mami

measurement and architecture for a middleboxed Internet

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FIRE Future Internet Research and Experimentation

Enhancing encrypted transport protocols with passive measurement capabilities

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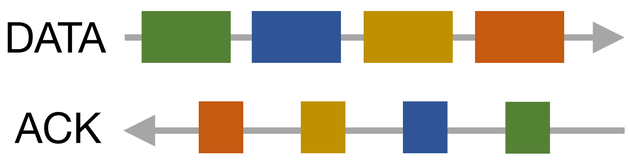
Transport Protocol Measurement Development

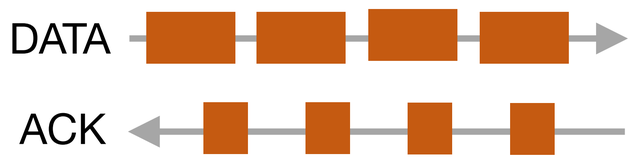
TCP/IP

Cleartext header fields. TCP or higher level information is (mis)used for measurements. No proprietary measurement capabilities.

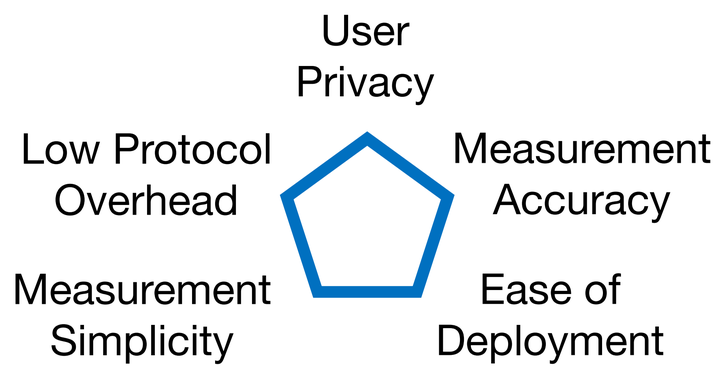


Encrypted (e.g. QUIC)

ACK frames and some header fields are **encrypted**. No packet matching is possible. E.g. RTT measurements are difficult for middleboxes.



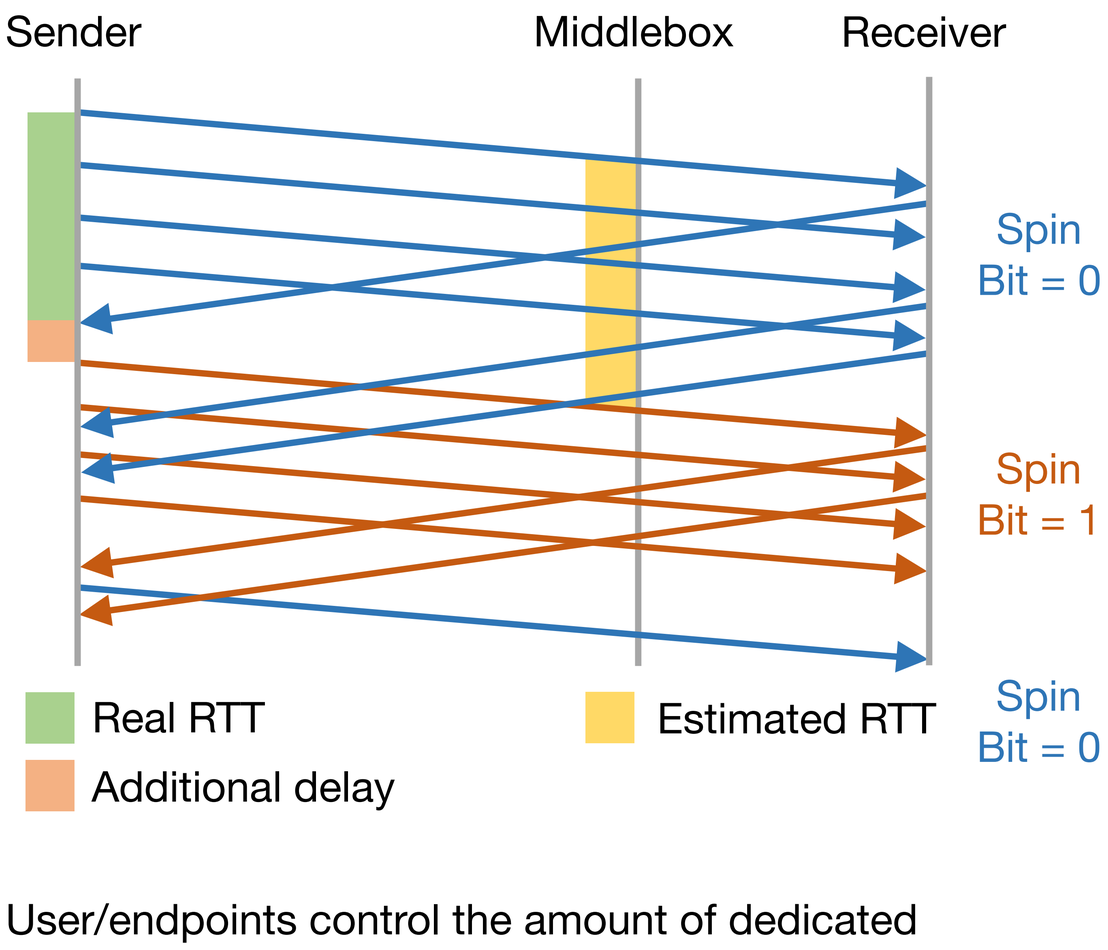
Conflicting Goals



Operators still need measurements.

Measurement Approaches

Protocol provides measurement-specific data:
Partially unencrypted wire image.
Packet matching is possible. Examples are:
Packet Number Echo, **Spin Bit**, additional flags



User/endpoints control the amount of dedicated measurement data and the time to expose this data.
An endpoint could expose data if:

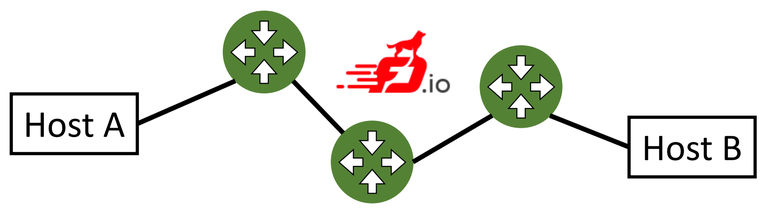
- problems are detected (e.g. losses or high delay);
- the user privacy is not influenced.

Track encrypted traffic:
Use the observed encrypted packets/payloads to estimate e.g. RTT or packet loss. Possible techniques:

- Use ML to learn traffic patterns which can be used for measurements;
- Infer measurements from coexisting TCP flows.

Implementation

Middlebox implementation: Using the **Fast Data Project (FD.io)**: Fast data processing on generic hardware (in user space/C). Realistic performance.



Endpoint implementation: Tests with an early QUIC implementation in **Go** and custom changes for e.g. packet number echo tests. Comparison with results based on TCP/IP flows.

measurement | architecture | experimentation

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