

SIGCOMM 17 Preview Session: Network Monitoring

Ying Zhang

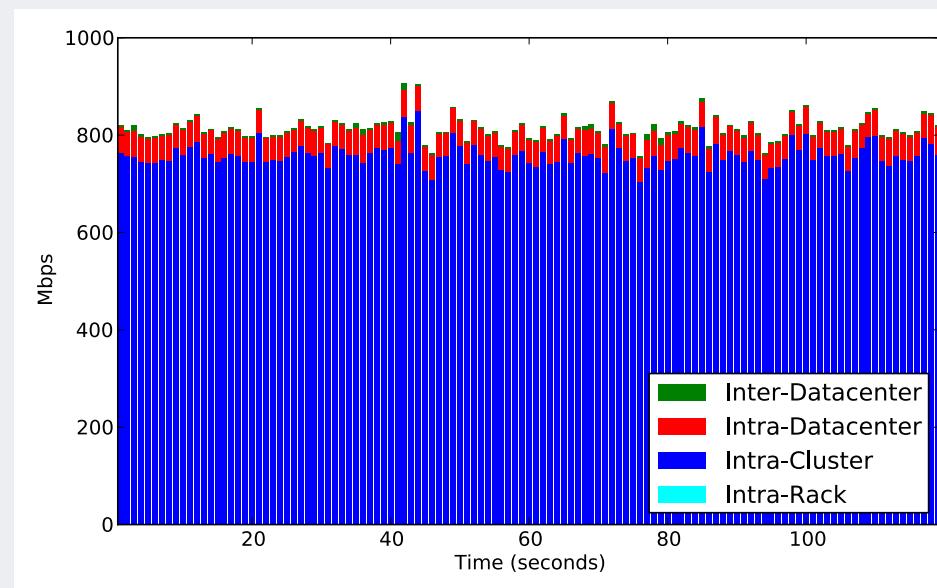
Software Engineer, Facebook

Network monitoring is important!



Performance

Diagnose long delay/loss problems



Utilization

Traffic engineering



Availability

Identify and diagnose failure



Security

Timely attack detection

Network monitoring is unsolved



Market research reports a \$2.32 B network analytics market by 2020

Startups in network analytics



State of the art: bottom up approach



Too much information: Hard to find needles in a haystack

Network analytics on the collector

Lack network-wide view:

Ad-hoc integration of data across switches & hosts



Too little information: aggregated, sampled data is not enough

Key challenges

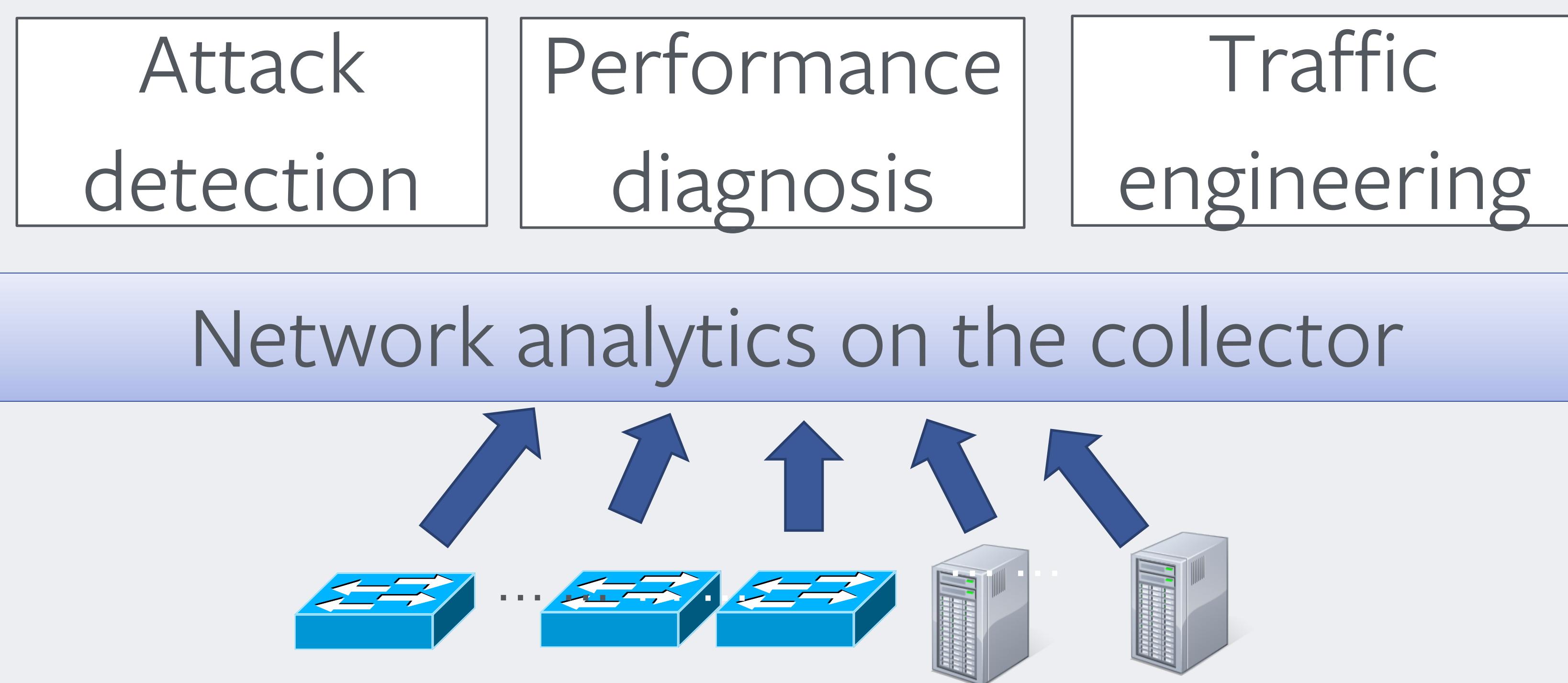
Flexible: diverse, real-time queries

Scale: thousands of devices, millions of flows, terabytes of traffic

Performance: limited resource/support on hardware switches

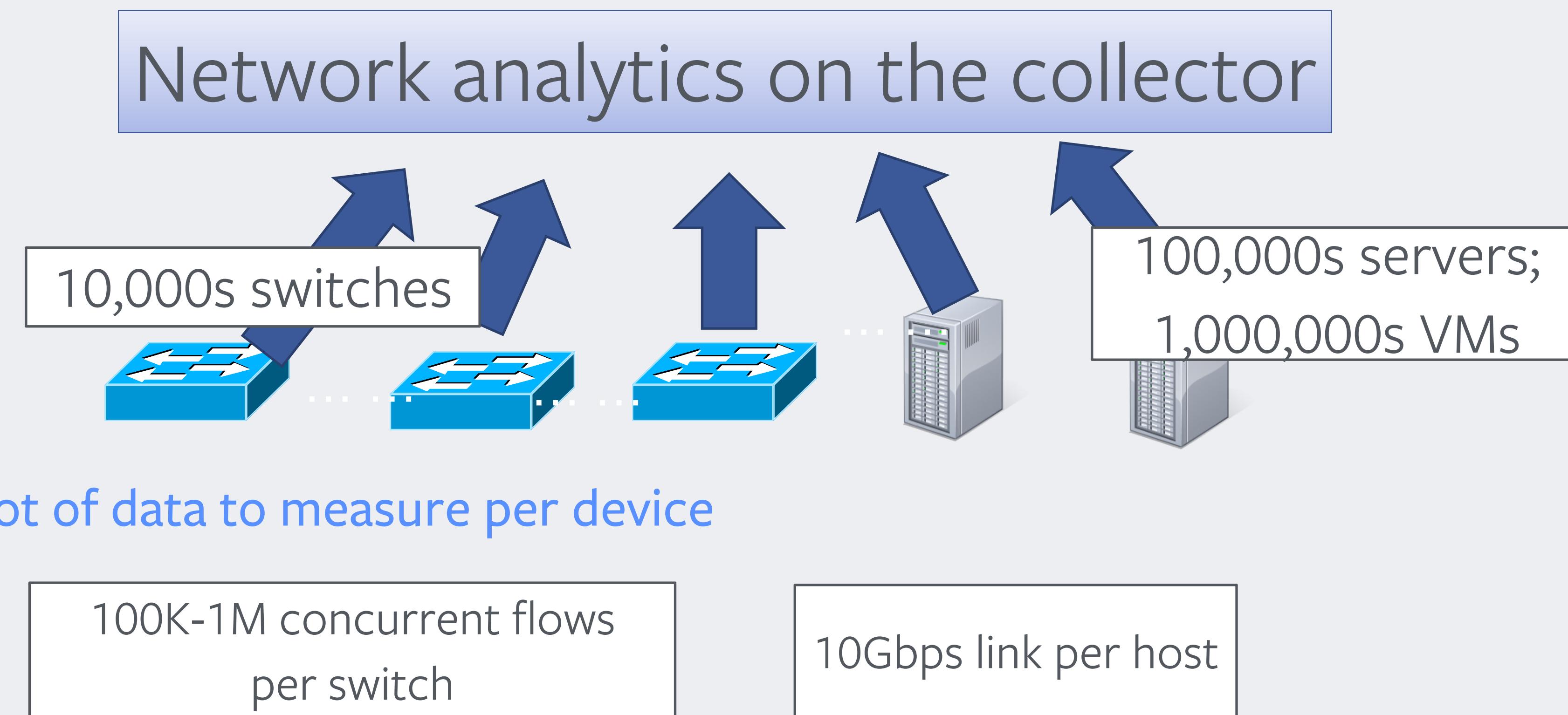
Challenge 1: lack of abstraction

Need to support diverse, customized, real-time query



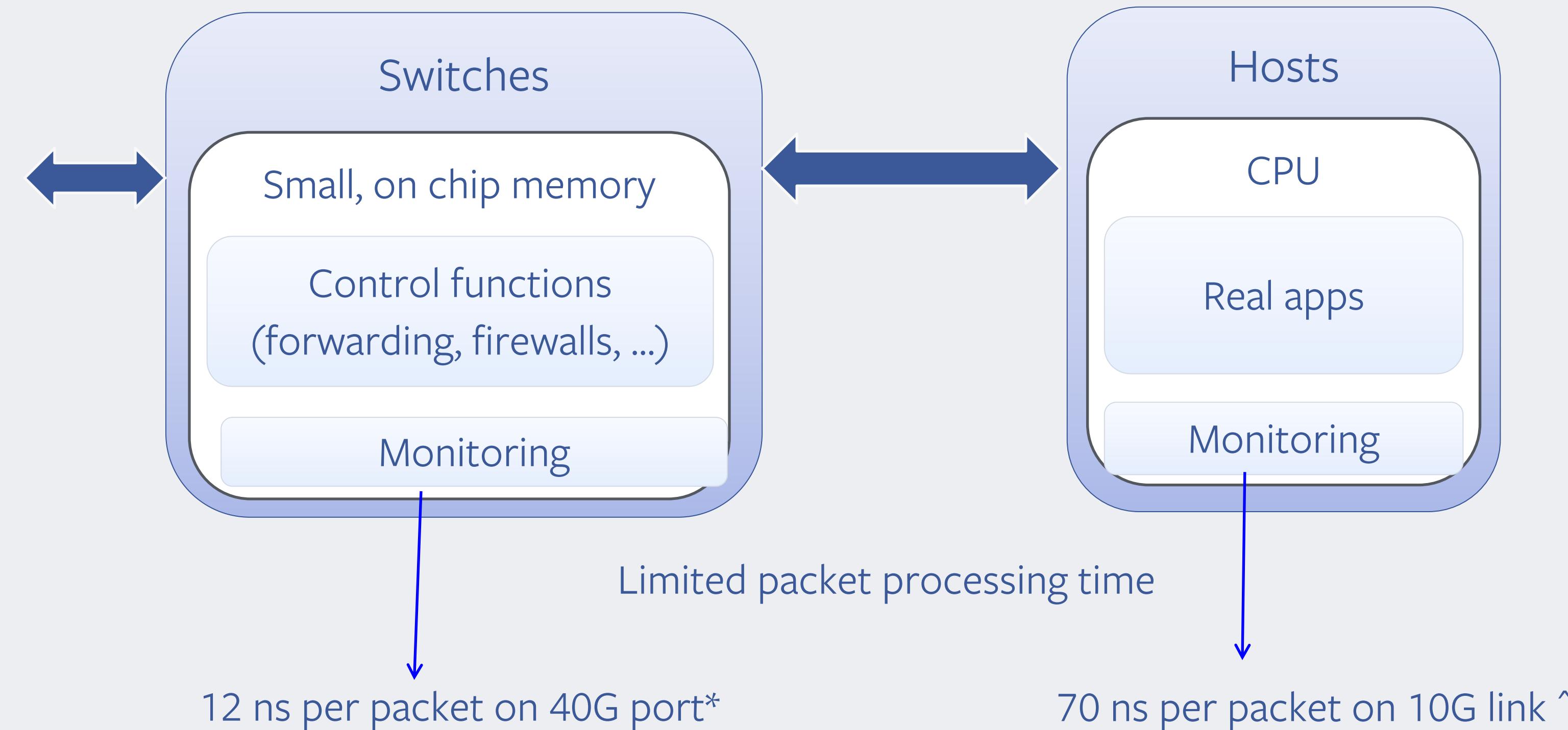
Challenge 2: Scalability

Scale to a large amount of traffic in a large network



Challenge 3: limited hardware support

Limited resources, lack of programmability



[*] Y. Li, R. Miao, C. Kim, and M. Yu. FlowRadar: A Better NetFlow for Data Centers. In Proc. of NSDI, 2016.

[^] M. Moshref, M. Yu, R. Govindan, and A. Vahdat. Trumpet: Timely and Precise Triggers in Data Centers. In Proc. of SIGCOMM, 2016.

State of the art: problems



Too much information: Hard to find needles in a haystack

Network analytics on the collector

Lack network-wide view:
Ad-hoc integration of data across switches & hosts



Too little information: aggregated, sampled data is not enough

How do we make it better?



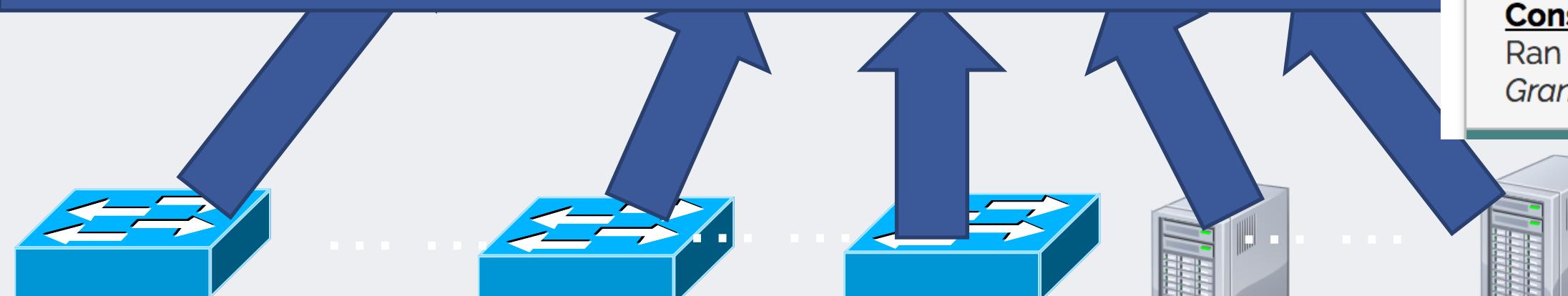
Quantitative Network Monitoring with NetQRE

Yifei Yuan (*University of Pennsylvania*), Dong Lin (*LinkedIn Inc.*), and Ankit Mishra, Sajal Marwaha, Rajeev Alur, and Boon Thau Loo (*University of Pennsylvania*)

Programmable abstractions

Network analytics on the collector

Algorithmic and system design



Programmable hardware support

Language-directed hardware design for network performance monitoring

Srinivas Narayana, Anirudh Sivaraman, Vikram Nathan, and Prateesh Goyal (*MIT CSAIL*), Venkat Arun (*IIT Guwahati*), Mohammad Alizadeh (*MIT CSAIL*), Vimalkumar Jeyakumar (*Cisco Tetration Analytics*), and Changhoon Kim (*Barefoot Networks*)

Paper



Paper preview: programmable abstraction

4:15pm - 5:55pm Technical Session 3 - Network Monitoring

Session Chair: Vyas Sekar (*Carnegie Mellon University*)

Room: Centennial Hall



Q&A

Live Streaming

Quantitative Network Monitoring with NetQRE

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Paper

Programmable abstraction

Algorithmic and system design

Programmable hardware support

- Background: existing languages provide low-level abstractions, hard to monitor application-level/session-level events: e.g. monitor VoIP usage exceeding a quota
- Challenges: flow level measurement fails to capture application semantics, hard to generalize or customize
- Core idea: NetQRE language built on top of quantitative regular expressions, compile to efficient implementation with low memory footprint

Paper preview: hardware support

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Q&A

Live Streaming

Language-directed hardware design for network performance monitoring

Srinivas Narayana, Anirudh Sivaraman, Vikram Nathan, and Prateesh Goyal (*MIT CSAIL*), Venkat Arun (*IIT Guwahati*), Mohammad Alizadeh (*MIT CSAIL*), Vimalkumar Jeyakumar (*Cisco Tetration Analytics*), and Changhoon Kim (*Barefoot Networks*)

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- Background: existing switch monitoring primitives (*sampling, mirroring, counting*) are restrictive; new technologies (*in-band network telemetry, Tetration*) lack flexibility
- Challenges: adding fixed function switch monitoring is unsustainable, need hardware to support expressive language
- Core idea: define Marple language, compiler to translate to programmable switches, use aggregation and filtering to improve performance

Programmable abstraction

Algorithmic and system design

Programmable hardware support

Paper preview: efficient algorithm

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Q&A

Live Streaming

SketchVisor: Robust Network Measurement for Software Packet Processing

Qun Huang (*Huawei Future Network Theory Lab*), Xin Jin (*Johns Hopkins University*), Patrick P. C. Lee (*The Chinese University of Hong Kong*), Runhui Li (*Huawei Future Network Theory Lab*), Lu Tang (*The Chinese University of Hong Kong*), and Yi-Chao Chen and Gong Zhang (*Huawei Future Network Theory Lab*)

Programmable abstraction

Algorithmic and system design

Programmable hardware support

- Background: Sketch summarizes traffic stats of all packets with fixed-size memory, with low errors.
- Challenges: Using sketches have overhead, fail to keep up with high speed
- Core idea: use normal path and fast path in data plane, use control plane to recover from the error

Paper preview: efficient algorithm

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Q&A

Live Streaming

Constant Time Updates in Hierarchical Heavy Hitters

Ran Ben Basat (*Technion*), Gil Einziger (*Nokia Bell Labs*), Roy Friedman (*Technion*), Marcelo Caggiani Luizelli (*Federal University of Rio Grande do Sul*), and Erez Waisbard (*Nokia Bell Labs*)

- **Background:** Hierarchical Heavy Hitters (HHH) aggregate of flows in a address block, used for detecting prefixes suddenly responsible for large traffic.
- **Challenges:** HHH update time is long, cannot keep up with line speed

Programmable abstraction

Algorithmic and system design

Programmable hardware support

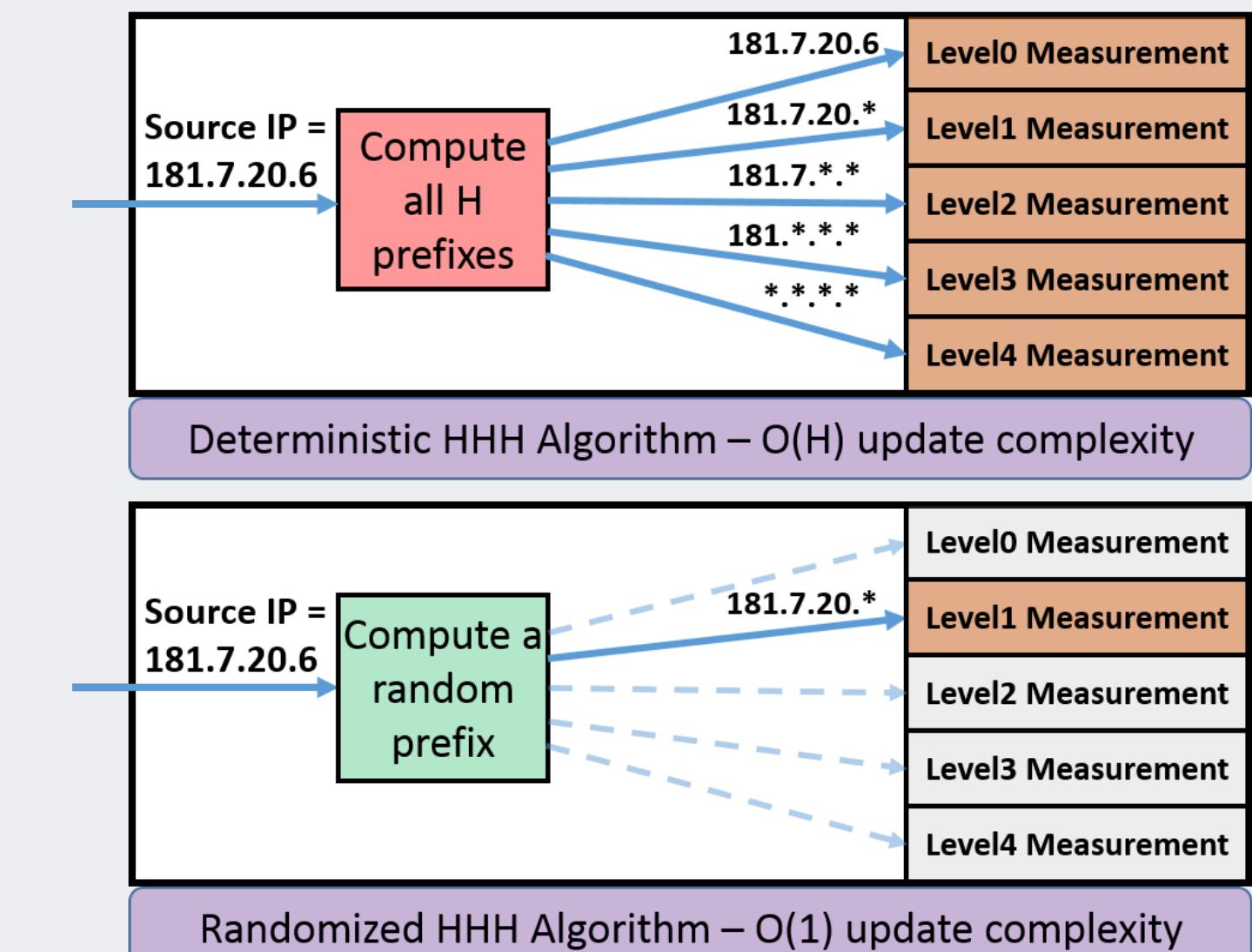


Figure 1: A high level overview of this work. Previous algorithms' update requires $\Omega(H)$ run time, while we perform at most a single $O(1)$ update.

- **Core idea:** randomized update with $O(1)$ complexity

Summary

- Network monitoring is important topic
- Traditionally an afterthought
- It requires coordination in multiple layers

Tuesday
4:15 -5:55!

3:15pm - 4:15pm Posters and Demos I
Room: Legacy Room
Includes coffee break from 3:30pm-4pm

4:15pm - 5:55pm Technical Session 3 - Network Monitoring
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6:30pm - 9:00pm Conference Banquet
The Conference Banquet will take place in Dickson Plaza North

Q&A **Live Streaming** **Paper** **Paper** **Paper** **Paper**