Spin Bit Measurements

Testing The Robustness of the 1-bit Signal

Purpose of the Study

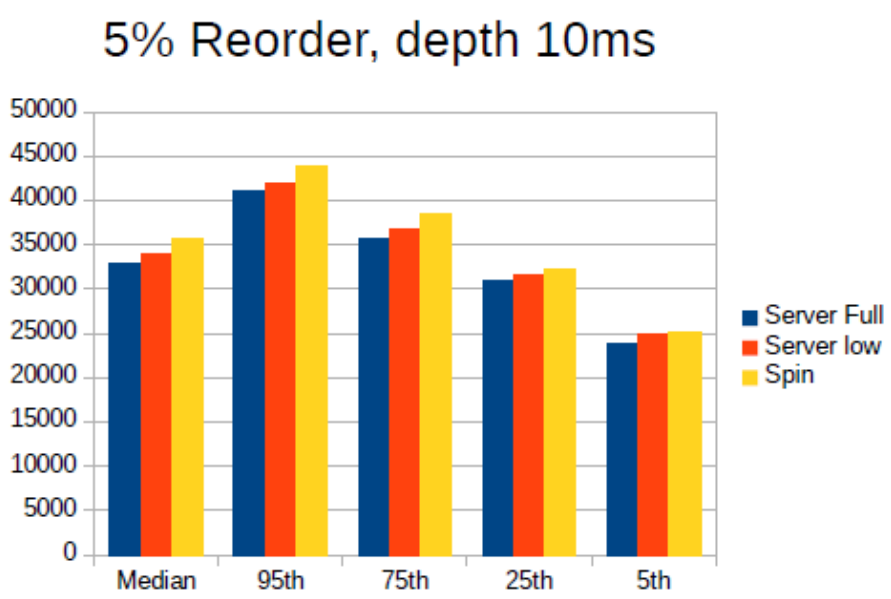
- Is the spin bit signal robust enough, so that it can be used as a reliable source of latency measurement?
  - Under what conditions does it break?
  - What can be done about it?

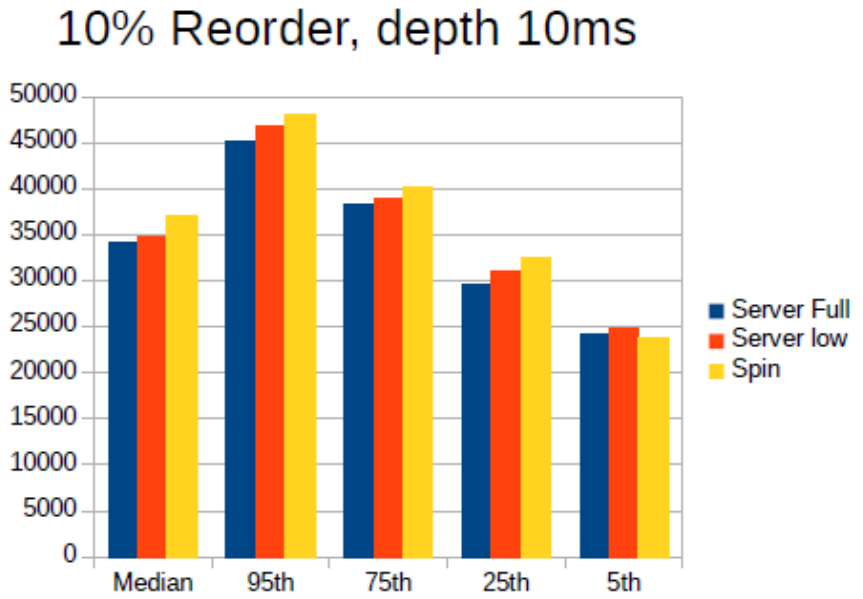
- Only focusing on single bit signal.

- Only focusing on latency (RTT) measurement.

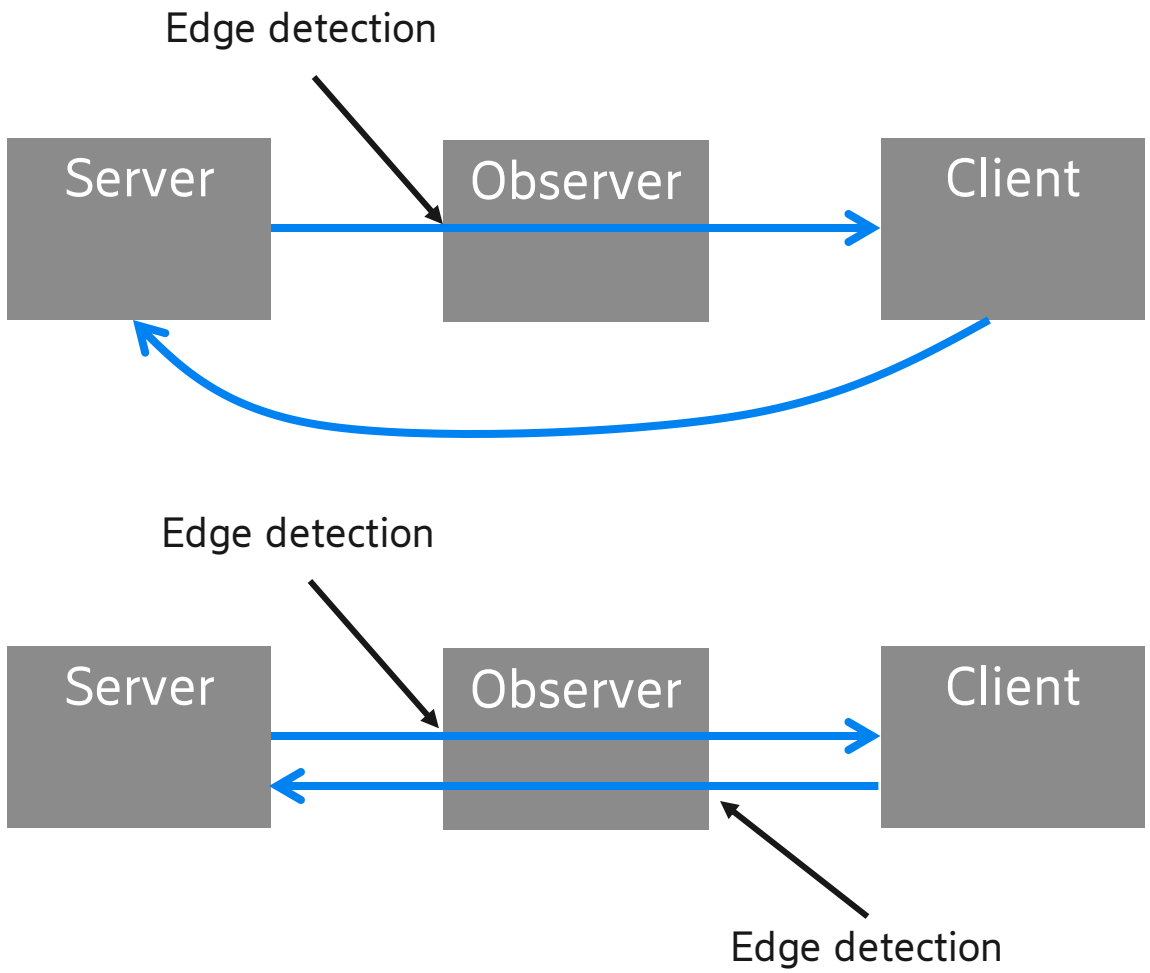
IETF 102 Recap

- Asymmetrical measurements of spin bit RTT.
- Use of simple heuristics to reject bad samples.
  - Count nr of packets between transitions.
  - Reject edge if packet count < 1/10 * previous packet count...
- Seems to work pretty well, but feels a bit hacky.



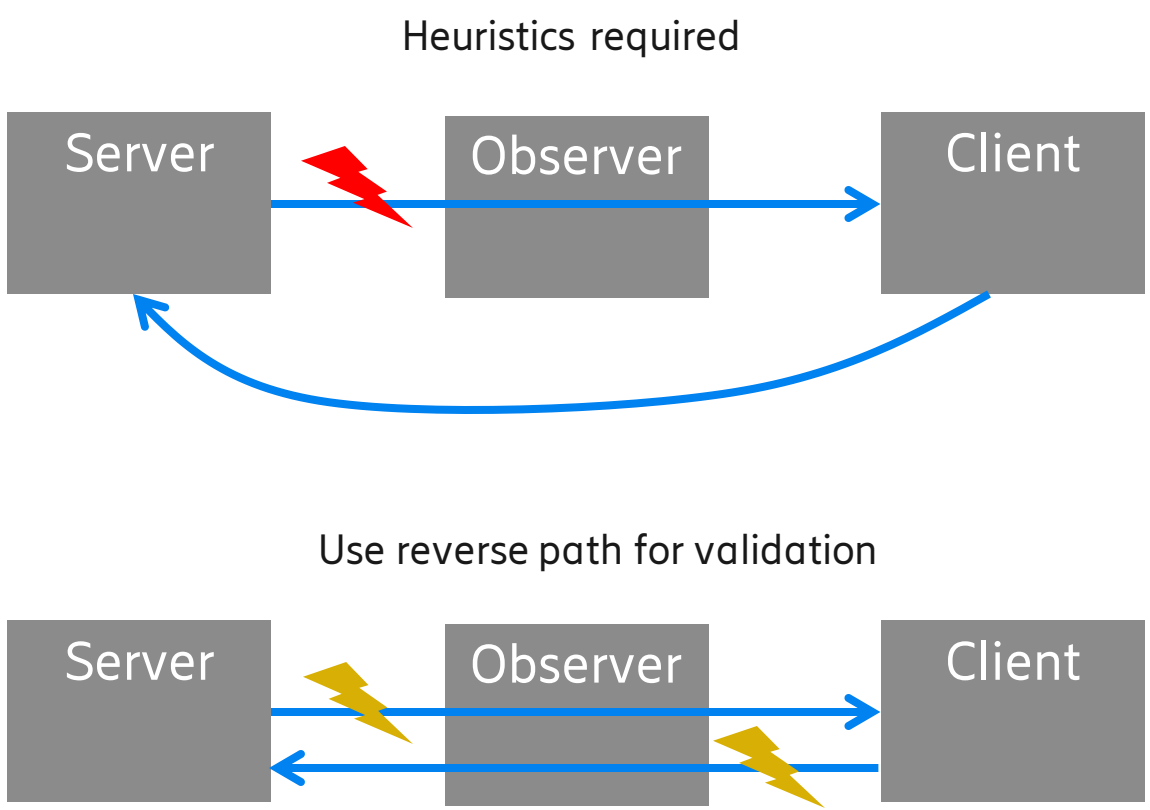


Asymmetrical vs Symmetrical Measurement



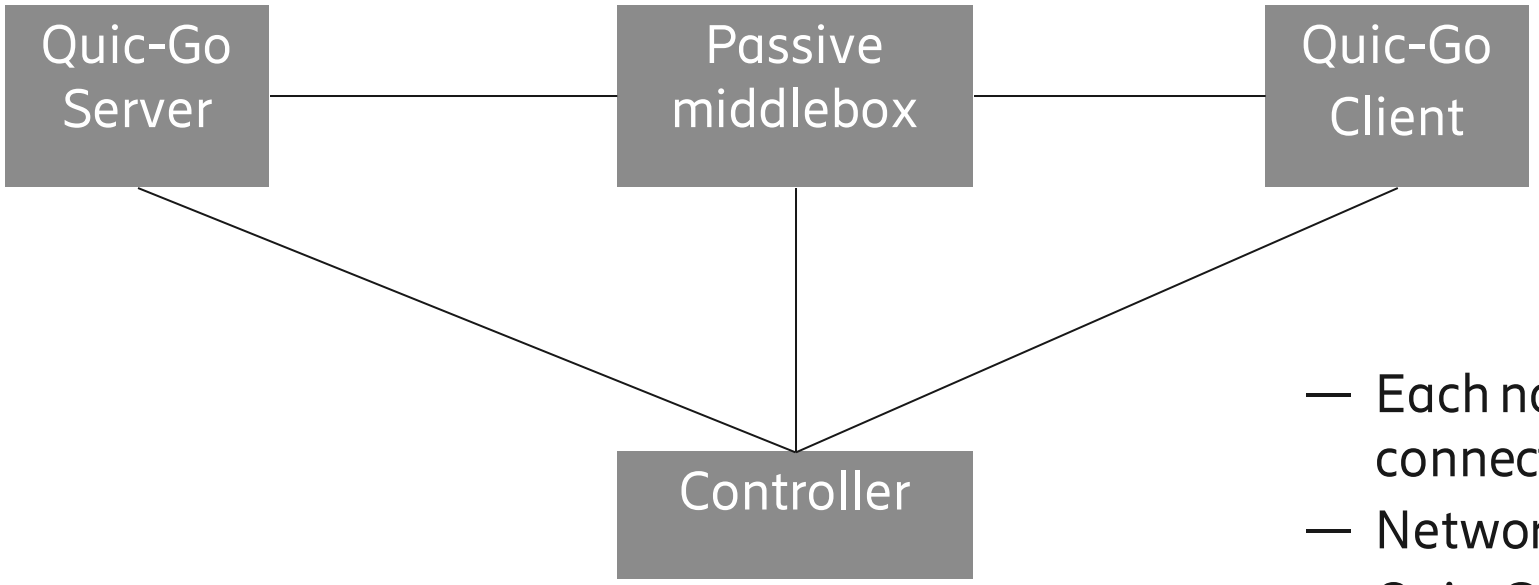
- For asymmetrical observation points edge transitions are visible in a single direction only.
- A symmetrical observation point allows for edge detection in both directions of the flow.

Asymmetrical vs Symmetrical Measurement



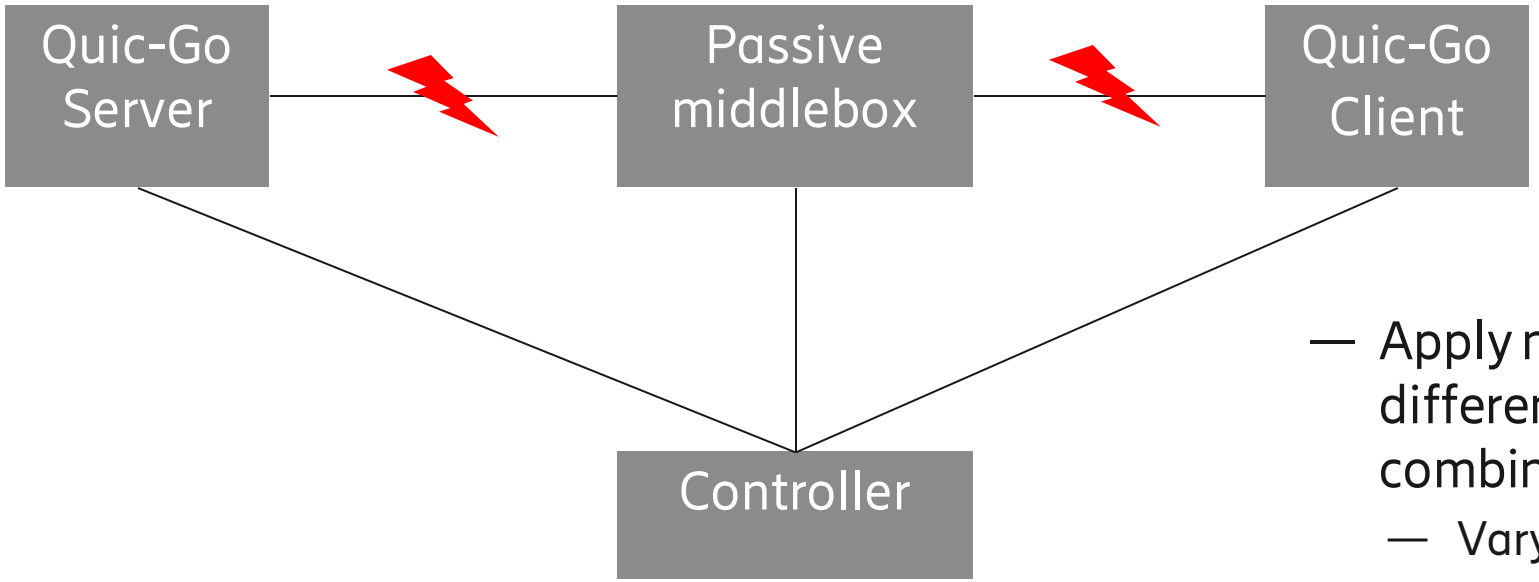
- For asymmetric measurements some form of heuristics is required when the signal gets scrambled (e.g due to packet reordering).
- A symmetrical observation point can use the reverse path signal to validate an edge transition.
  - Transitions reflect successful exchange of packets between endpoints.
  - An edge transition observed in one direction is only valid if it has been preceded by a transition in the reverse direction (or if it's the first observed transition).

Test System



- Each node runs on a Linux VM connected via emulated networks.
- Network conditions applied per egress.
- Quic-GO with added spinbit functionality and RTT logging.
- Middlebox perfoms measurements "on line".

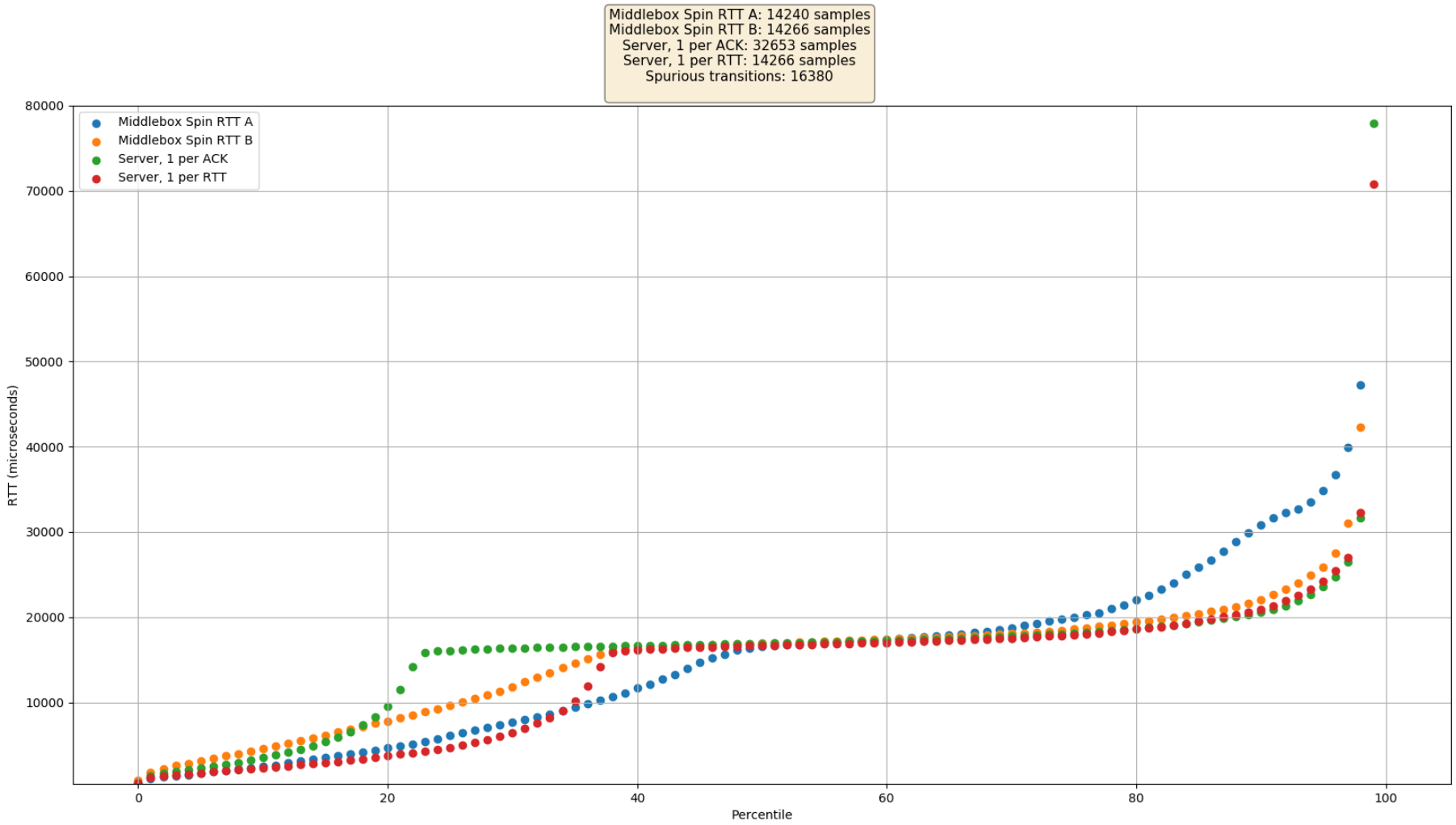
Tests



- Apply network impairment on the different links in isolation and combination.
  - Vary degree of reordering.
  - Vary degree of loss.
- Generate traffic for each combination and collect RTT data from server and middlebox.

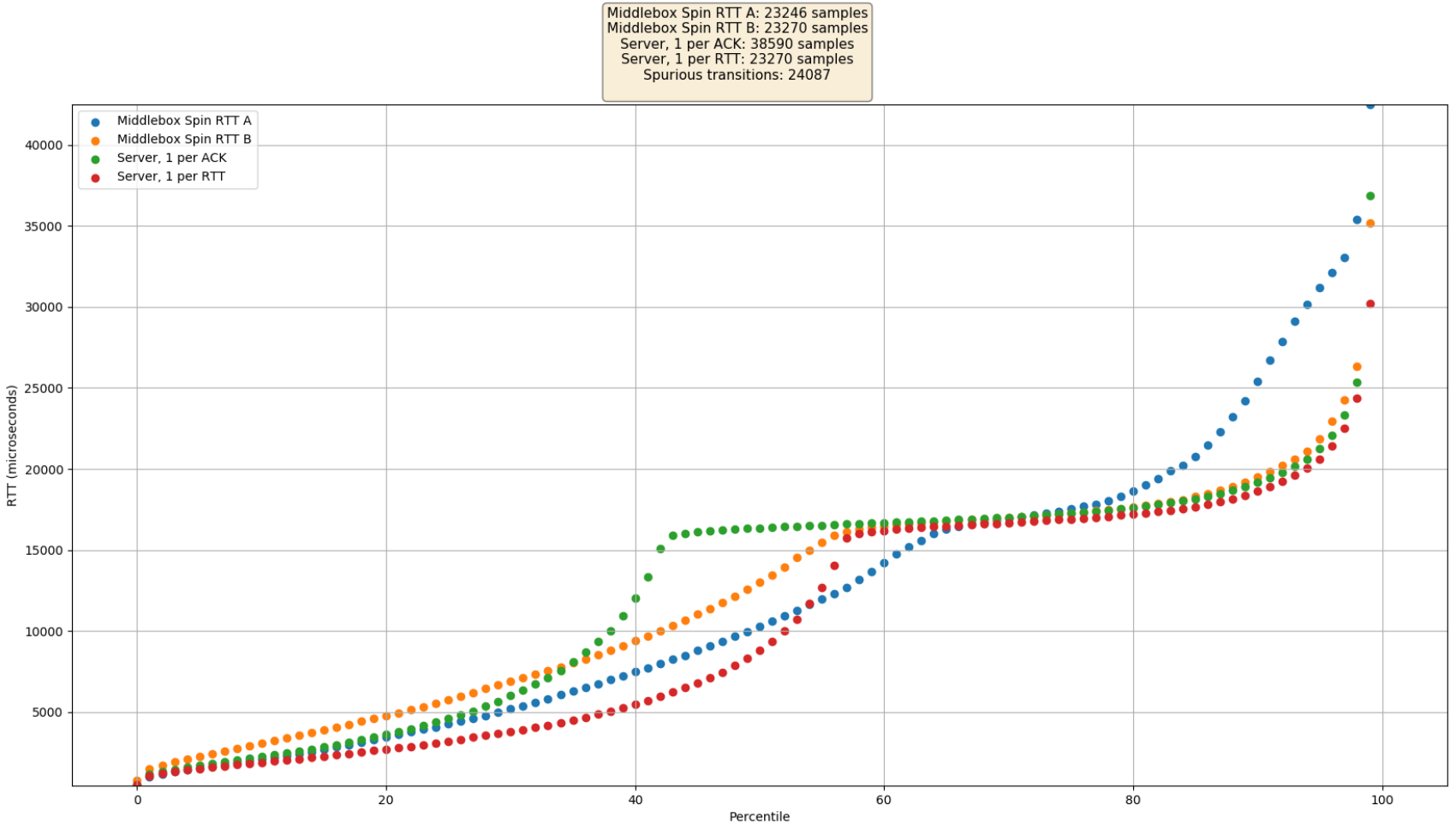
Example results

10% of server egress packets reordered, depth 15 ms.



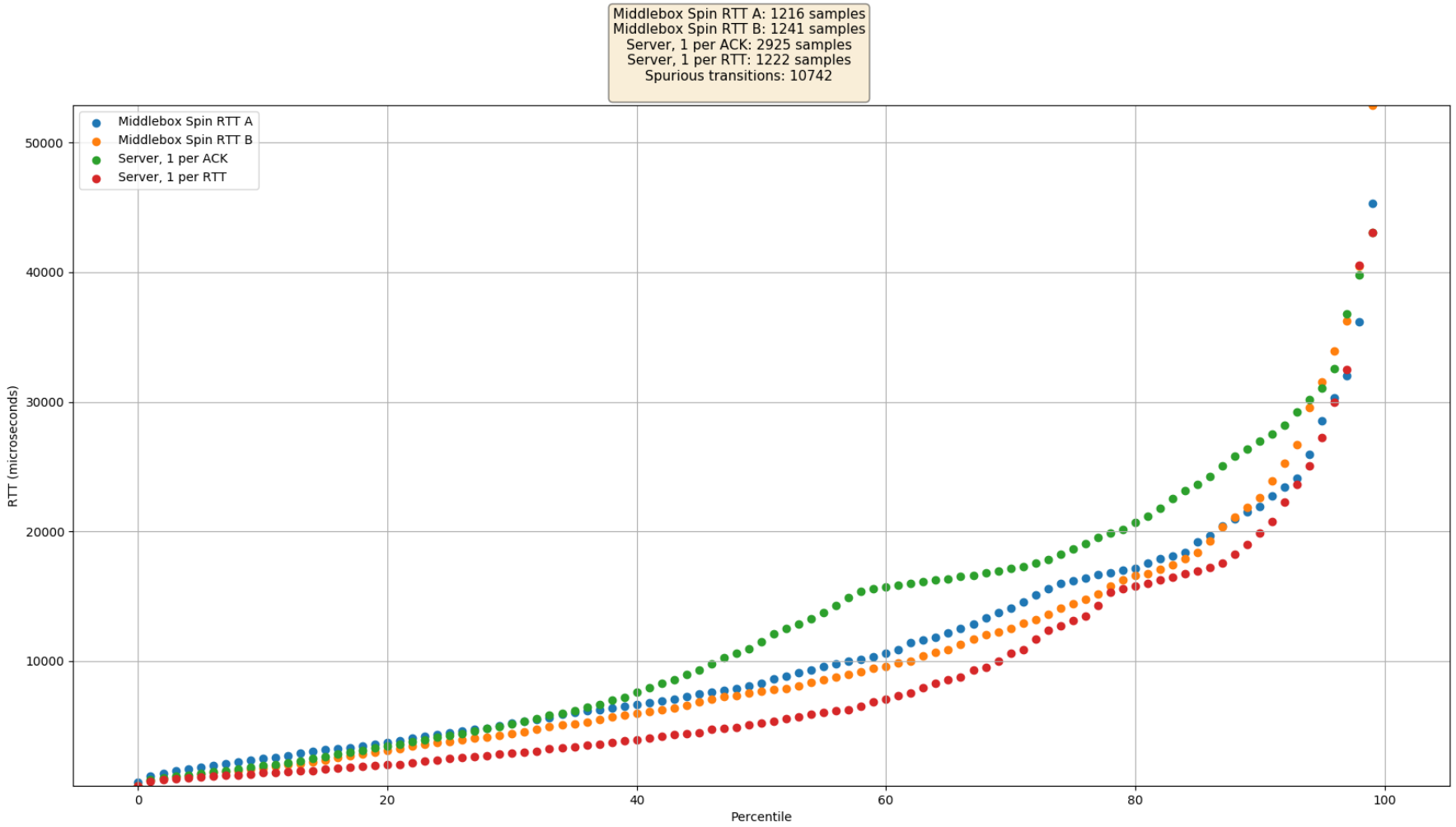
Example results

20% of server egress packets reordered, depth 15 ms.



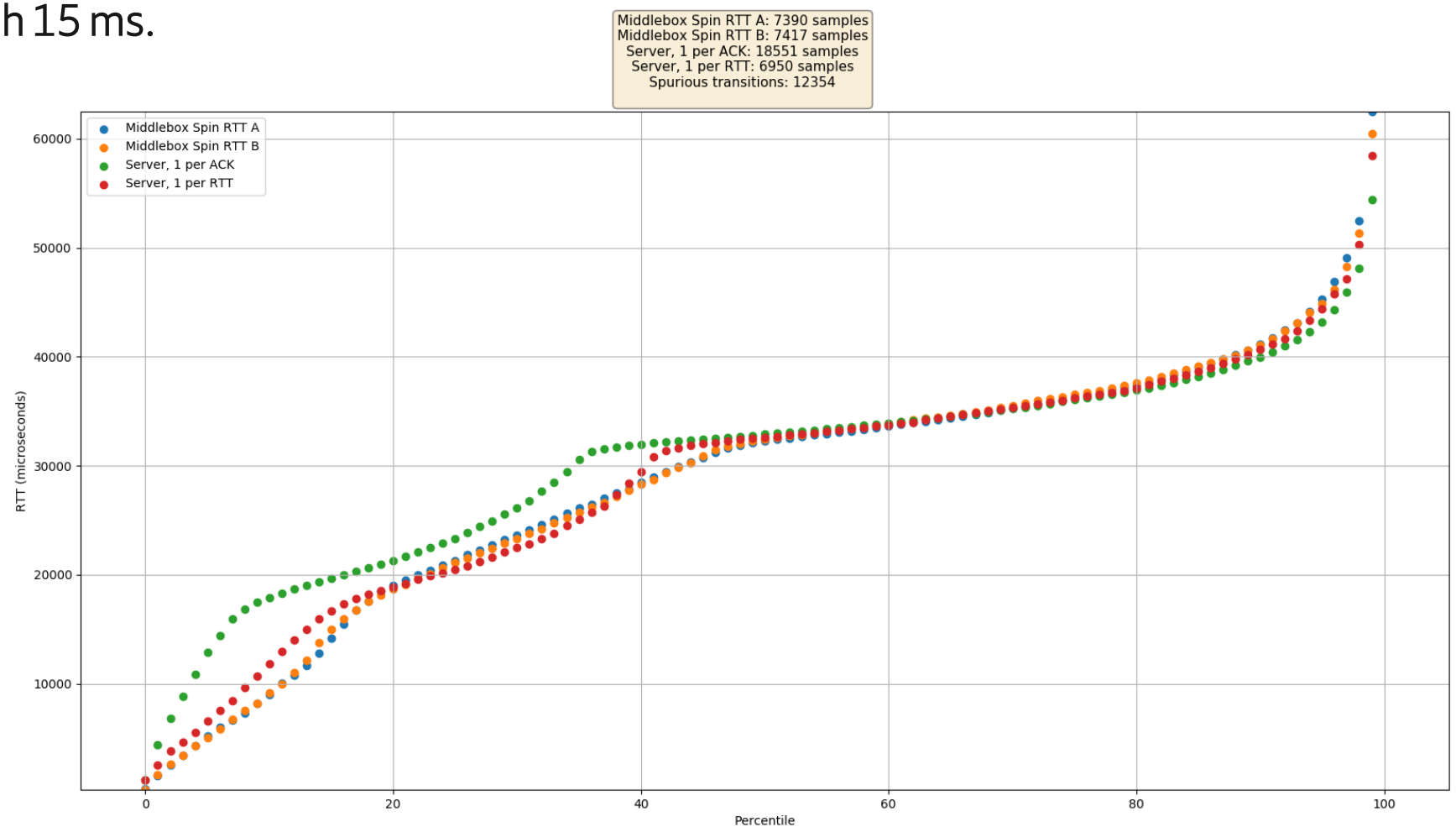
Example results

10% of client egress packets reordered, depth 15 ms.



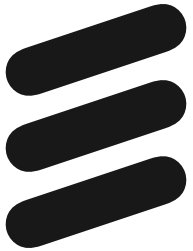
Example results

10% of server egress packets and 10% of client egress packets reordered, depth 15 ms.



Future work

- Improved network impairments
  - Randomized reordering depth
  - Realistic loss models
- Deploy middlebox in live network
  - Perform measurements over live LTE network



Some more results...

40% of server egress packets and 40% of client egress packets reordered, depth 15 ms.