Applying IETF IP Performance Metrics to Broadband Mapping

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Mapping of Broadband Services in Europe
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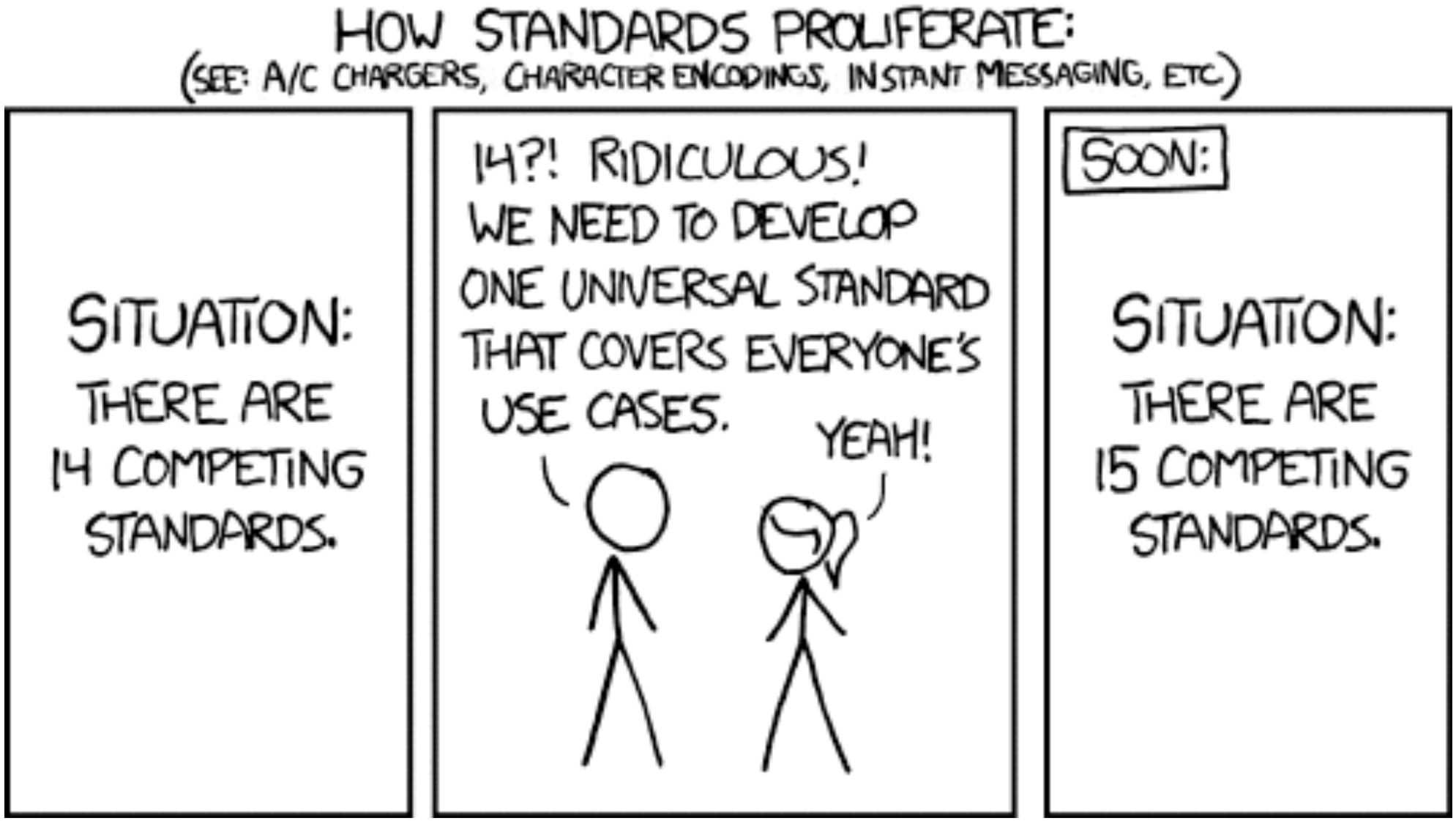
Standards



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Who am I?

- Senior Researcher, ETH Zürich, Switzerland
  - focus on Internet measurement and architecture
- Co-Chair, IETF IP Performance Metrics (IPPM) Working Group (WG)
  - not speaking for the working group

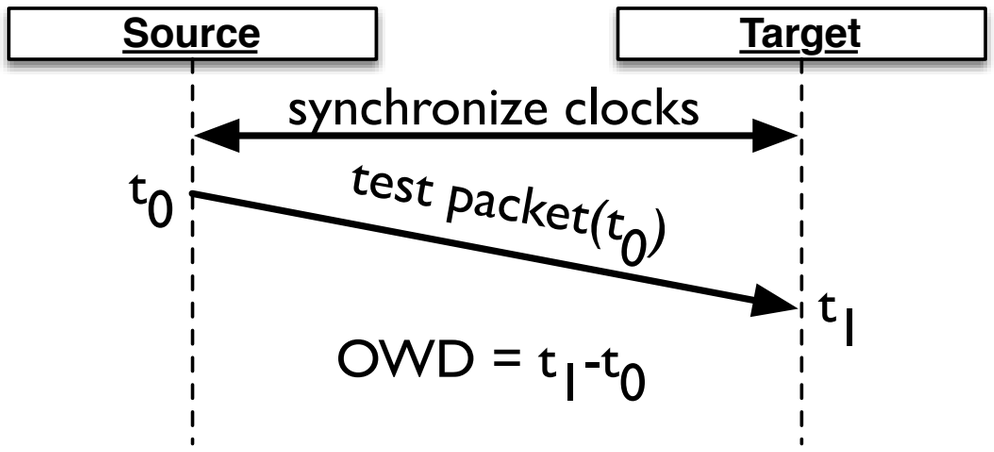
Overview

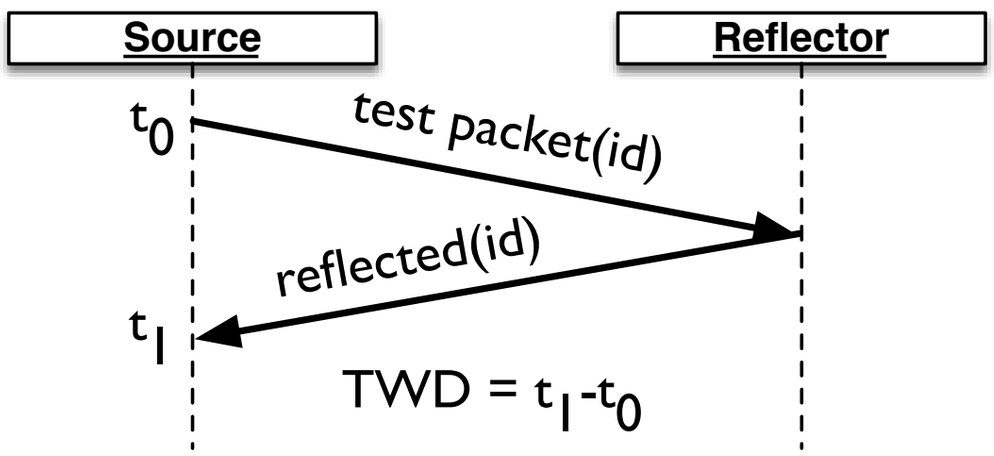
- Applicable metrics and methodologies
- Registry of tests for broadband performance
- Experiments in better bandwidth metrics
- A word about comparability

Applicable Metrics

- One-way packet loss (RFC 7680)
  - Measurement simple, interpretation harder
    - Cannot separate line condition from congestion
    - TCP induces loss to measure capacity
- One- (RFC 7679) and two-way (RFC 2681) delay
  - Two-way doesn’t require clock sync
- Delay variance (RFC 3393) (“jitter”)

Active delay measurement





- OWD: synchronize clocks, send timestamp, compare
- TWD: send packet, reflect, compare
- Loss: “infinite” OWD
- Jitter: derived from delay
- *Any protocol with IDs usable for TWD*

Test Protocols

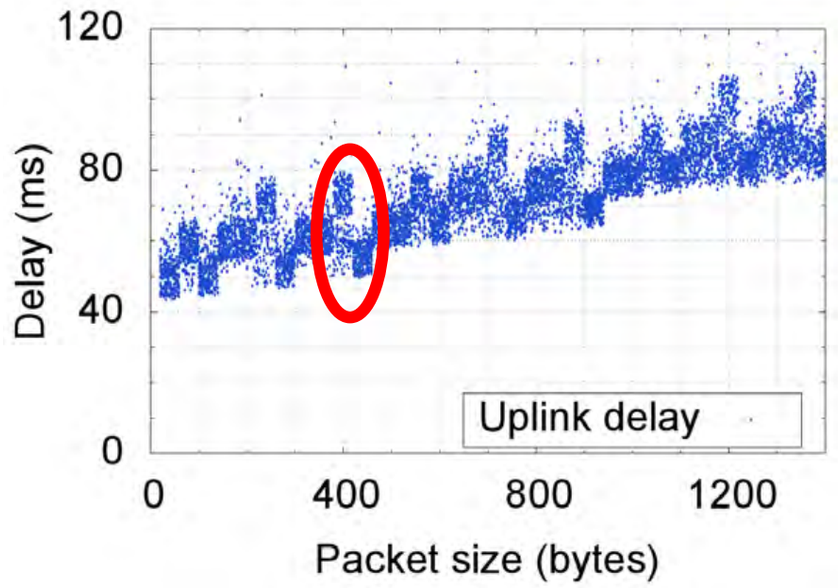
- One-way Active Measurement Protocol (OWAMP) & Two-Way Active Measurement Protocol (TWAMP)
- Arbitrary UDP packets as measurement traffic
- Control protocol between initiator and reflector
- Can be used for loss and timing on CPE to operator segment, or CPE to Internet.

Test Registry

- Bridge gap between RFCs and recommended tests for access network measurement.
- Methodology for a few common tests, focus on comparable implementability
  - UDP two-way delay (RFC 2681)
  - UDP delay variation (RFC 3393)
  - DNS response latency (like RFC 2681, but with DNS)
  - UDP one-way delay (RFC 7679)
- Work in progress, complete in 2016?

What about bandwidth?

- IPPM founded in 1990s to define transfer capacity metrics…
- We still haven't managed it.
  - Network links are reactive (see RFC 7312)
  - Congestion-controlled traffic is reactive
  - "send a big file with TCP" measures a mix of capacity, latency, loss, TCP congestion control at the sender.



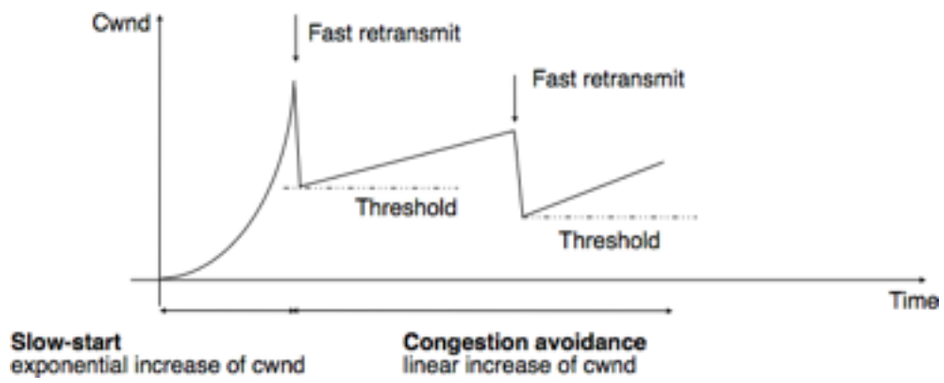


Image Credits: Joachim Fabini, "Access Networks: Dormant Middleboxes?" HOPSRG, IETF 94, Yokohama, Nov 2015; Bonaventure et al "Computer Networking : Principles, Protocols and Practice" 2nd Edition (CC-BY)

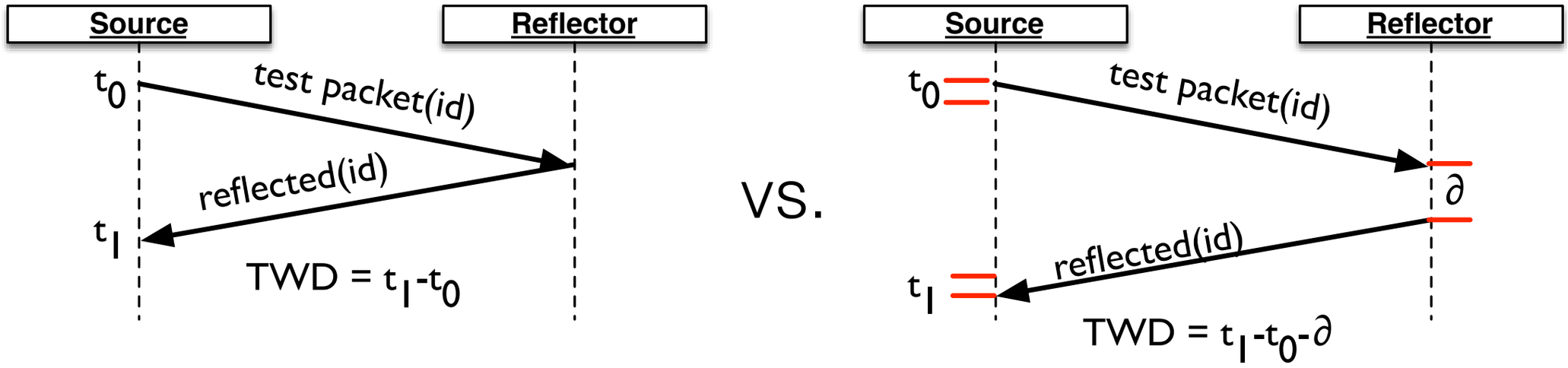
What about bandwidth?

- Problem: TCP is reactive

$$B = \min(\frac{W_{max}}{RTT}, ...)$$

- Approach: account for this by “open-looping” congestion control with synthetic traffic
- Mathis & Morton, draft-ietf-ippm-model-based-metrics
- New metric type: pass/fail at rate X:
  - “does link L support of X Mb/s?”
- Work in progress, experimental RFC done end 2016?

Comparability in Broadband Mapping



- Metric comparison: equivalent definitions
- Measurement comparison: equivalent methodology
- Implementation details matter, too.
- ***Analysis necessary to compare apples to apples***

Getting Involved

- The IETF is a non-membership, volunteer-driven, voluntary standards organization.
- Open participation on the mailing lists
  - ippm@ietf.org (IPPM WG: metrics and methods)
  - lmap@ietf.org (LMAP WG: control and reporting)
- IETF 96 in Berlin, 17-22 July

- Questions? come talk to me, or ietf@trammell.ch