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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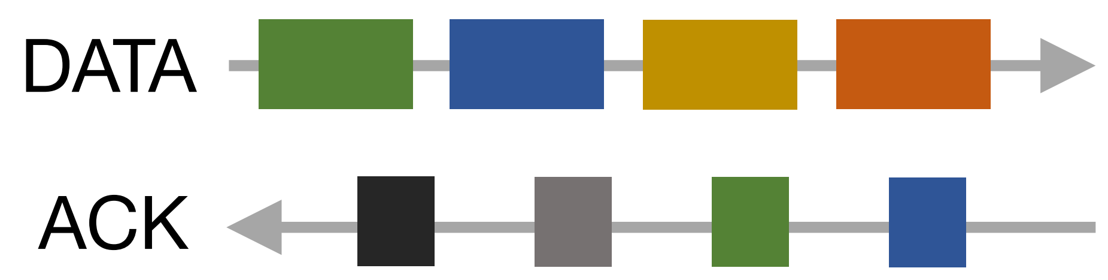
Transport Protocol Measurement Development

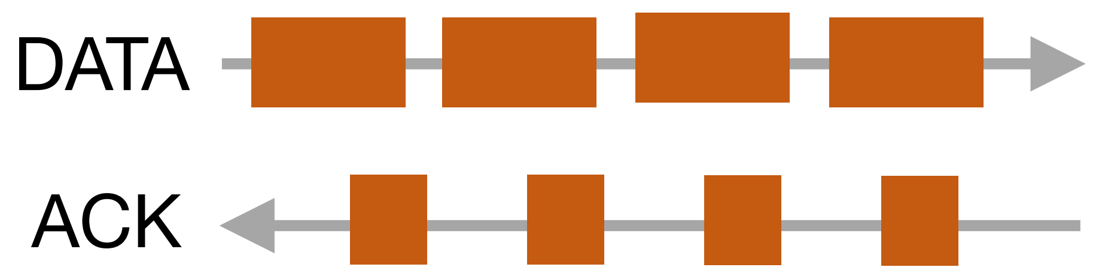
TCP/IP

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

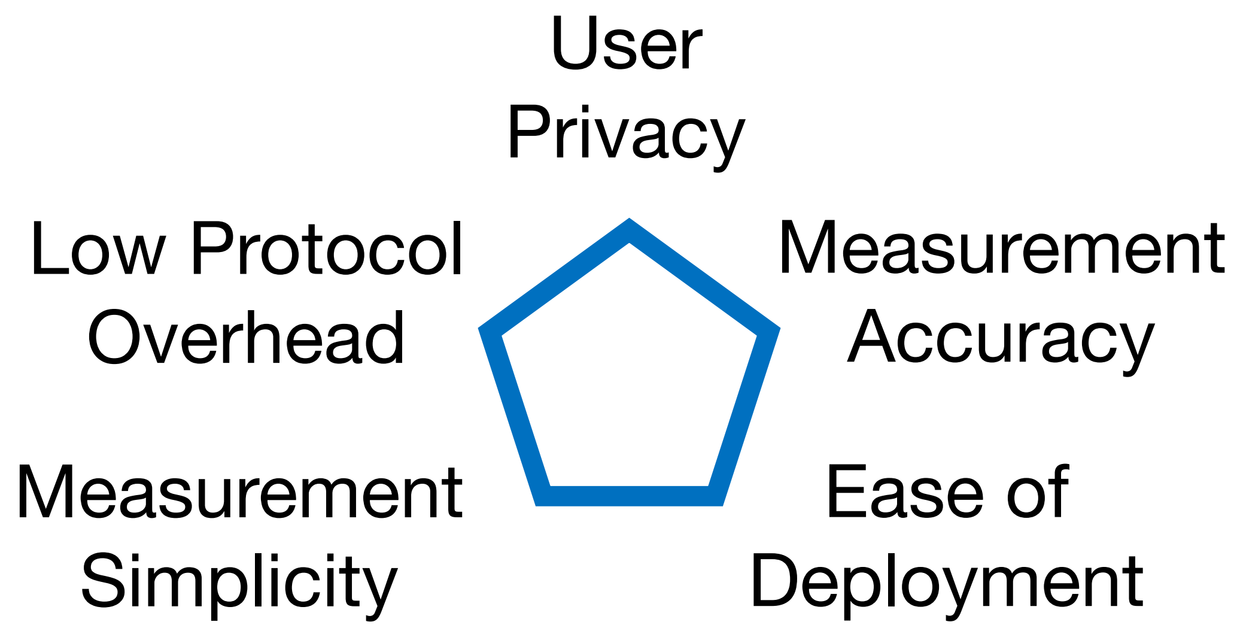


Encrypted (e.g. QUIC)

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



Conflicting Goals



User Privacy

Low Protocol Overhead

Measurement Accuracy

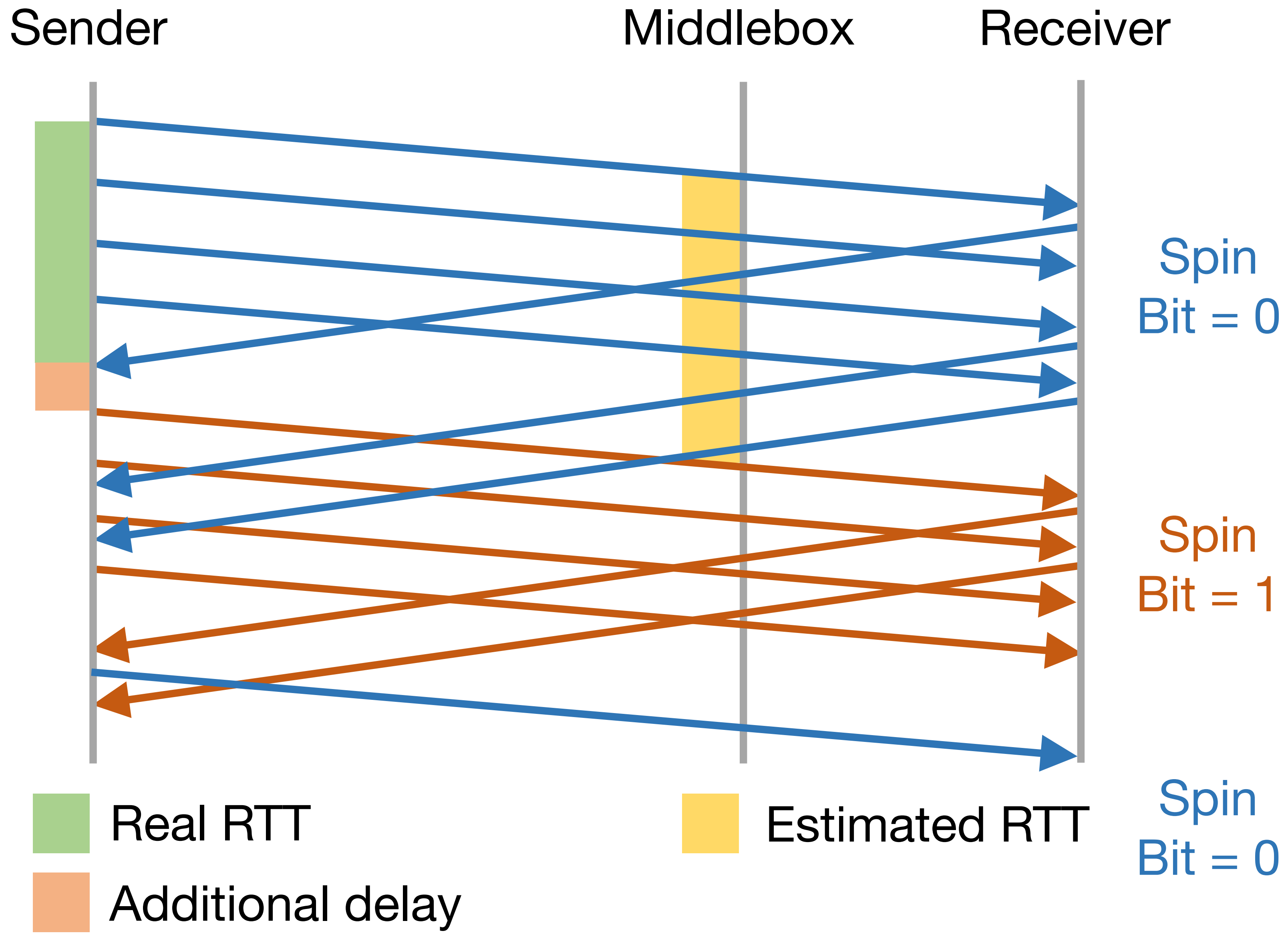
Measurement Simplicity

Ease of Deployment

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:

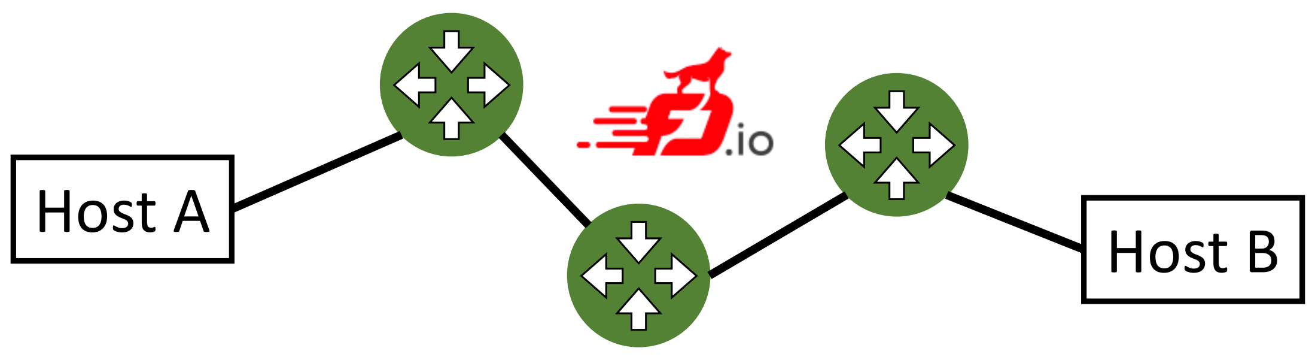
- problems are detected (e.g. losses or high delay);
- the user privacy is not influenced.

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

- Use ML to learn traffic patters 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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