

Limitations of Partial Timing Support

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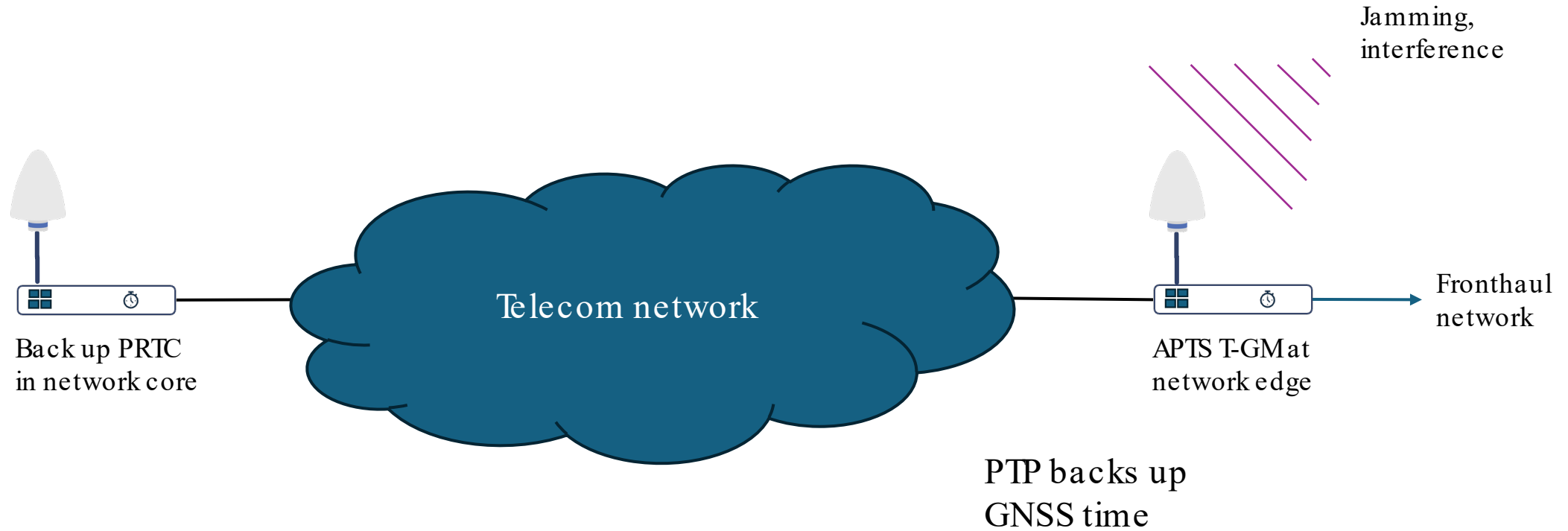
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Agenda

- Options for telecom network time distribution
- Disadvantages of Partial Timing Support
- Packet Delay Variation
- Path asymmetry
- Traffic Engineering
- When does PTS work
- What is needed for WAN timing without full support
- Summary

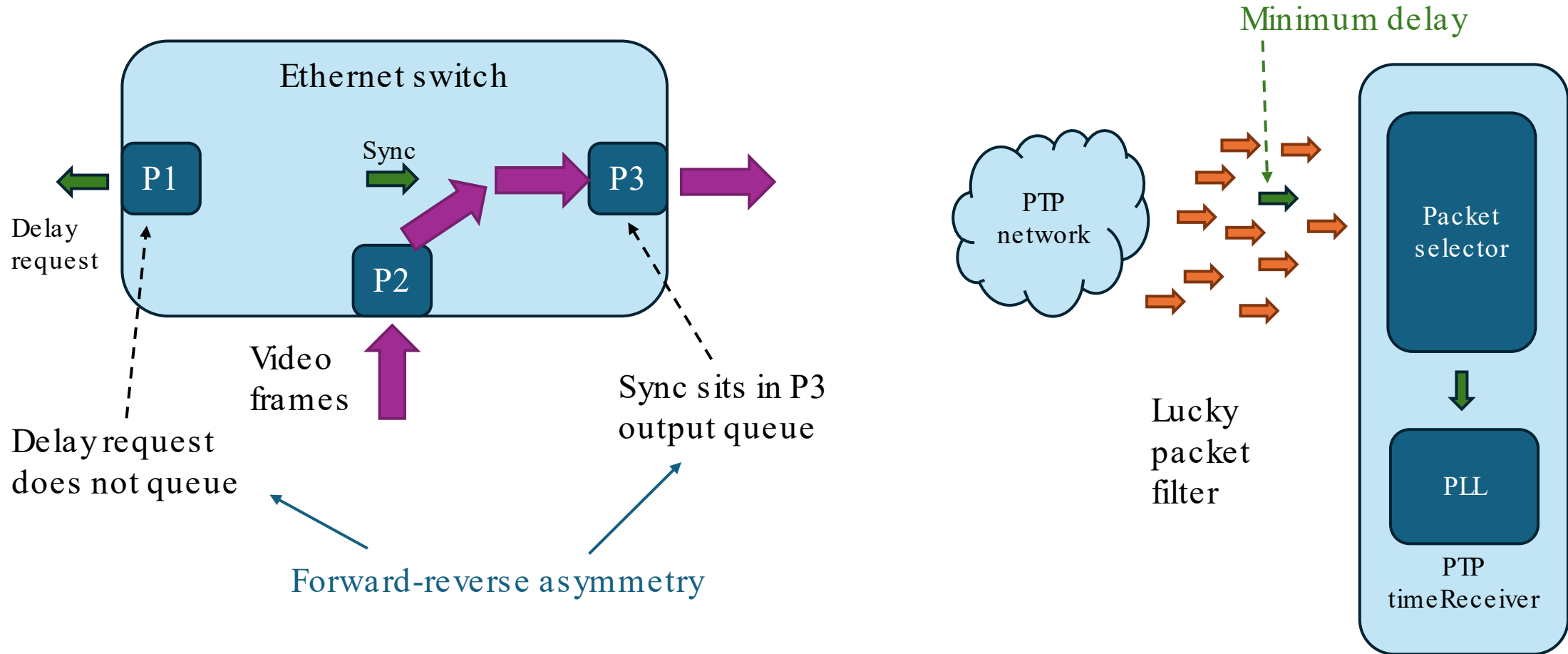
Telecom network time distribution



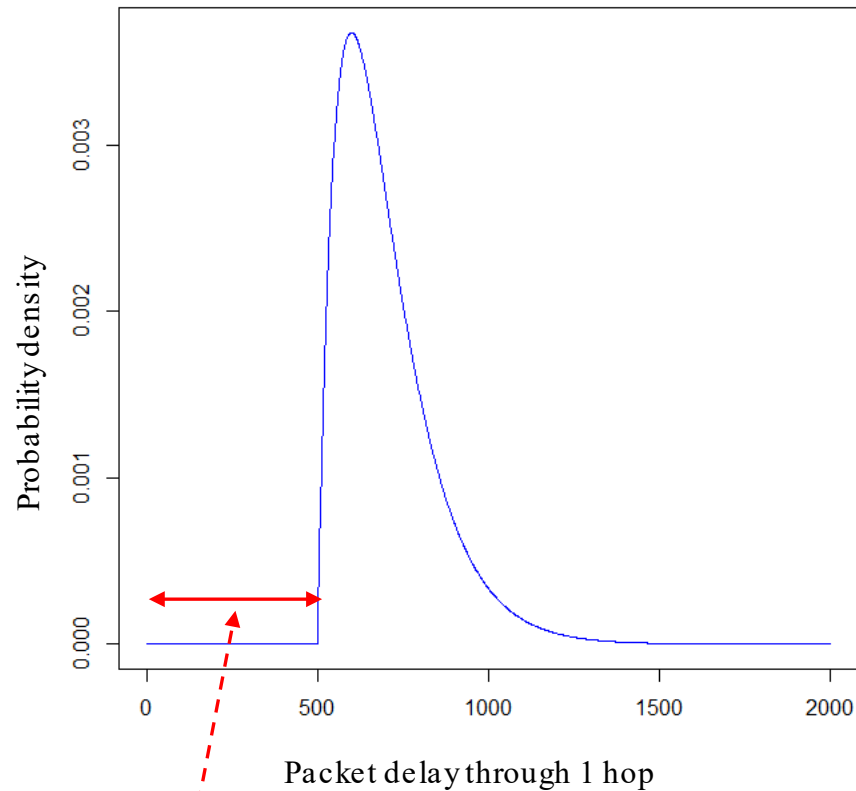
Options for time distribution

- Full timing support (FTS) – G.8275.1
 - Advantage
 - Time inaccuracy the network can be estimated from specifications of network nodes
 - Disadvantage
 - All switches and routers must support PTP
 - This is can be expensive and might not be an option
- Partial Timing Support (PTS) – G.8275.2
 - Advantage
 - Operates in a network with switches and routers that do not support PTP
 - Disadvantages
 - Time inaccuracy can not easily be estimated
 - Time inaccuracy might be too large for use case

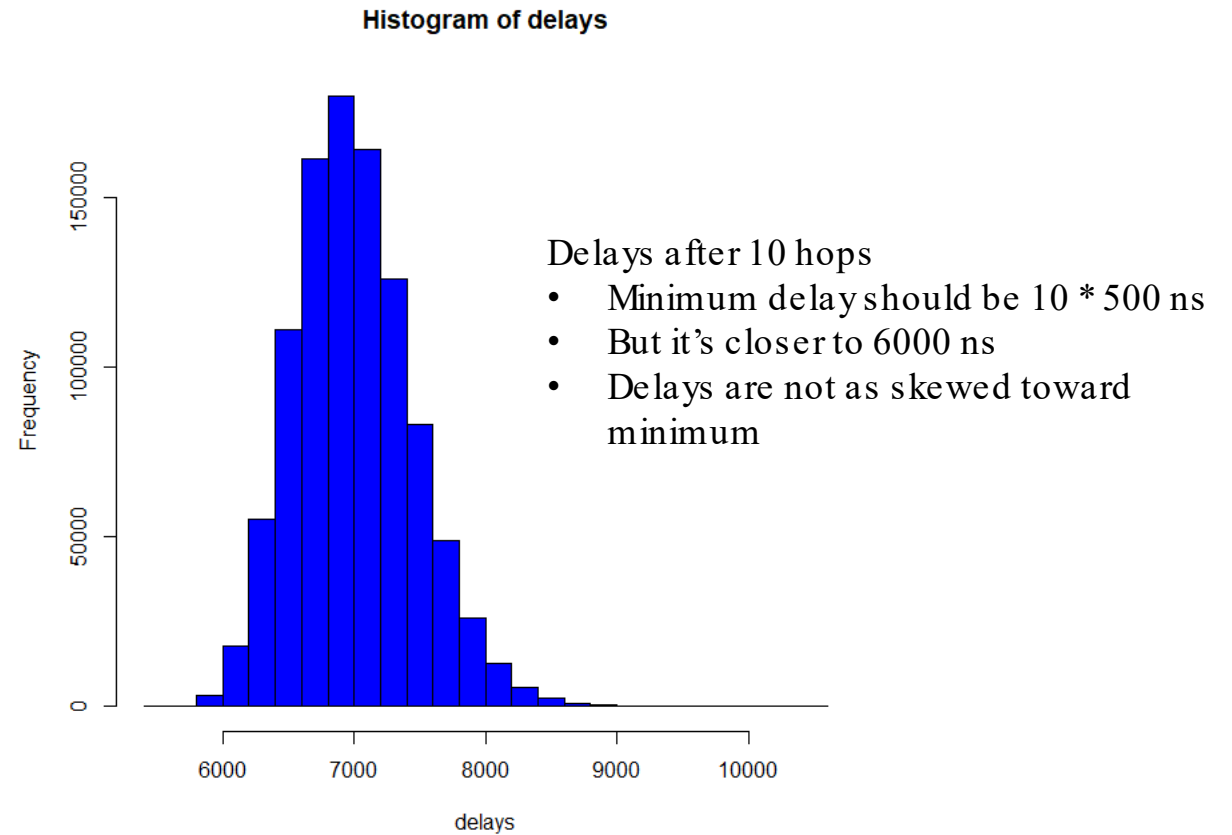
Packet Delay Variation (PDV)



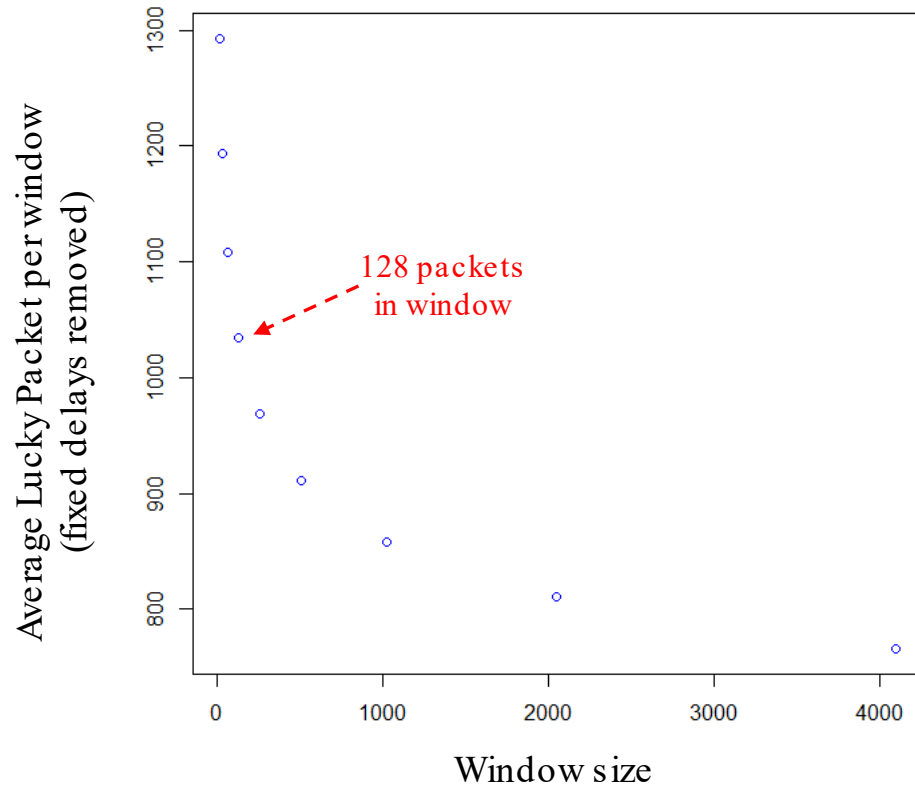
Packet Delay Distributions



Fixed delay due to network links and
minimum switch/router delay



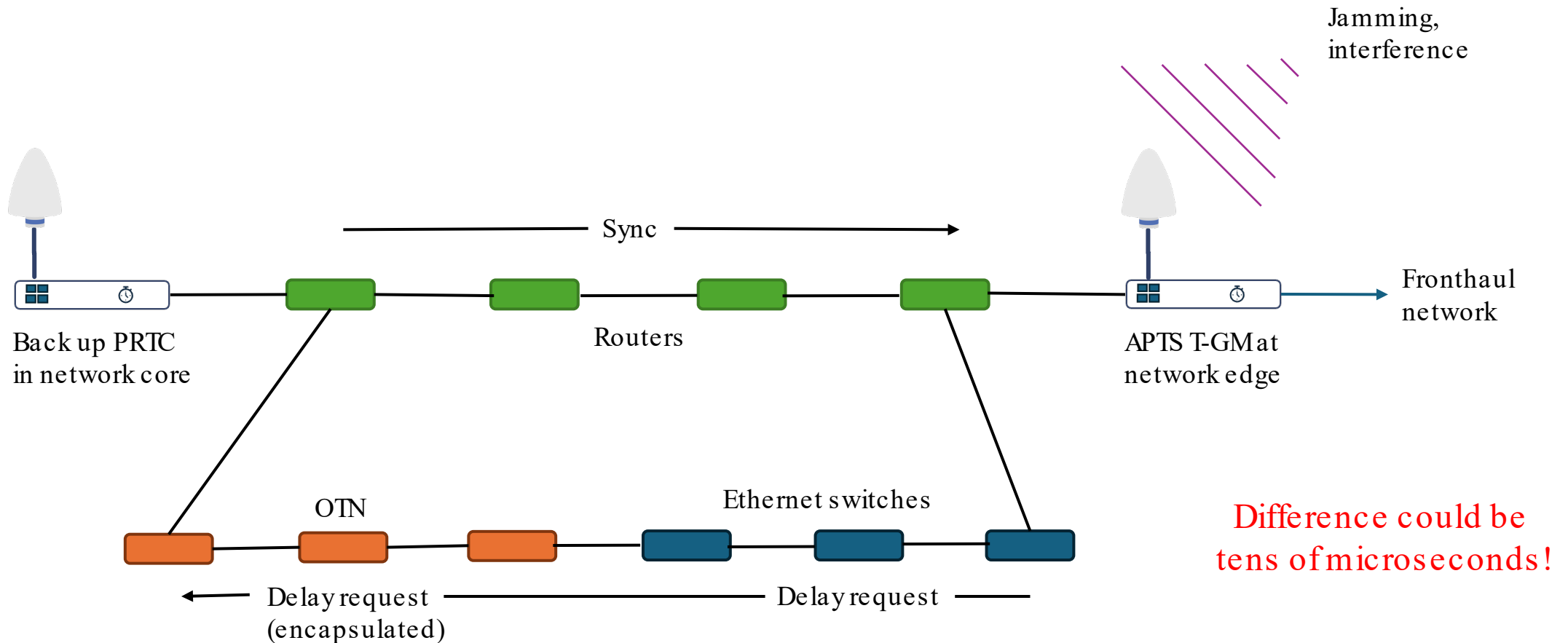
Lucky packet simulation results



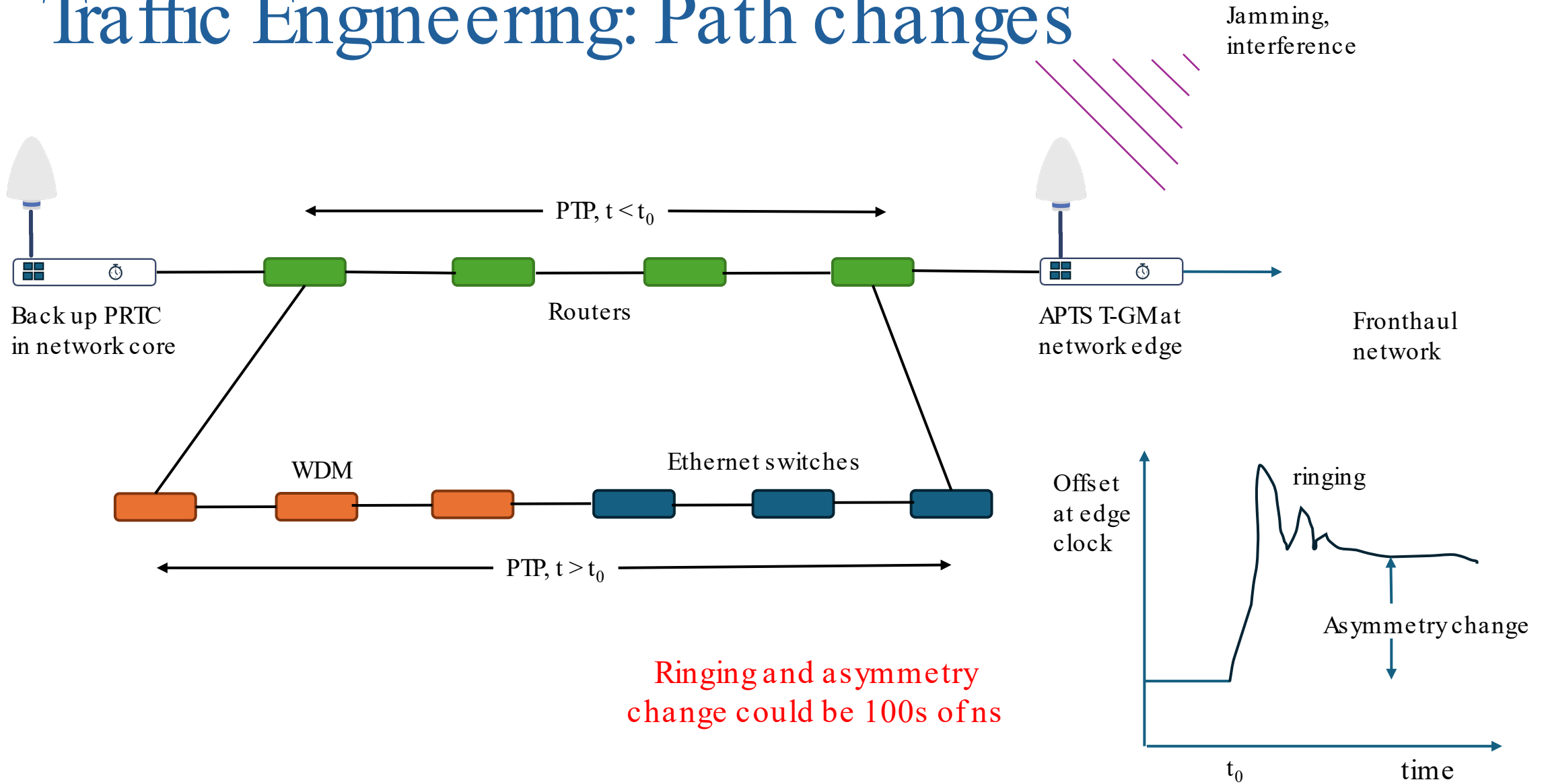
Observations:

- Scenario: 10 hops as per last slide
- No packets until about 700 ns
- Minimum delay is still going down as window increases
- Largest window result is about 250 ns less than the result for 128 packets (max per second in PTS Profile)
- timeReceiver clock error is the difference between the forward and reverse delays of selected lucky packets
 - This could be hundreds of ns!

Traffic Engineering: Path Asymmetry



Traffic Engineering: Path changes



When does G.8275.2 work ?

- Small networks
 - Few hops
 - Lightly loaded
- PTP messages traverse the same path in both directions
- No dynamic path changes
- Could work in small parts of a telecom network
- Will not work in a wide area telecom network

Requirements for a WAN time distribution technology

- Timing message rates $\gg 128$ messages/second
 - For more effective PDV filtering
- Path asymmetry correction
 - Not just cable asymmetry but includes number and type of nodes
- Calibrations and real-time corrections for path changes
 - Calibration process might need a real-time learning algorithm to support changes in the network over time

Summary

- Telecom networks need to operate in a world where GNSS availability is uncertain
- G.8275.2 does not meet telecom timing requirements for distribution of timing in a WAN
 - PDV too large for lucky packet filters
 - Path asymmetry
 - Dynamic path changes due to traffic engineering
- A new WAN time distribution technologies are needed to address these challenges

Thank you for your attention

If we don't get your question in the panel

Catch during one of the breaks

We love questions