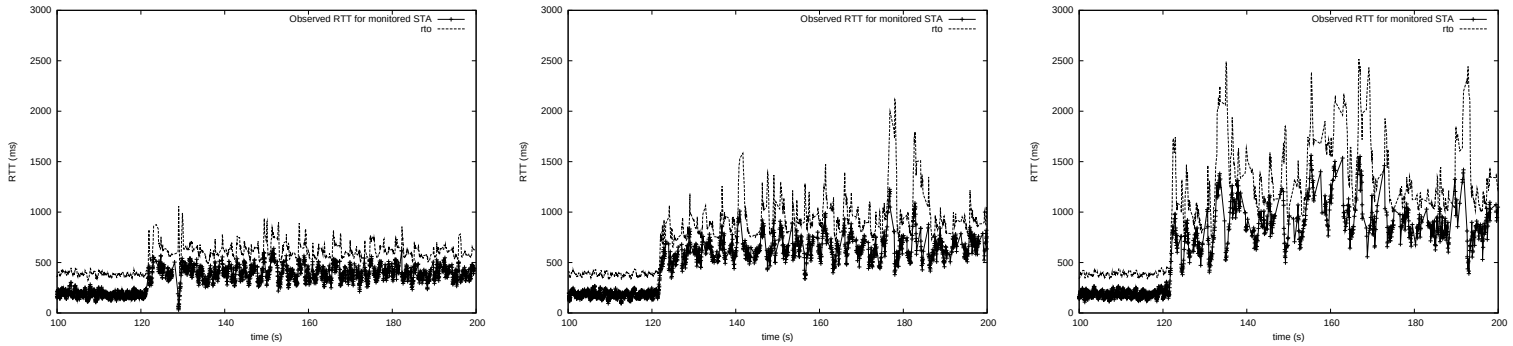


Trying Harder

- Maybe 4 uploads not hard enough?
- Other sources of RTT varience?
- Mobility.
- Varying number of users.
- Varying physical rate.

More users

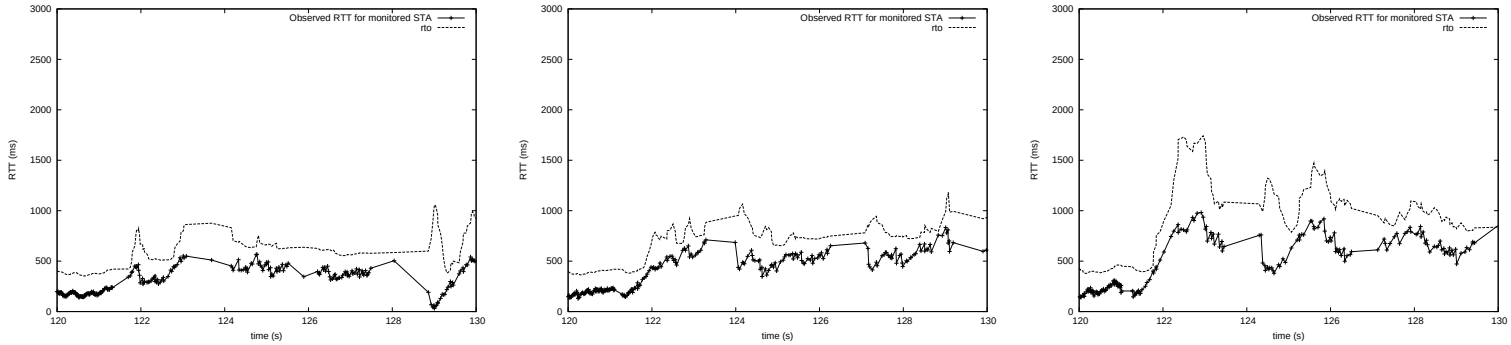
Change from 4 to 8, 12 and 16.



RTTs increase: 200ms, 400ms, 600ms and 900–1000ms.

Collision prob also rising: 18%, 35%, 47% and 54%.

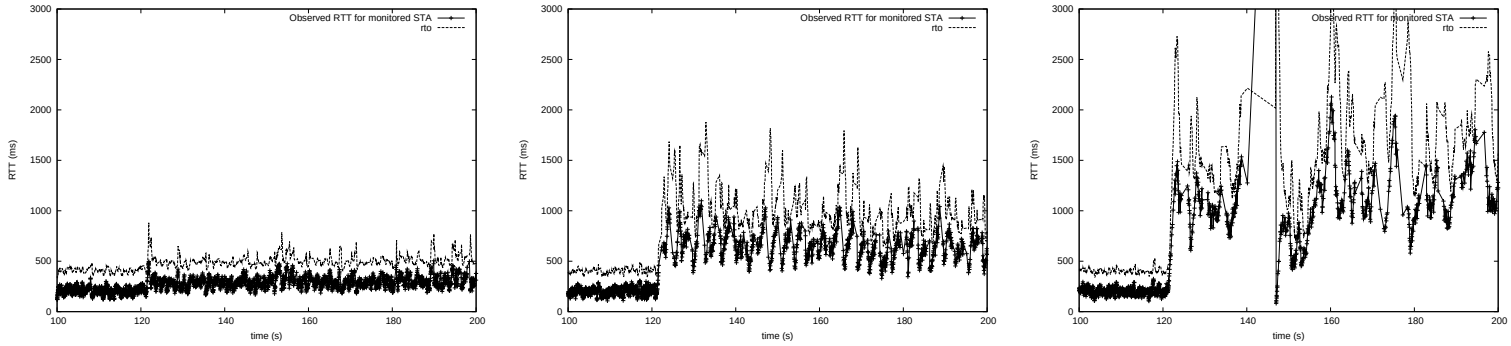
More users: close up



No timeouts (but one failed fast retransmit).

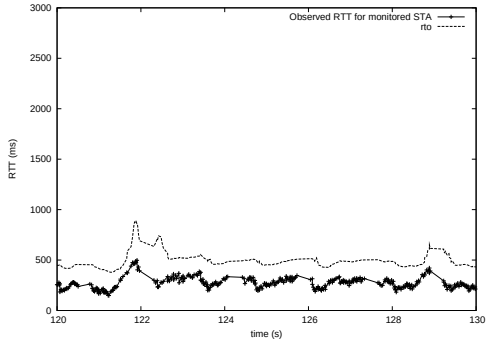
Harsh Rate Control

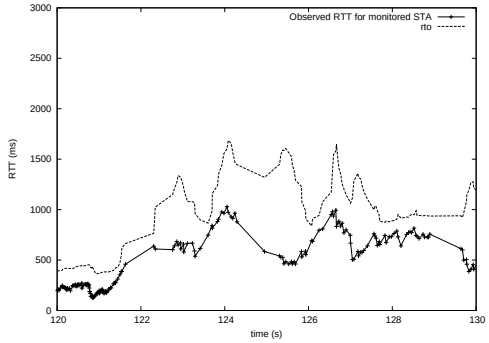
Change from 11 to 5.5, 2 and 1.

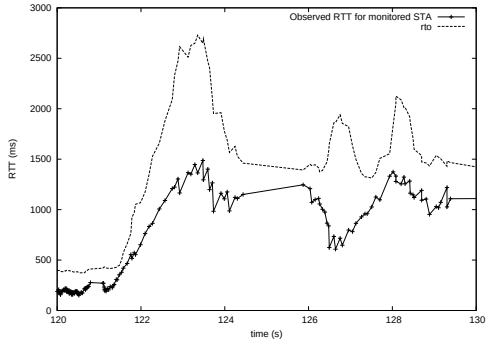


Sharp increase, in line with expectations.

Close Up



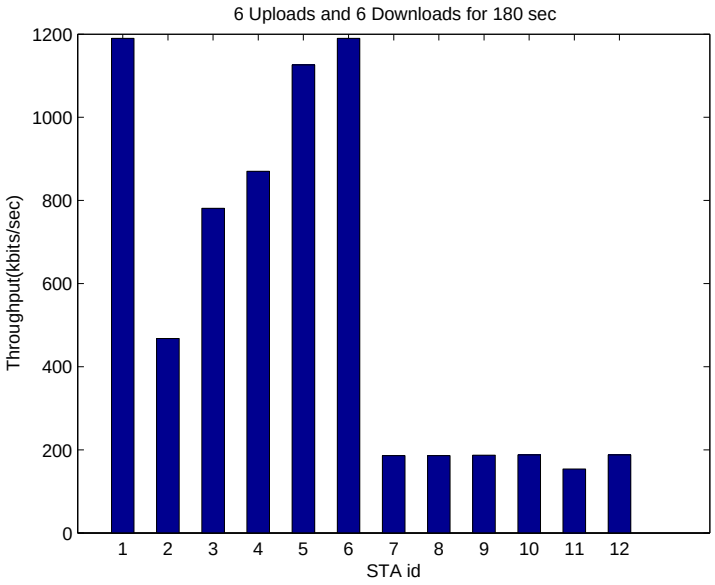




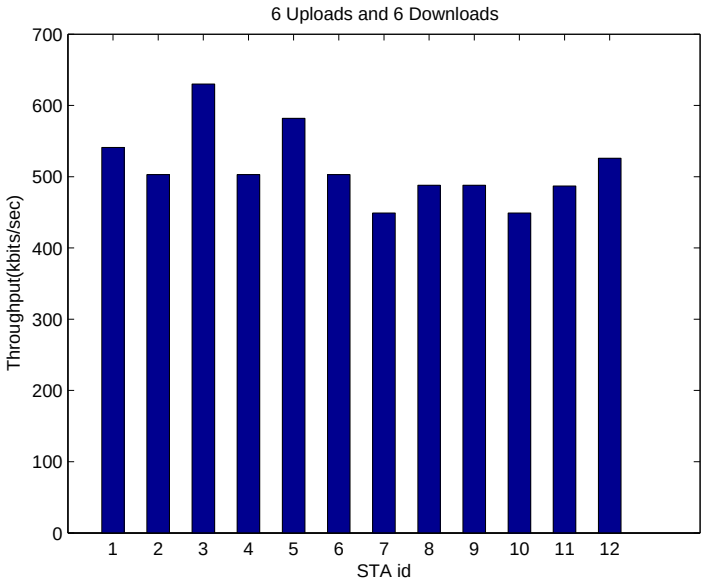
No timeouts even though RTT quite long.

Why Uploads?

12 uploads



fixed 12 uploads



Conclusions

- Didn't find spurious timeouts.
  (even after trying hard.)
- Need to check up/down and request/response.
- Buffer size interesting.
- ARP over busy WLAN busted.