Verification of Common 802.11 MAC Model Assumptions

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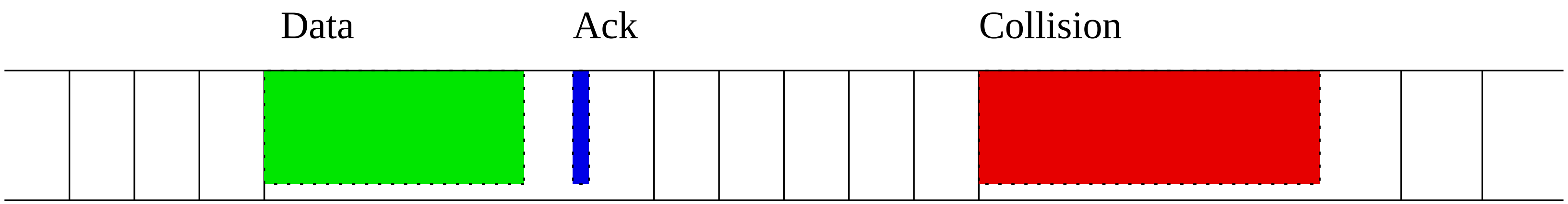
Motivation

- Lots of 802.11 modeling work.
- Modeling has been quite successful.
- However, models make simplifying assumptions.
- Theory to justify assumptions has proven hard.
- Can measurement help?

802.11 Summary

- After TX choose $\text{rand}(0, \text{CW} - 1)$.
- Wait until medium idle for DIFS($50\mu s$),
- While idle count down in slots ($20\mu s$).
- TX when counter gets to 0, ACK after SIFS ($10\mu s$).
- If ACK then $\text{CW} = \text{CW}_{\text{min}}$ else $\text{CW}* = 2$.

Assumptions

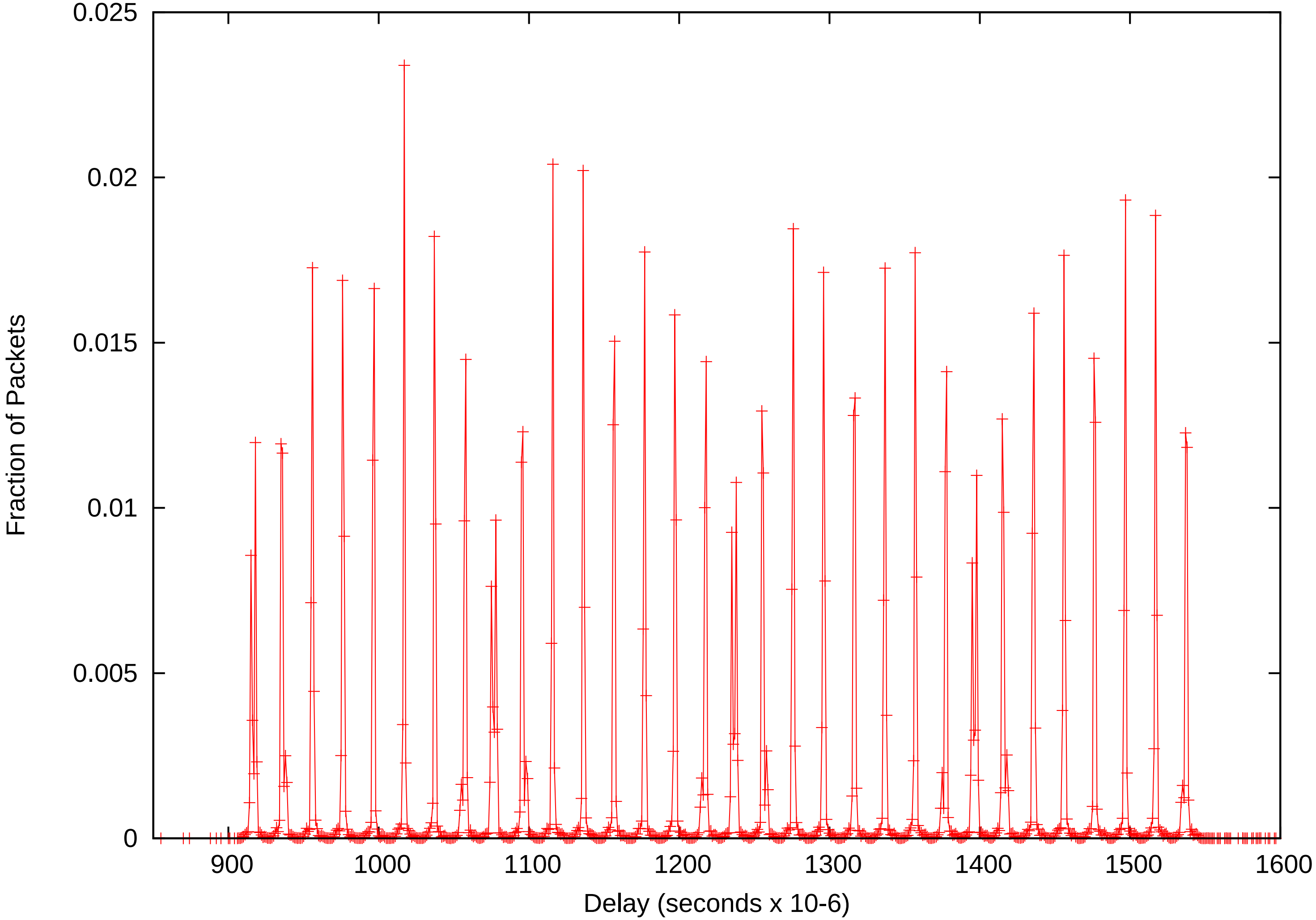


- Time is slotted.
- Stations transmit in a slot independently.
- Transmission/Collision probabilities fixed.
- $1 - p = (1 - \tau)^{n-1}$.
- $S = \frac{E_p n\tau(1-\tau)^{n-1}}{\sigma(1-\tau)^n + T_s n\tau(1-\tau)^{n-1} + (1-(1-\tau)^n - n\tau(1-\tau)^{n-1})T_c}$.

What Can We Test?

- We can measure delay, collisions and throughputs.
- Are cards close to 802.11?
- Is the timing good enough to slot time?
- Is collision probability really fixed?
- Does throughput formula work out?

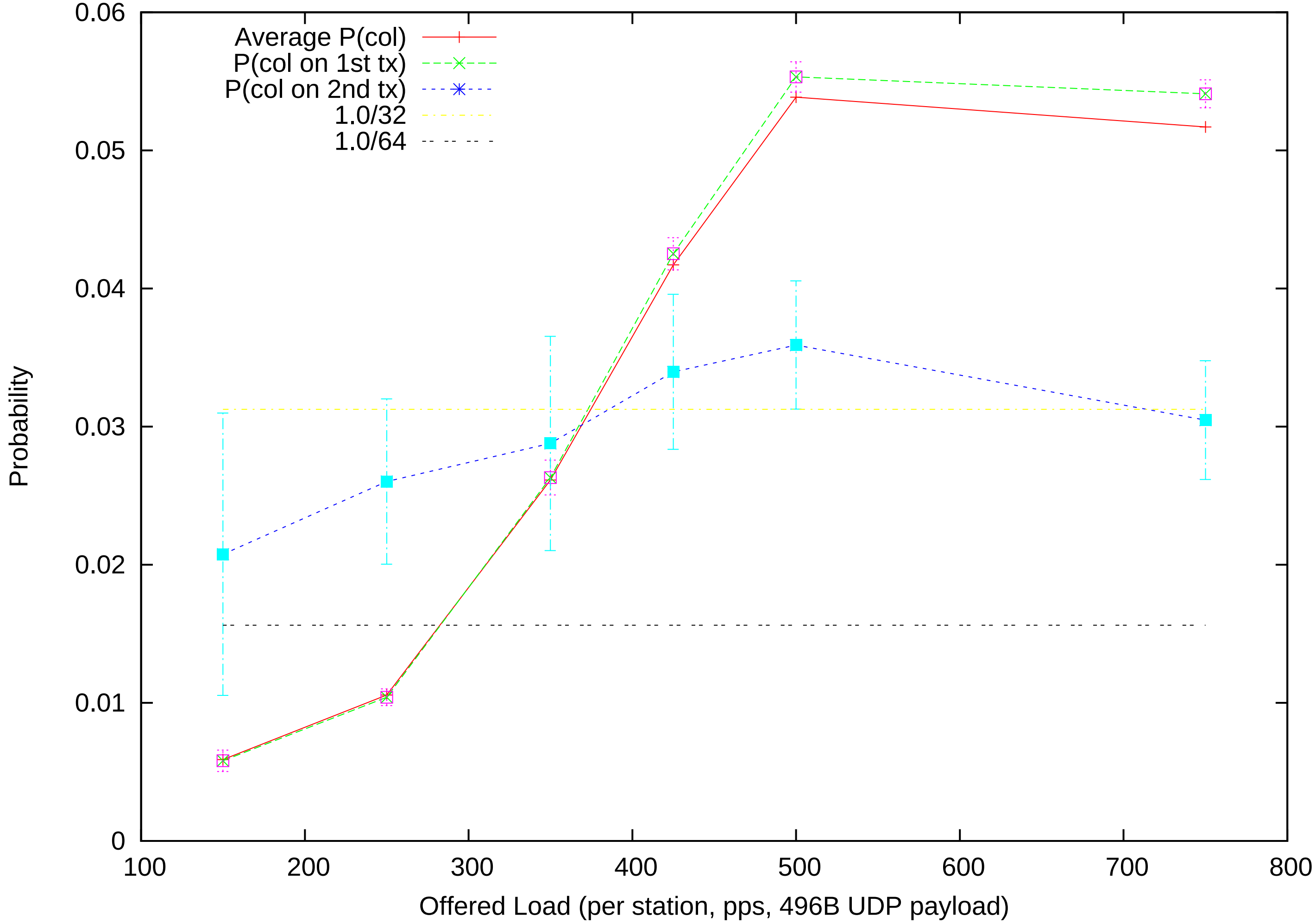
Card timing



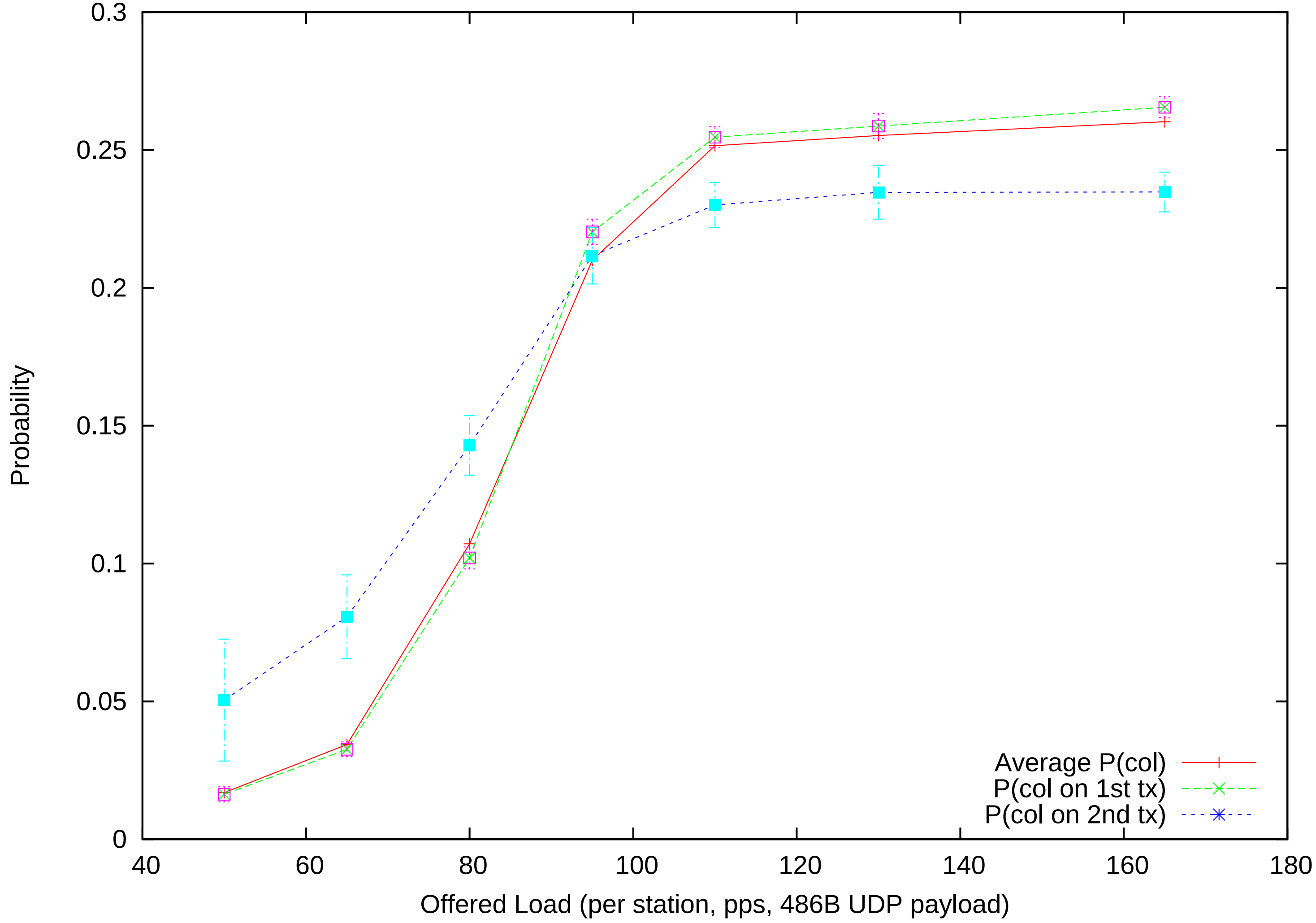
0.025
0.02
0.015
0.01
0.005
0
Fraction of Packets
900
1000
1100
1200
1300
1400
1500
1600
Delay (seconds x 10-6)

- 32 Uniform peaks, within jitter.
- Stefano, et al show not all cards so well behaved.
- Card trying to follow standard, timing plausible.
- Now look at collision probabilities.
- Use synthetic Poisson arrivals.
- Fixed number of stations.

Two Stations

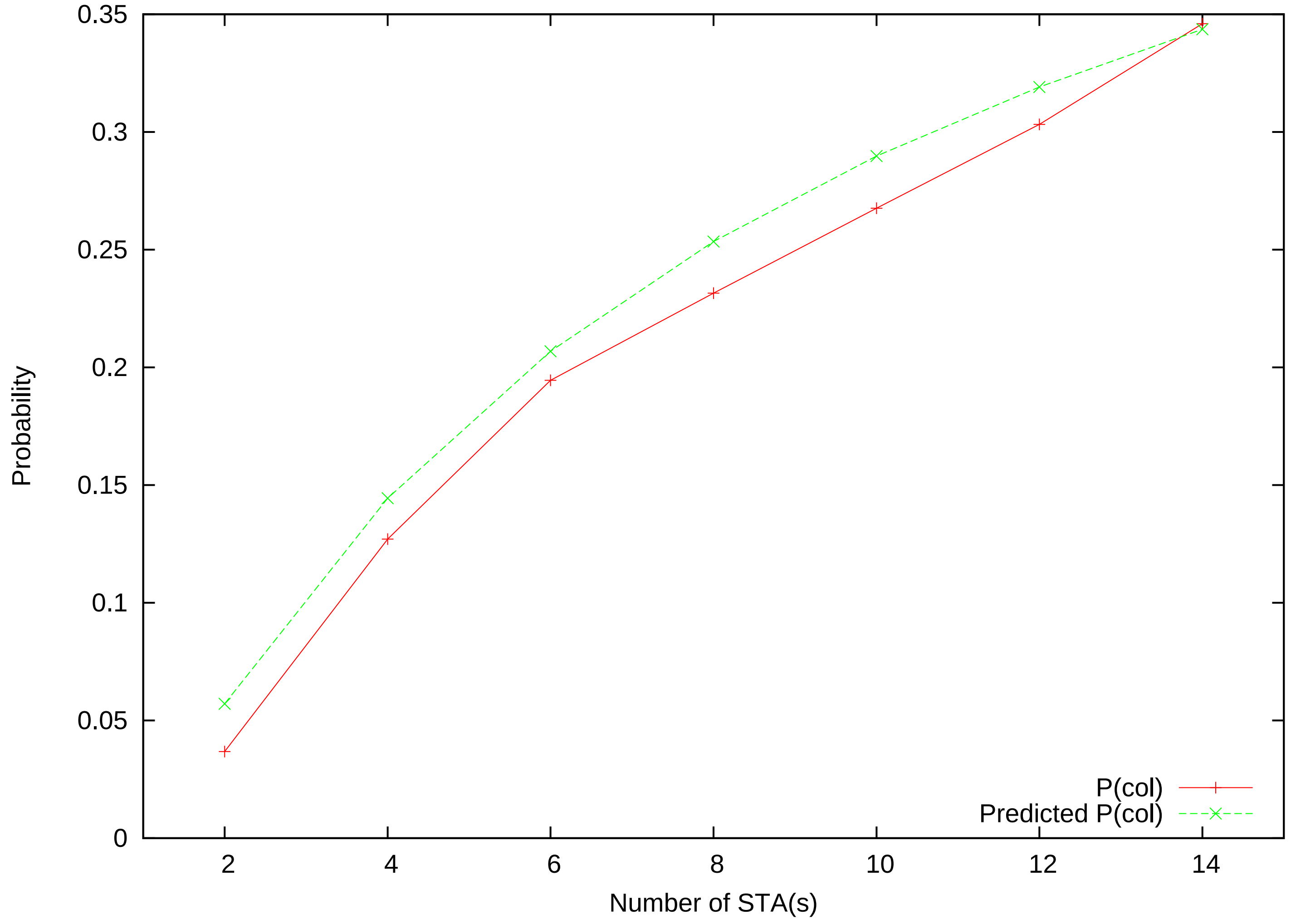


Ten Stations

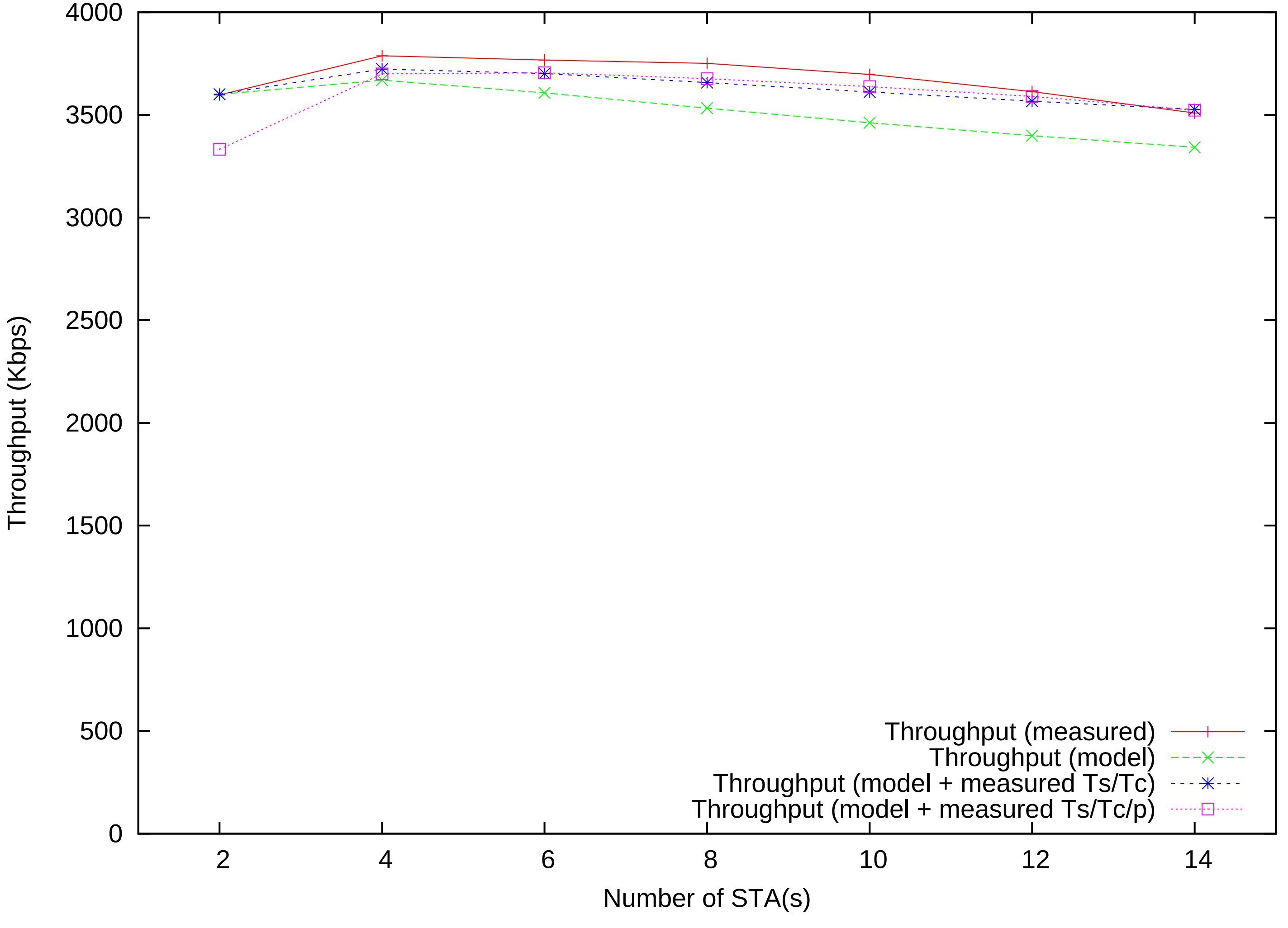


- Collision probability not constant.
- First stage dominates mean.
- Later stages closer for more stations.
- What about independence?
- Use transmit/collision/throughput relationship.
- Look at saturated traffic, vary stations.

Collisions vs Stations



Throughput vs Stations



Conclusion

- n small — assumptions don't hold.
- n large — assumptions closer.
- For small n maybe cancellation of errors.
- Can we now improve second order stats?
- Can we measure inter-station correlations?
- Can we get a better handle on slottedness?