Hochschule für Angewandte Wissenschaften Hamburg
Hamburg University of Applied Sciences

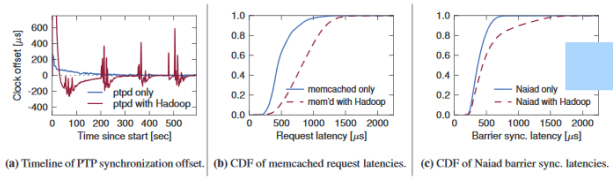
Technische Universität München

Freie Universität Berlin

Towards an Ecosystem for Reproducible Research in Computer Networking

Quirin Scheitle (TUM), Matthias Wählisch (FU Berlin), Oliver Gasser (TUM), Thomas C. Schmidt (HAW Hamburg), Georg Carle (TUM)

Recap: What do we want?



(a) Timeline of PTP synchronization offset. (b) CDF of memcached request latencies. (c) CDF of Naiad barrier sync. latencies.

Figure 1: Motivating experiments: Hadoop traffic interferes with *(a)* PTPd, *(b)* memcached and *(c)* Naiad traffic.

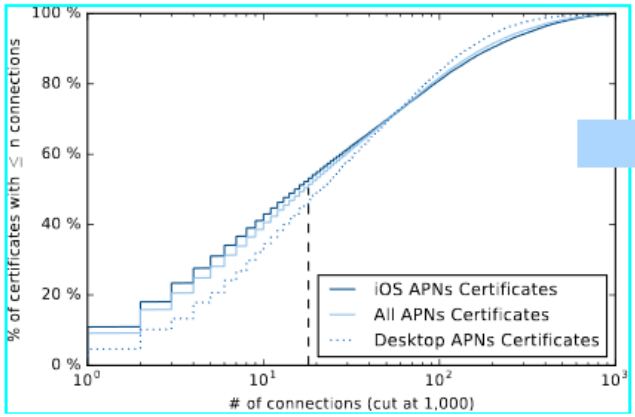
Setup	50th%	99th%
one host, idle network	85	126µs
two hosts, shared switch	110	130µs
shared source host, shared egress port	228	268µs
shared dest. host, shared ingress port	125	278µs
shared host, shared ingress and egress	221	229µs
two hosts, shared switch queue	**1,920**	**2,100µs**

Table 1: Median and 99th percentile latencies observed as `ping` and `iperf` share various parts of the network.

in §6) and measure the effects.

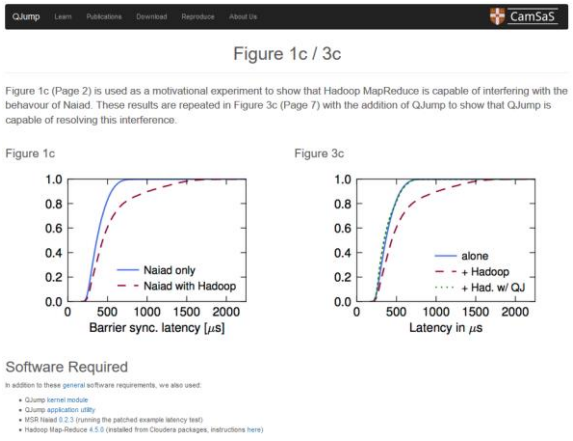
1. Clock Synchronization Precise clock synchronization is important to distributed systems such as Google's Spanner [11]. PTPd offers microsecond-granularity time synchronization from a time server to machines on a local network. In Figure 1a, we show a timeline of PTPd synchronizing a host clock on both an idle network and when sharing the network with Hadoop. In the shared case, Hadoop's shuffle phases causes queueing, which delays PTPd's synchronization packets. This

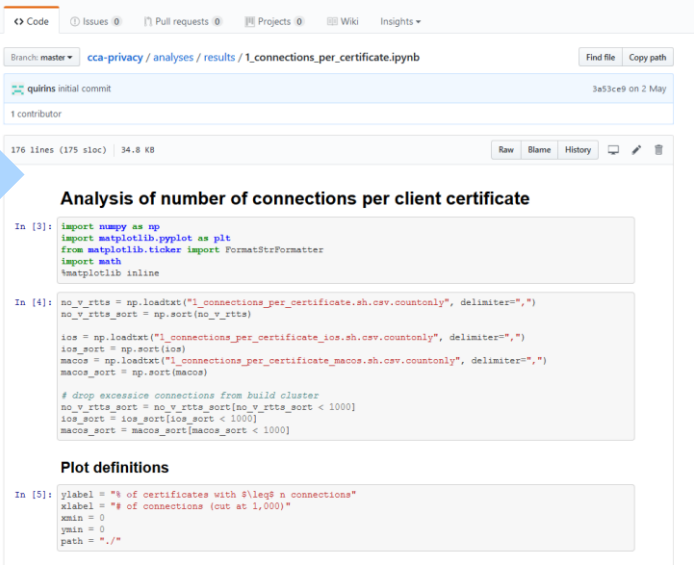
[Grosvenor et al., NSDI'15]



(a) ∼50% of certificates observed with more than 17 connections, 9% of certificates only observed once (5% desktop, 11% iOS).

[Wachs et al., TMA'17]





Recap: Where are we?

Workshop on Models, Methods and Tools for Reproducible Network Research (MoMeTools)

Karlsruhe, Germany, August 25, 2003
In conjunction with **ACM SIGCOMM 2003**

- **Main**
- **Formatting/Submission**
- **Call for Papers**
- **Workshop program**
- **ACM Digital Library Proceedings**

Workshop on Models, Methods and Tools for Reproducible Network Research (MoMeTools)

Compared with other scientific areas such as experimental physics, network research appears significantly less mature concerning methodology. The goal of this workshop is to critically assess the current models, methods and tools of network research for identifying shortcomings of the state-of-the-art, and to discuss approaches for improvements and innovation. The workshop aims for sharing knowledge about how to apply today's tools most successfully, and for generating a common understanding about what is needed for network research to progress more rapidly and to ensure widely reproducible results. The workshop solicits submissions that improve our understanding of the current state-of-the art, and that help to identify improved models, methods and tools.

ACM SIGCOMM 2017 Reproducibility Workshop (Reproducibility'17)

Call For Papers

Ensuring the reproducibility of results is essential in experimental sciences. Unfortunately, as highlighted recently, a large proportion of research results are hardly, if not at all, reproducible, raising reasonable doubts on the research lead by scientists around the world.

Why do we lack reproducibility?

Why do we lack reproducibility?

Because we lack incentives.

Key players need incentives

Authors

Reviewers

Independent Reproducers

Key players need incentives

Authors

Preparation takes time

Details may conflict with reading flow

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Independent Reproducers

Reproduction papers are rarely accepted

Why does reproducibility enforcement not help?

Reject non-reproducible papers.

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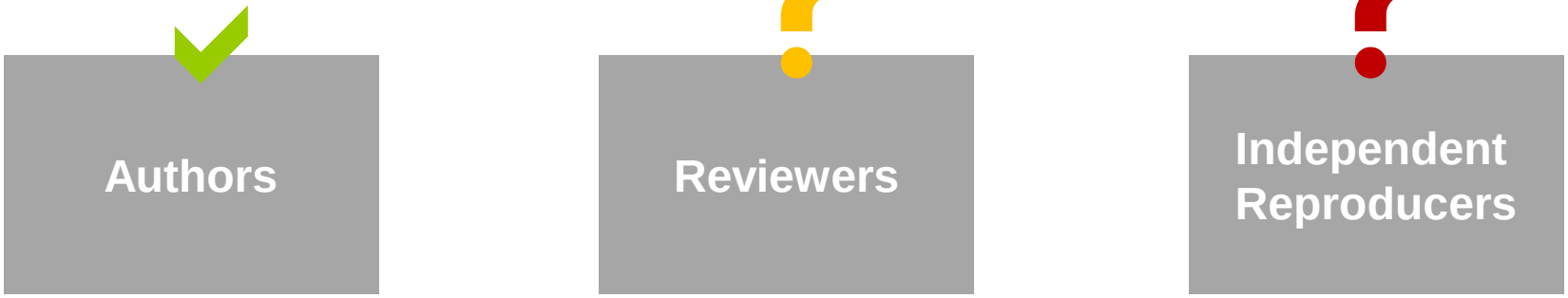

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Details may conflict with reading flow

Are already overloaded

Reproduction papers are rarely accepted

Observations

Enforcing reproducibility does not solve all problems.

We need multiple independent reproductions.

Visibility is a major incentive.

We need an ecosystem that is based on visibility.

Supportive measures may help.

Supportive measures should adapt to experiences.

Building blocks for an ecosystem to support reproducible research

(SIGCOMM) Reproducibility Challenge

Core idea of an Reproducibility Challenge

- Venue to submit reproduction reports
- Reproducers gain visibility
- Badly reproducible papers would be highlighted, increasing incentives for authors
- Mix of proceedings, presentations, and live “hacking”

Why at SIGCOMM?

- High visibility, high incentives for both authors and reproducers
- Authors of original papers likely attend SIGCOMM for other reasons

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Most basic building block.

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Explicit incentives for authors

Requirement

- Articulate expectations about reproducibility in Call for Papers

Possible implementations

- Reproducibility is a tie breaker
- Positive comments at the conference, highlighted in proceedings
- Reproducibility award

Reproducibility review

Idea

- First, review technical merit, then, second, review reproducibility

Problem

- Timeliness

Approach

- Establish a SIGCOMM Reproducibility Review Committee (RRC)
  - Central pool of proficient graduate students chaired by a senior members
- PCs may submit subset of papers to RRC
  - Papers that are likely to be accepted and claim reproducibility
- RRC may help with reproducibility shepherd
  - Helps authors to select meta data format, storage sites etc.

Metrics, Badging, Journal Fast Tracking

Requires high experience with reproducibility papers

Building Block	Initial	Evolved	Mature
Reproducibility Challenge	✓	✓	✓
Author Incentives	✘	✓	✓
Reproducibility Review	✘	✓	✓
Metrics & Badging	✘	✘	✓
Journal Fast-Track	✘	✘	✓

Conclusion

Lack of reproducibility mainly because of lack of incentives

Incentives are needed for authors *and* reproducers

We need a forum for reproducibility

Expose reproducibility and non-reproducibility

Co-locate Reproducibility Challenge with visible and established conference

Next steps

Reproducibility Challenge
@ SIGCOMM 2018?

Backup

Comparison with other approaches

ACM Conf. On Hybrid Systems: Computation and Control

Artifact Evaluation Committee

Building Block	CCR	AEC	HSCC
Reproducibility Challenge	✘	✘	✘
Author Incentives	✓	n/a[1]	✓
Reproducibility Review	✓	✓	✓
Metrics & Badging	✓	✘	✓
Journal Fast-Track	n/a	n/a[1]	✘

1: Details depend on specific venue, not central AEC.