NetMicroscope: Passive Measurements of Residential Internet Performance

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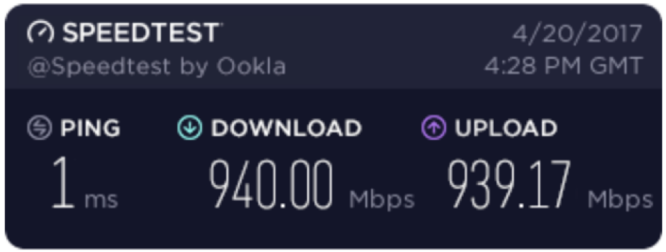
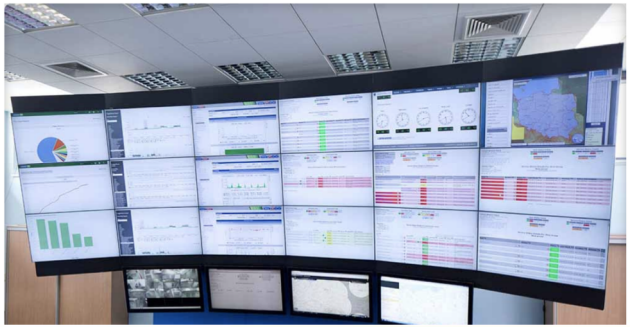
Who cares about residential Internet performance?

- Home users



- ISPs, content providers



- Regulators, policymakers

Eighth
Measuring Broadband America
Fixed Broadband Report

A Report on Consumer Fixed Broadband Performance in the United States

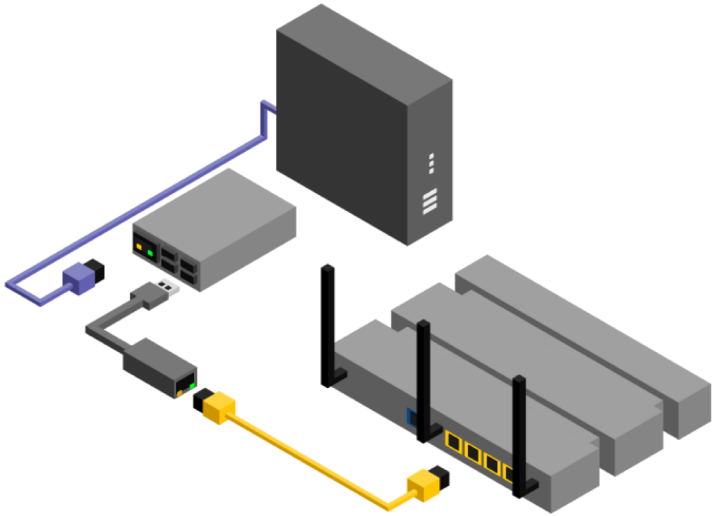
Federal Communications Commission

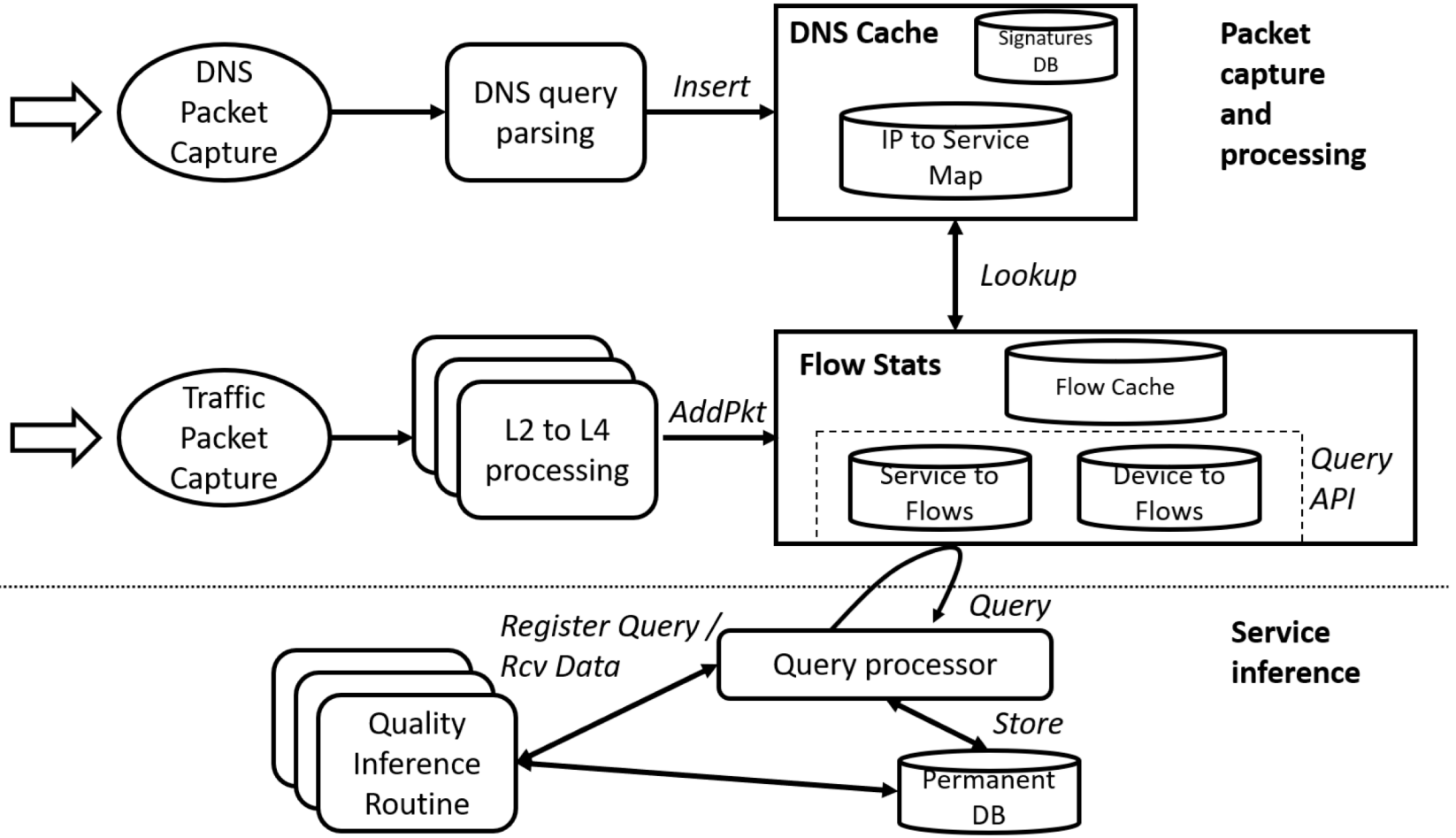
Active measurements are reaching their limits

- Access link may not be the bottleneck
- “Filling up” path is disruptive
- Measured paths != application paths
- Per-application active measurements != user experience

The gigabit era: The future is passive

- NetMicroscope: Passive measurements to infer application quality
  - Co-design of traffic capture and inference
- Deployed in home networks
  - Implemented for low-cost devices
    - Raspberry Pi, Odroid
  - Deployment
    - ~10 in Paris
    - ~50 in the US

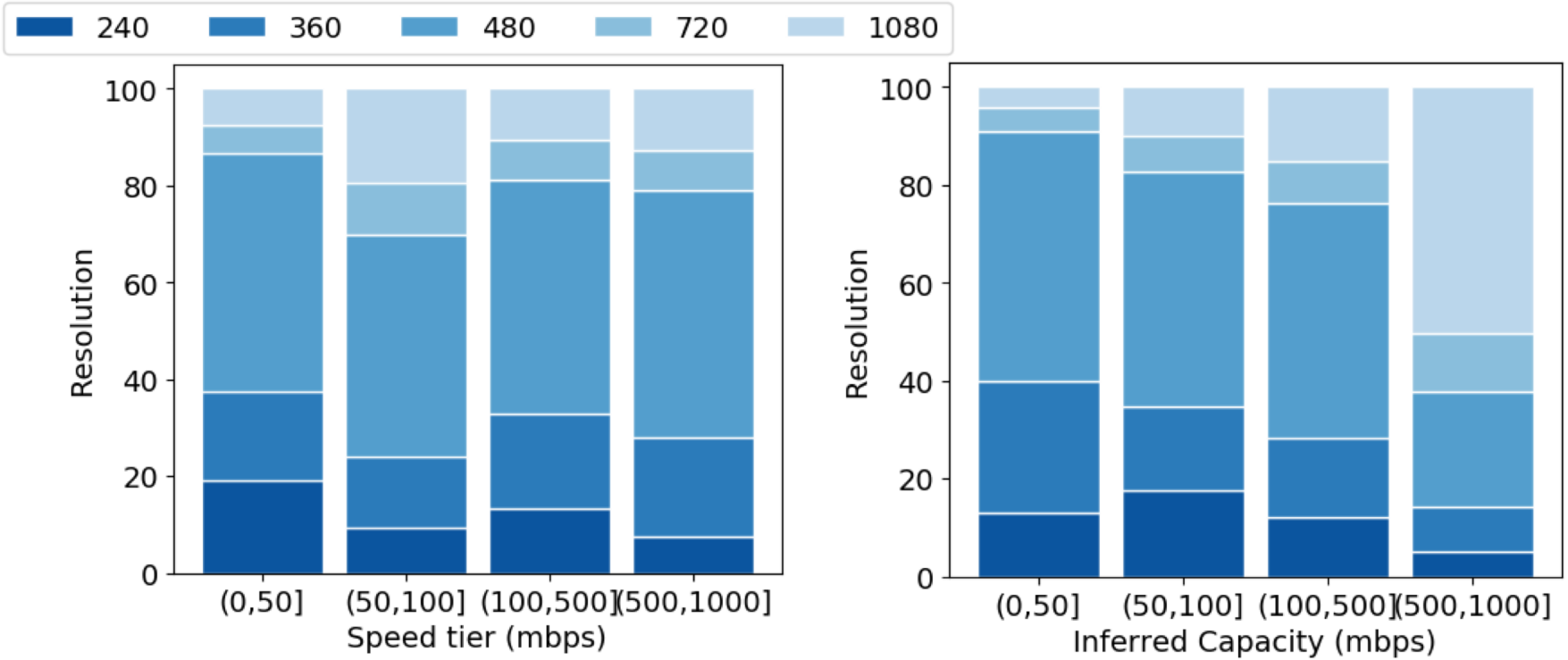



DNS Packet Capture
DNS query parsing
Insert
DNS Cache
Signatures DB
IP to Service Map
Packet capture and processing
Lookup
Traffic Packet Capture
L2 to L4 processing
AddPkt
Flow Stats
Flow Cache
Service to Flows
Device to Flows
Query API
Query
Register Query / Rcv Data
Query processor
Service inference
Quality Inference Routine
Store
Permanent DB

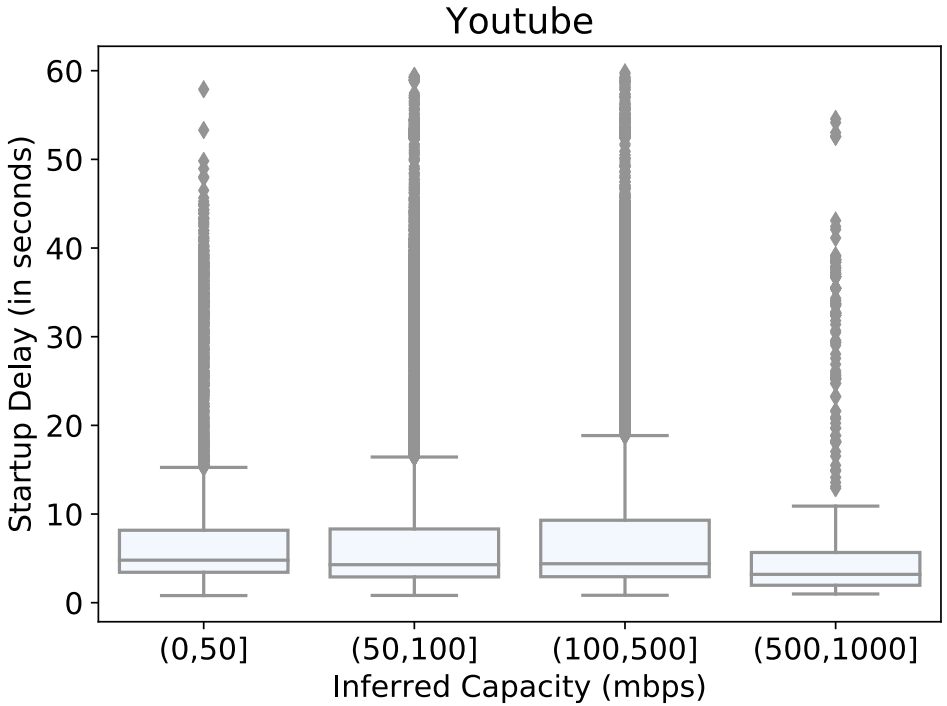
Inferring video quality

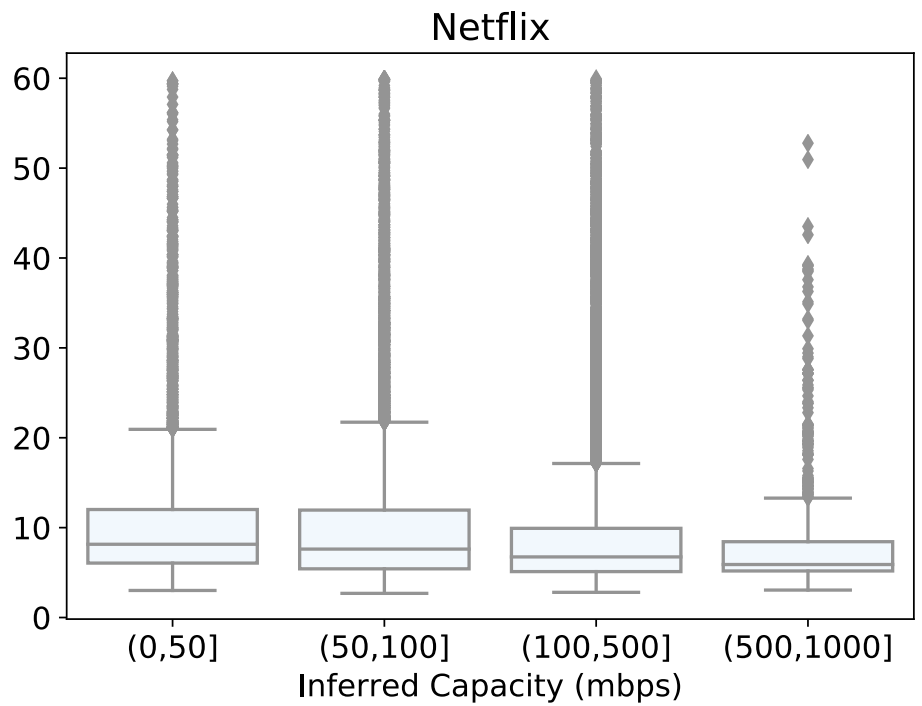
- Inference goal: Video quality metrics
  - Startup delay, video resolution, resolution changes, rebuffering
- Input: encrypted video traffic
  - E.g.: bytes up/down, pkt interarrival, video segment sizes
- Training data with ground truth from browser
  - Netflix, Youtube, Twitch, Amazon Prime

YouTube’s resolution in the deployment



Startup delay in the deployment





Looking ahead

- How does inferred quality relate to quality of experience?
- How to generalize quality inference to other applications?
- How to preserve privacy?
- How to deploy system in diverse vantage points?