Empirically Testing the PacketLab Model

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SUMMARY

- **PacketLab**: a network measurement endpoint interface design to overcome the barrier of vantage point (VP) sharing.

- **Takeaway A**: native-implementation-level accurate results (< 7% difference) can be obtained through PacketLab for canonical measurements.

- **Takeaway B**: over 77% of distributed or location-extensible active measurement experiments in past measurement studies can be supported through PacketLab.

INTRODUCTION

- PacketLab VPs are similar to **VPN servers** (Fig 1) with **send scheduling** and **event** (e.g. data reception) **timestamp support**.

- **Motivation**: communication model restrictions on measurement methods merit analysis on the **applicability of the PacketLab model toward popular measurements**.
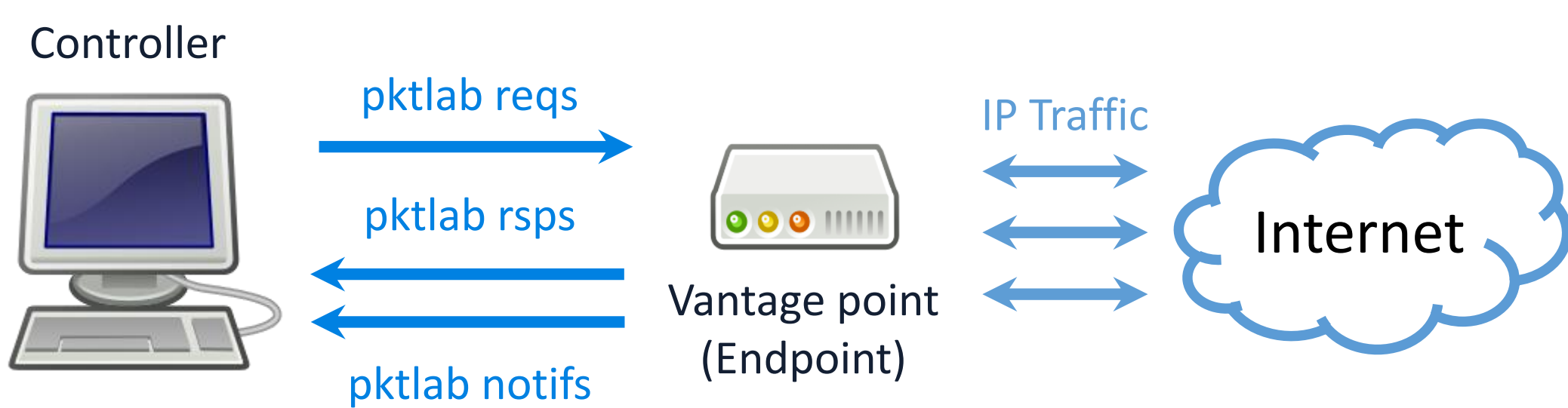

Figure 1: Illustration of the PacketLab communication model

STUDY OUTLINE

- **Empirical analysis**: past measurement study survey + experiment evaluation of canonical measurement methods.

- **Further feasibility assessment**: additional PacketLab communication model feasibility assessment based on examination of measurement methods.

MEASUREMENT STUDY SURVEY

- 171 measurement studies in IMC/SIGCOMM '20 − 22.

- Select **36** studies with **distributed or location-extensible active measurement experiments**.

- Metric-wise method categories: **latency**, **throughput**, **network path**, and **non-timing data**.

- Two measurement methods: **traceroute** and **TCP pipe filling** covering latency, network path, and throughput categories as canonical measurements.

INTERESTED? TRY IT OUT!

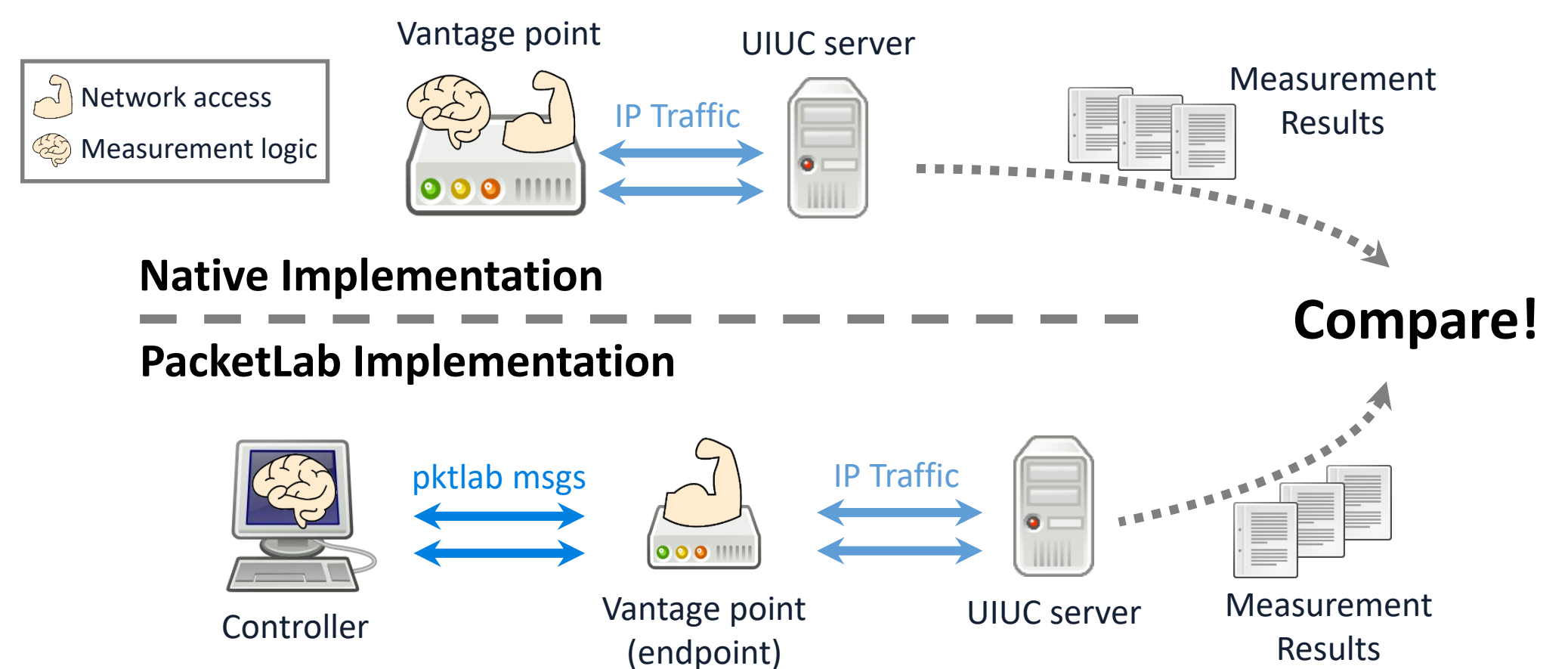See our website @ pktlab.github.io, for more instructions.

Figure 2: Illustration of the experiment evaluation process

EXPERIMENT EVALUATION

- **Core idea**: per method, compare PacketLab and native implementations (impl.) results to see if they are similar. **Similar results => proof on PacketLab ability to produce native-impl-level results.**

- **Experiment Setup**: Geo-distributed VPs run measurements against UIUC server running TCP bandwidth server and responsive to traceroute. Native impl. directly run on VPs, while PacketLab impl. use endpoint on VPs to conduct measurement (Fig 2).

- **Findings: similar results** (average throughput and latency; total unique hop addresses) **across impl. with < 7% difference** (Fig 3).
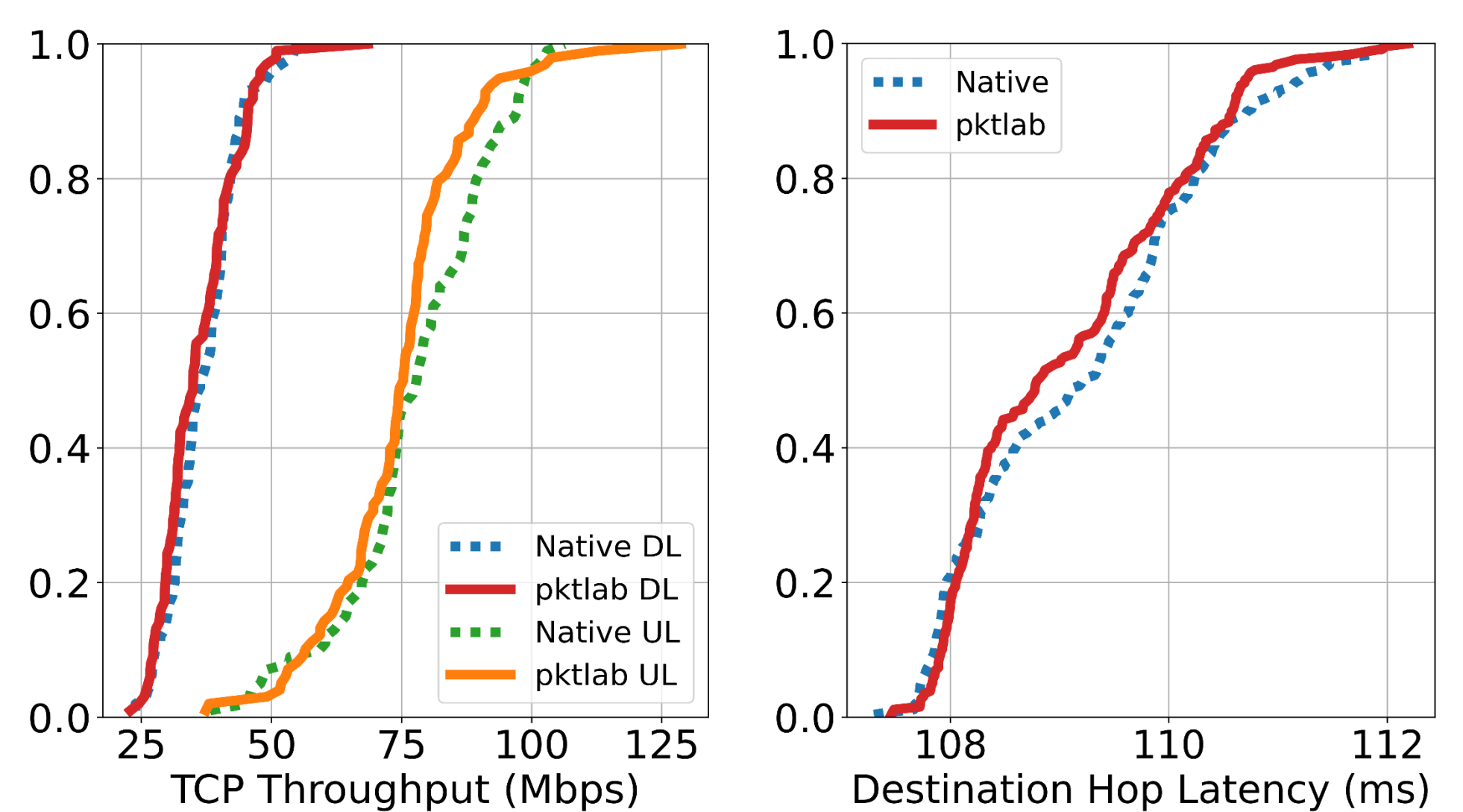

Figure 3: Experiment evaluation result CDFs for AWS Frankfurt

PKTLAB MODEL FEASIBILITY ASSESSMENT

- Further examined methods used in the 36 selected studies to understand the applicability of PacketLab.

- **Findings: relevant experiments for most examined studies (28/36, 77.8%) can be implemented in PacketLab**, of which 18 are strictly of the non-timing-data measurement type.

- **Main case of infeasibility**: method also measured **VP computation capability**, e.g. methods collect metrics like browser page load time.