Advanced Stream and Sampling Framework for IPPM

draft-ietf-ippm-2330-update-00

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Status: IPPM Charter Update

- draft-morton-ippm-2330-update-01 adopted as a WG item

“Specific near-term milestones include:

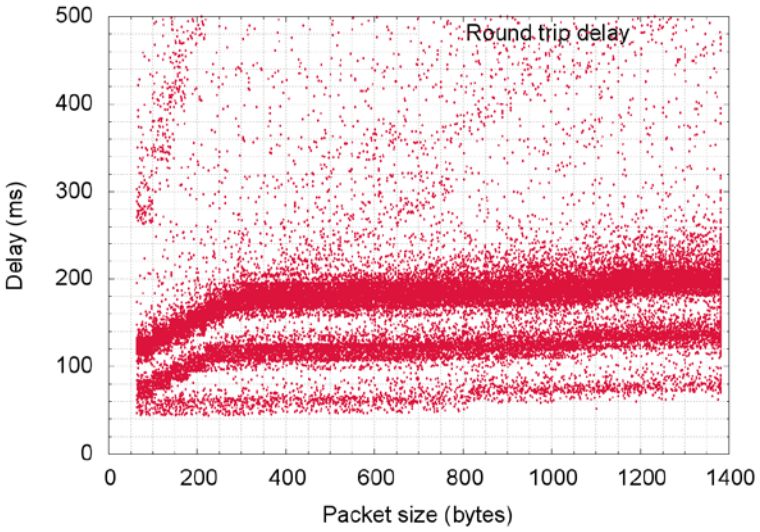
[…]

2. Update of the IPPM framework document (RFC 2330) to reflect experience with the framework, and to cover planned future metric development.

[…]”

Motivation

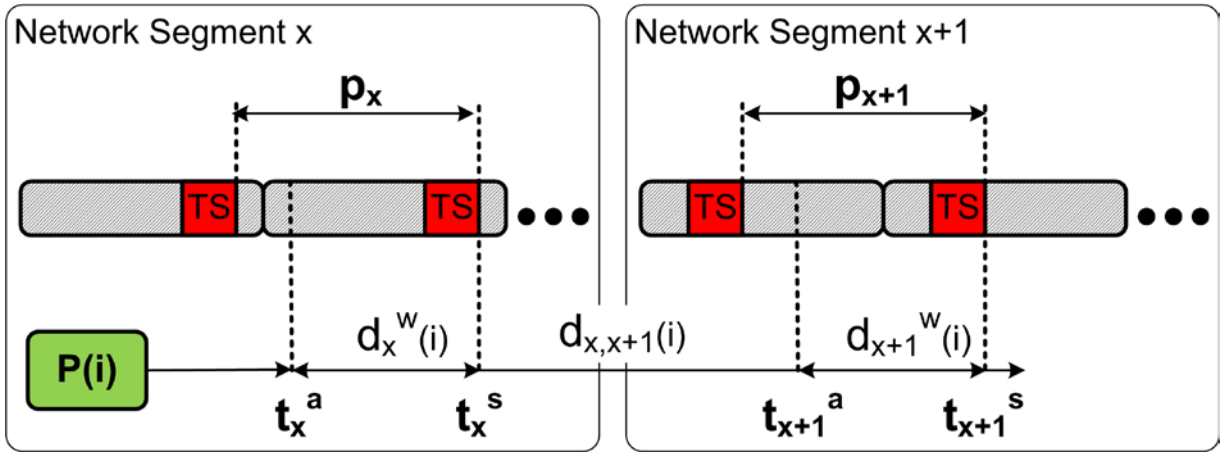
- Networks have evolved
  - RFC 2330 assumes linear network behavior (“wire“)
  - Smart networks: Measurement results depend to a large extent on measurement stream (on-demand allocation)
  - RFC 2330 **metric and methodology properties** are a useful theoretical instrument - limited in real life now (repeatability)
  - Network-internal **flow state** at layers below IP
  - RFC 2330 prerequisites fail



Scope of Advanced Framework

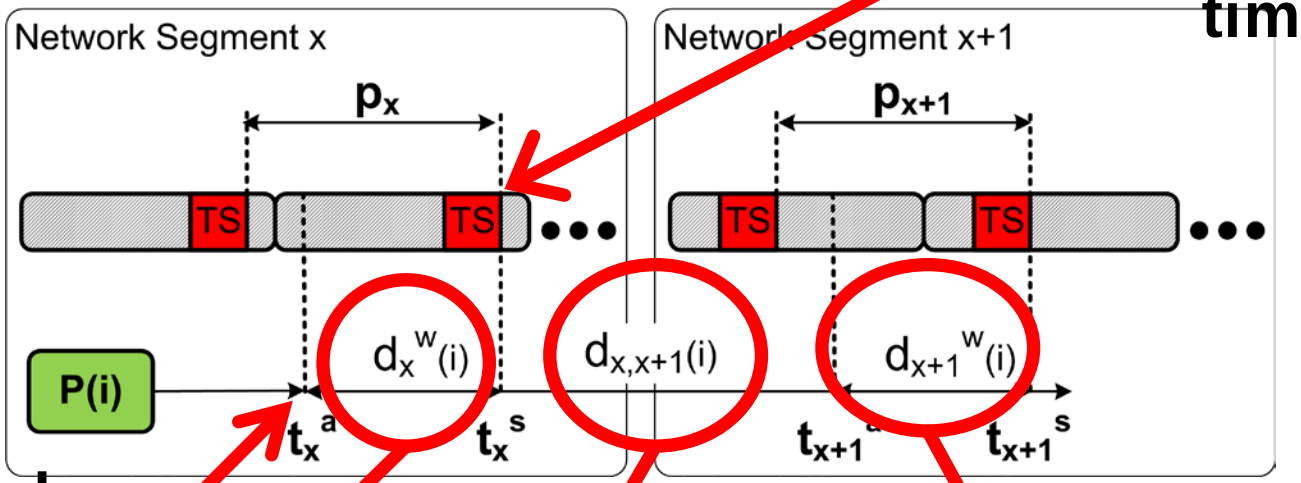
- Describe useful additional stream parameters
  - Restore repeatable measurements in modern networks
- Aspects
  - 1. Network treatment depends on Type-P (concept ext.)
  - 2. Packet history influences network/results
  - 3. Access technology may change during session
  - 4. Time-slotted service time in network paths

Time-slotted Randomness Cancellation (TSRC)



- Condition for TSRC:
  - At least two time-slotted, global time synchronous links or systems in the measurement path
  - Common period in subsequent ts network segments x,x+1
- Measurement results valid for same session ONLY!

Time-slotted Randomness Cancellation (TSRC)



3. **Packet synchronous with global time (mod p_x)**

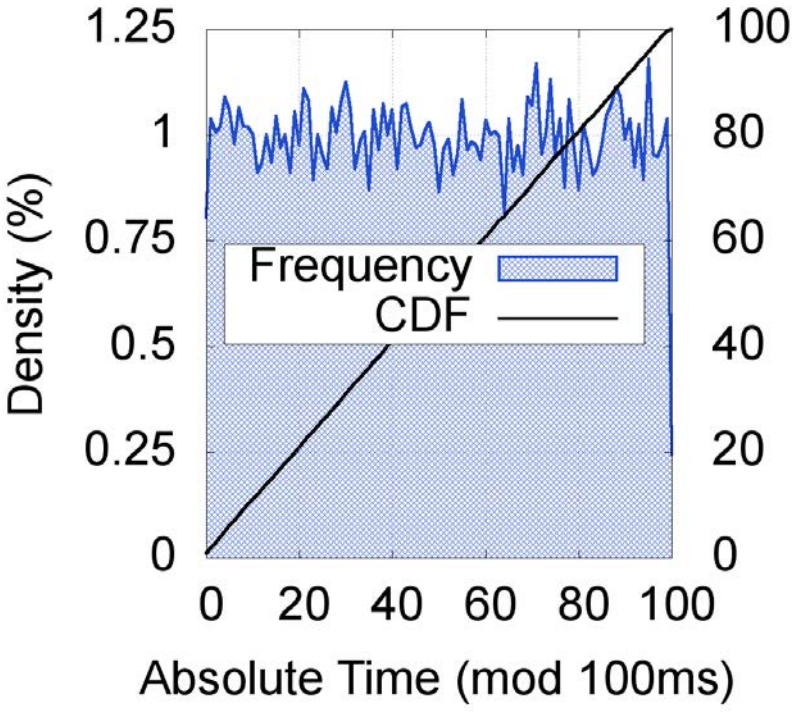
1. **Random arrival time**

2. **Random wait time**

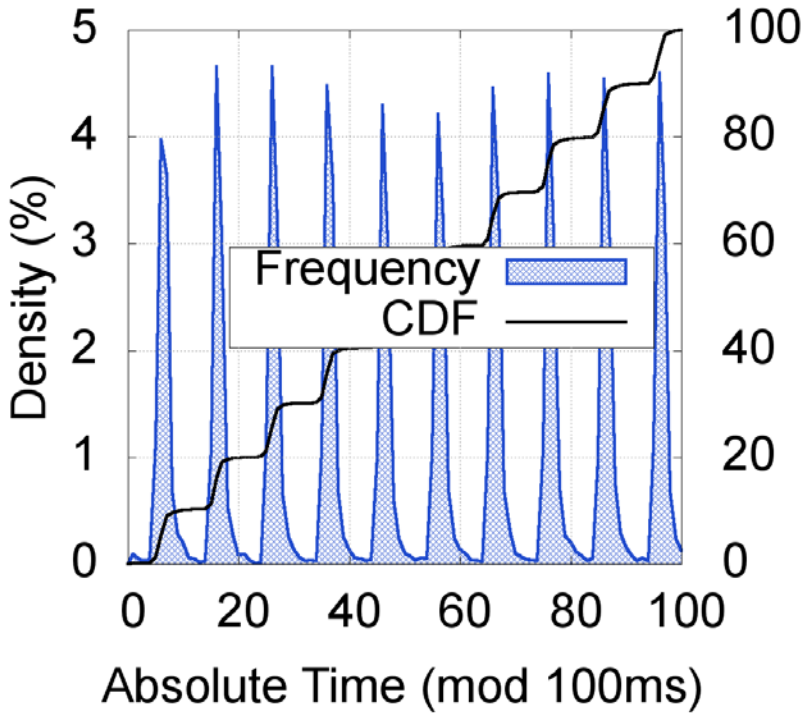
4. **Constant propagation delay**

5. **Constant (!) wait time**

Randomness Cancellation (TSRC)



- Ingress



- Egress

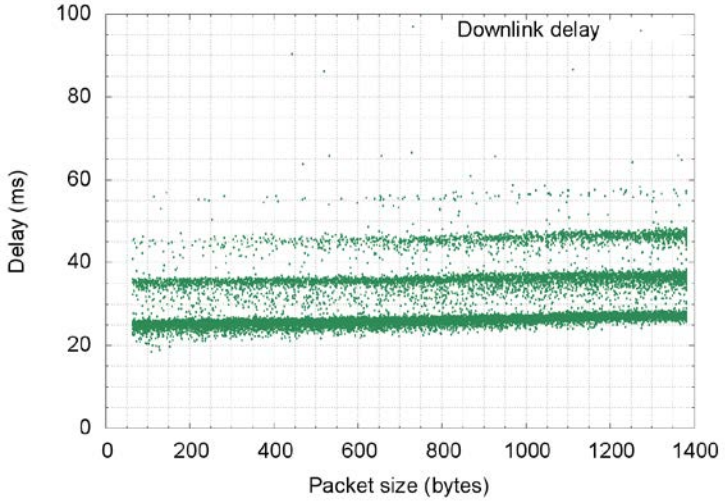
- HSPA tcpdump, 10ms period (size: 64-1400 bytes)

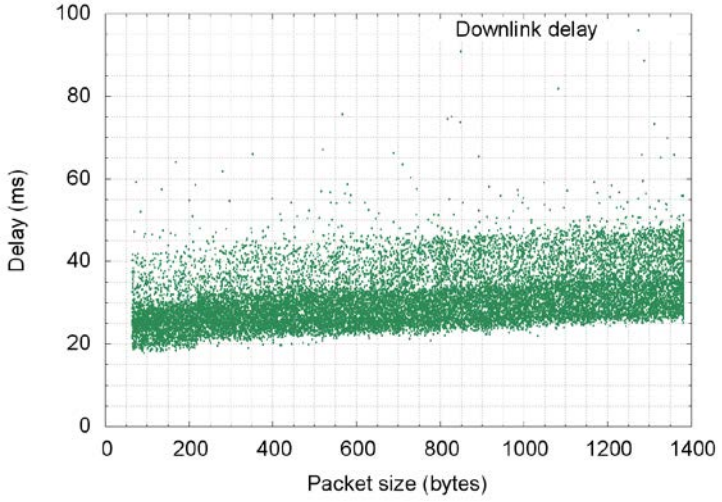
Consequences TSRC

- Start-time random measurements (RFC 2330)
  - Can‘t guarantee representativeness beyond m. session
- Passive Measurements in TS networks
  - Randomness potentially cancelled by access network(s)
  - Traffic replay meaningless?
- Difficult to bypass this limitation by methodology (end-to-end)
  - **Dedicated functionality in intermediate ingress nodes**
  - **Dedicated measurement protocols**
  - **Randomness re-generation in intermediate nodes**
  - Wired and wireless networks

Consequences TSRC (ctd).

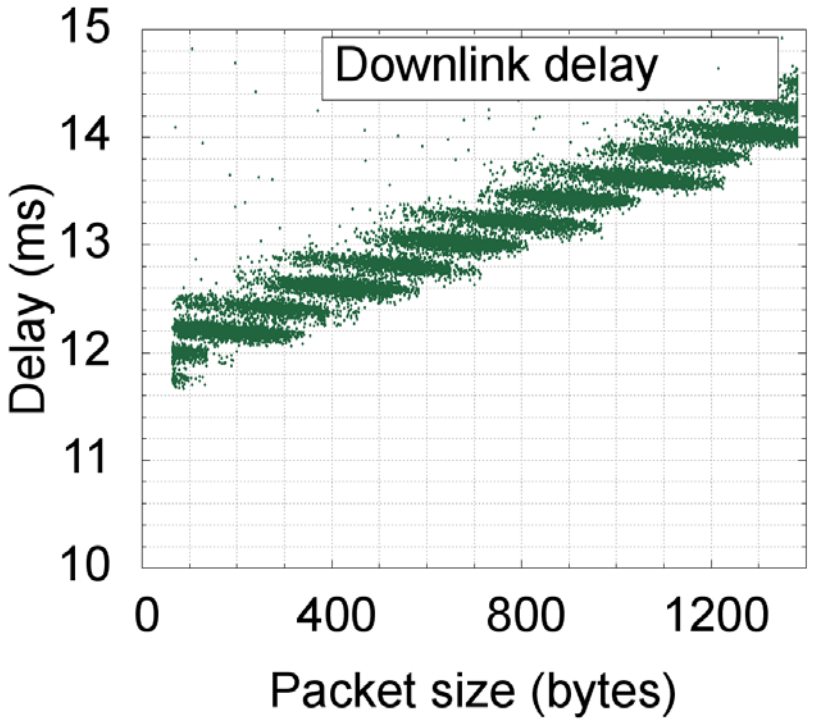
- TSRC effect **visible in almost any access network**
  - Matter of order of magnitude
  - Particular influence on **reply leg of RTD**
- HSPA downlink extracted from RTD sample

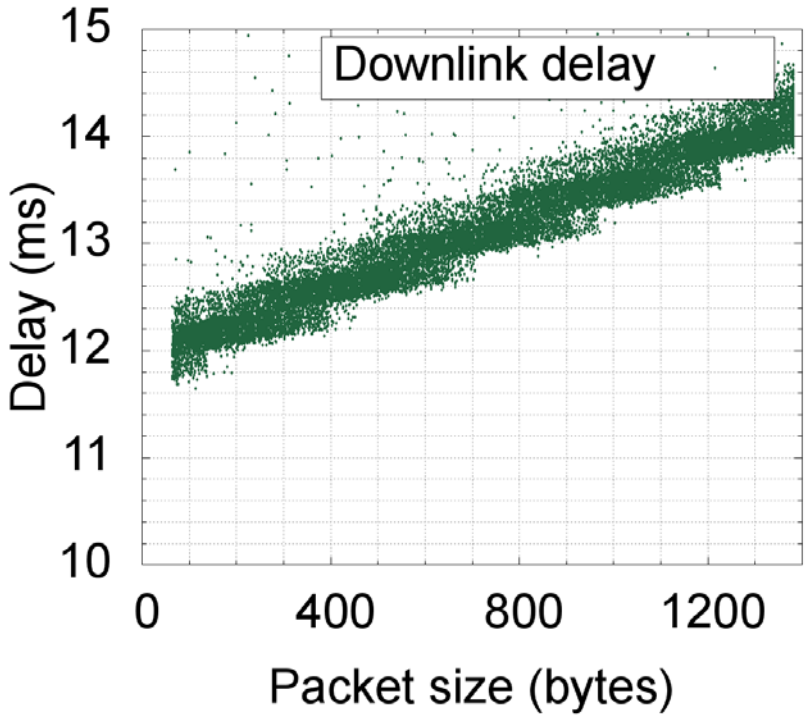




Consequences TSRC (ctd).

- VDSL Downlink, 8 Mbit/s





Main Comment (Kostas): Widen Scope

- Sec 1.1 comment: term “Reactive Network” too restrictive
  - Is currently based on past experience
  - Should include future networks, policy, mobility
- Key Issue: Repeatability
  - Black box measurements
  - Sequences of network segments (policy composition?)
  - Can we envision/predict SDN-behavior and measurement requirements?
  - Focus on general applicable concepts
    - Wired and wireless

Summary Status and Discussion

- Networks have changed, indeed
  - Requirement for RFC 2330 update
- Todo:
  - Detailed discussion needed to refine/widen “reactive networks” term
  - More opinions needed – volunteers to read/review?
  - Consider draft-mathis-ippm-model-based-metrics-01 requirements relative to RFC2330 (Sec. 2)
- TSRC applicable to other areas (LMAP?)
  - Prefer hop-by-hop metrics over end-to-end?
  - Randomness re-generation, new measurement protocols?

Summary Status and Discussion

- Possible future work: Define methods to test for xxx (reactive, …) network behavior.
  - Categorize networks based on fundamental IPPM metrics
  - Test for pre-requisites and assumptions? (“This network fulfills basic RFCxxx requirements”)

Backup

Examples: Reactive Behavior

Layer Independent:

- Link establishment in response to flow activity
  - This is why a concept of pre-test load is needed
- Channel capacity adaptation
  - Decision to increase or decrease capacity on a sub-IP link based on past or current flow rate.
  - Decision to use signaling channel for sporadic, small data packets instead of allocating dedicated bearer

Layer Dependent:

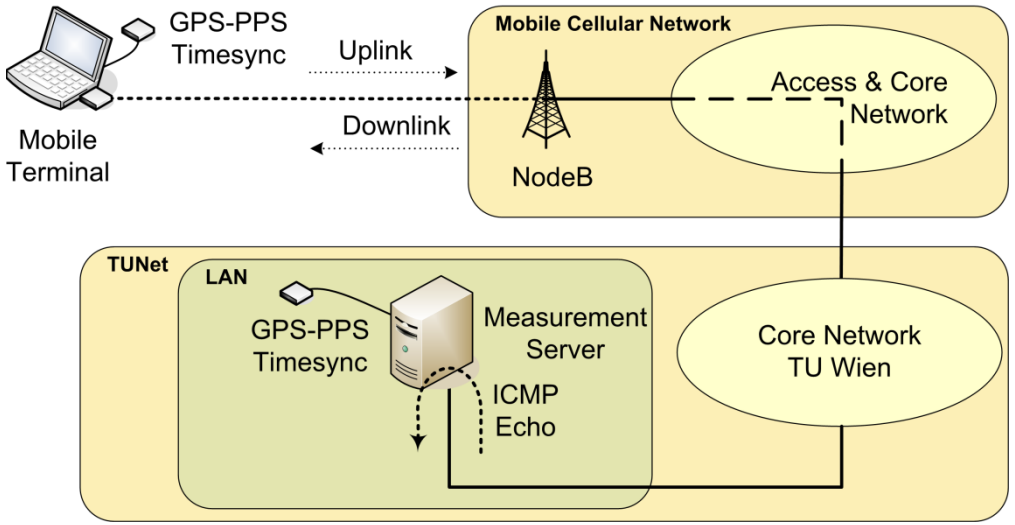
- Link-level compression of packet payload(s) depending on Type-P and higher-layer content
  - For instance JPEG file downsizing and –scaling in mobile networks (server-side optimizers)
- Content-based interception

Examples: NON-Reactive Behavior

- “Green” features
  - Activate idle fiber link when Util>X
  - Deactivate fiber link when Util<Y
- Policies triggering on total cell load
  - Mobile networks: bias of capacity allocation algorithms by current total cell load (all users)
- Channel adaptation between low-capacity or high-capacity on a sub-IP link appears random.
  - Fall-back to accommodate appearance of a legacy device
  - Signal quality (lower-layers, position, interference)
  - Activating or de-activating a dedicated VC on an xDSL link (e.g., some DSL modems do this when switching on or off a VoIP phone or an IPTV box, substantially reducing the capacity available for best-effort traffic).

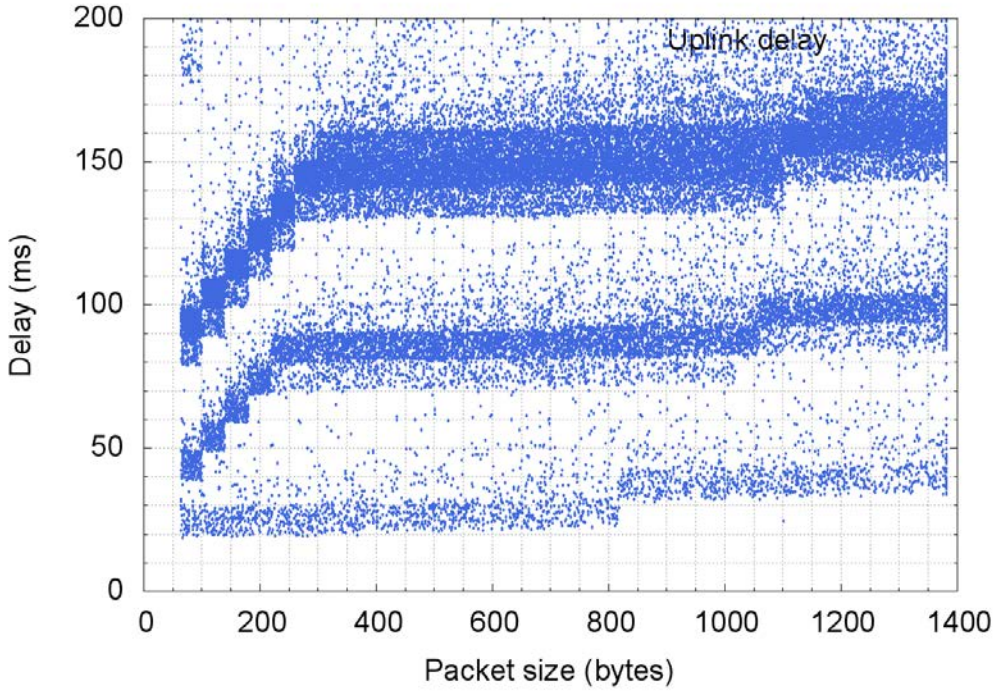
Measurement Methodology & Setup

- End-to-end ICMP round-trip delay measurements
- Initiated by UE (mobile client), reflected by server
- Client and server synchronous with global time (PPS, ~10µs).
- Randomness in space and time
  - Packets having random payload size are sent out at random start times



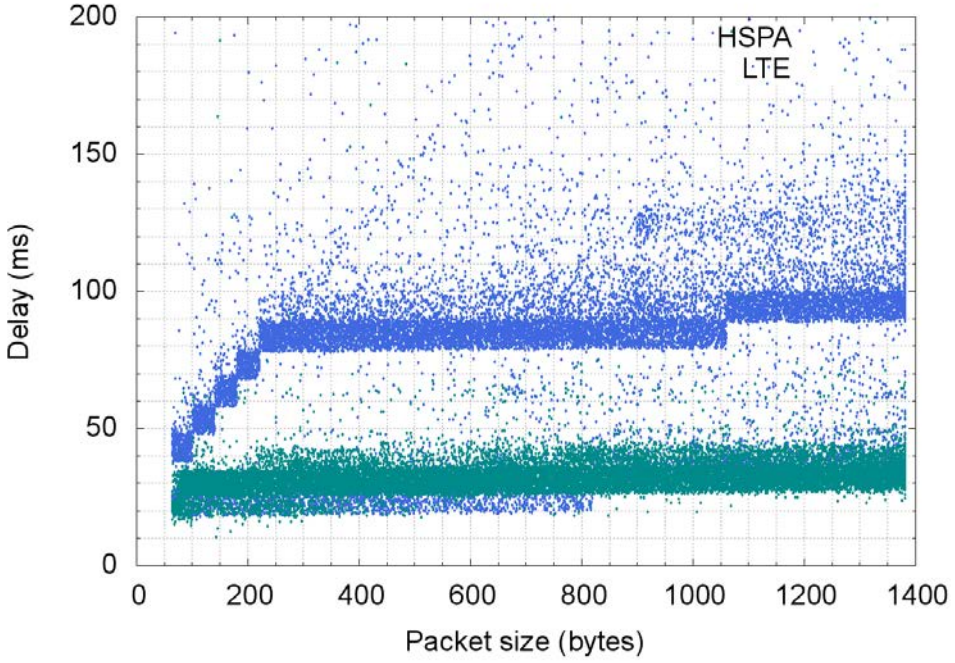
1. Expand elements of Type-P
2. Packet History Influence

- Test packet length
- Content optimization
- Flow state: multi-modal distributions



3. Access Technology Change (App-transparent)

- Applications might not detect changes
- Overlayed
- Mobile measurements (LMAP)



- Representativeness?

Goals – Next Steps

- Metric & Methodology **properties**:
  - Improve **Repeatability, Continuity, Extensibility**
  - Can/should we formalize these properties?
  - Assess “Quality of Measurement” to evaluate if properties are satisfied for two measurement sample sets?
  - Aim: find minimum set of parameters such that measurements have one or several of the above-mentioned properties.
- Classification: methodology-invariant metrics?