MITATE: Mobile Internet Testbed for Application Traffic Experimentation

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Montana State University - Bozeman

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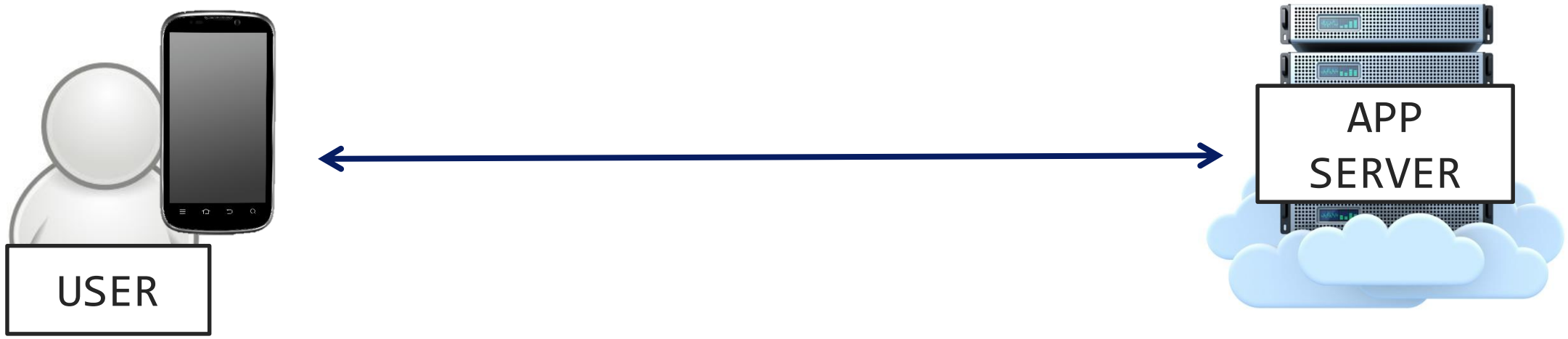
Workshop on Active Internet Measurements (AIMS'14)

Motivation



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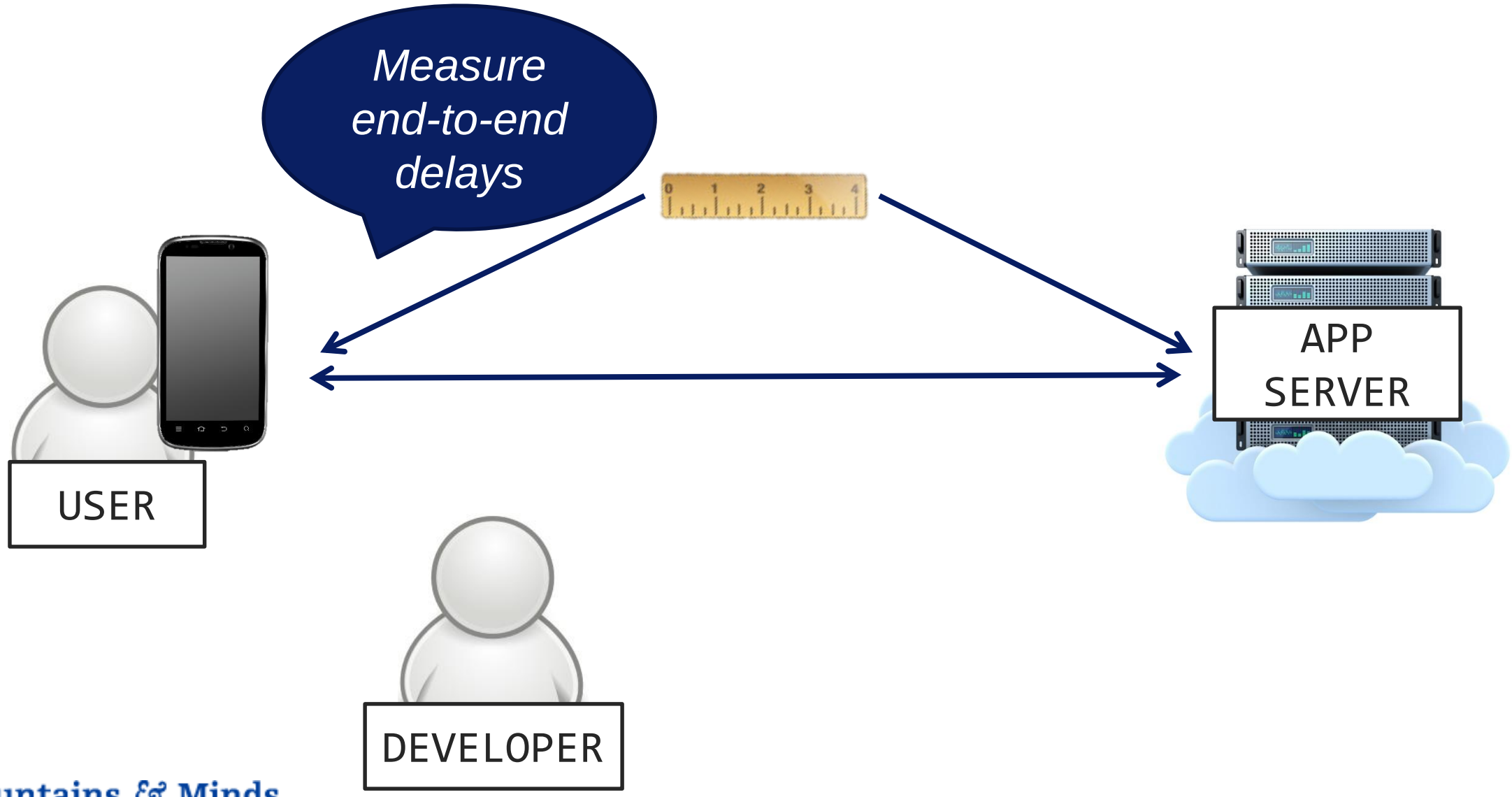

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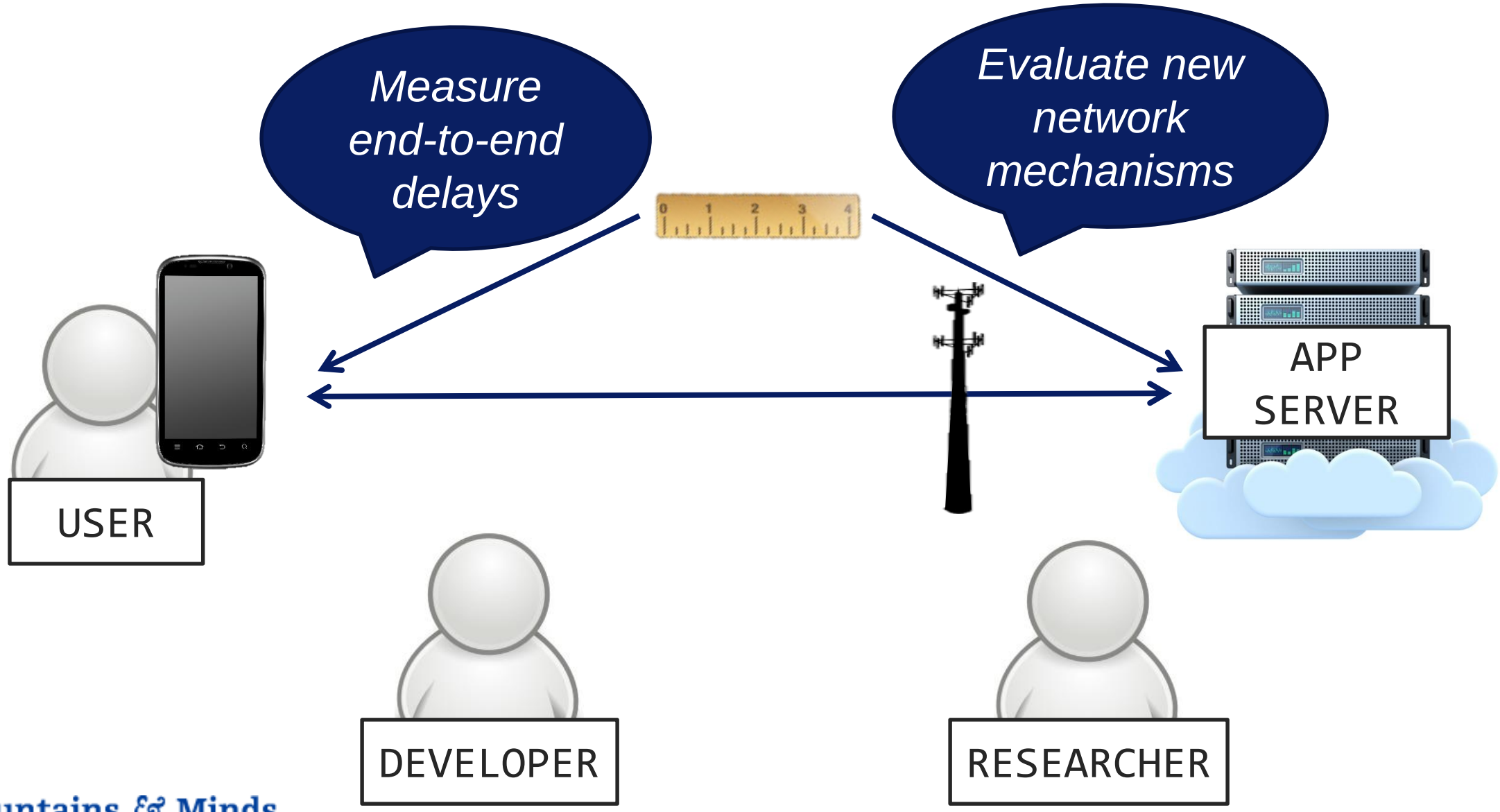
Measure end-to-end delays
Evaluate new network mechanisms
USER
APP SERVER
DEVELOPER
RESEARCHER

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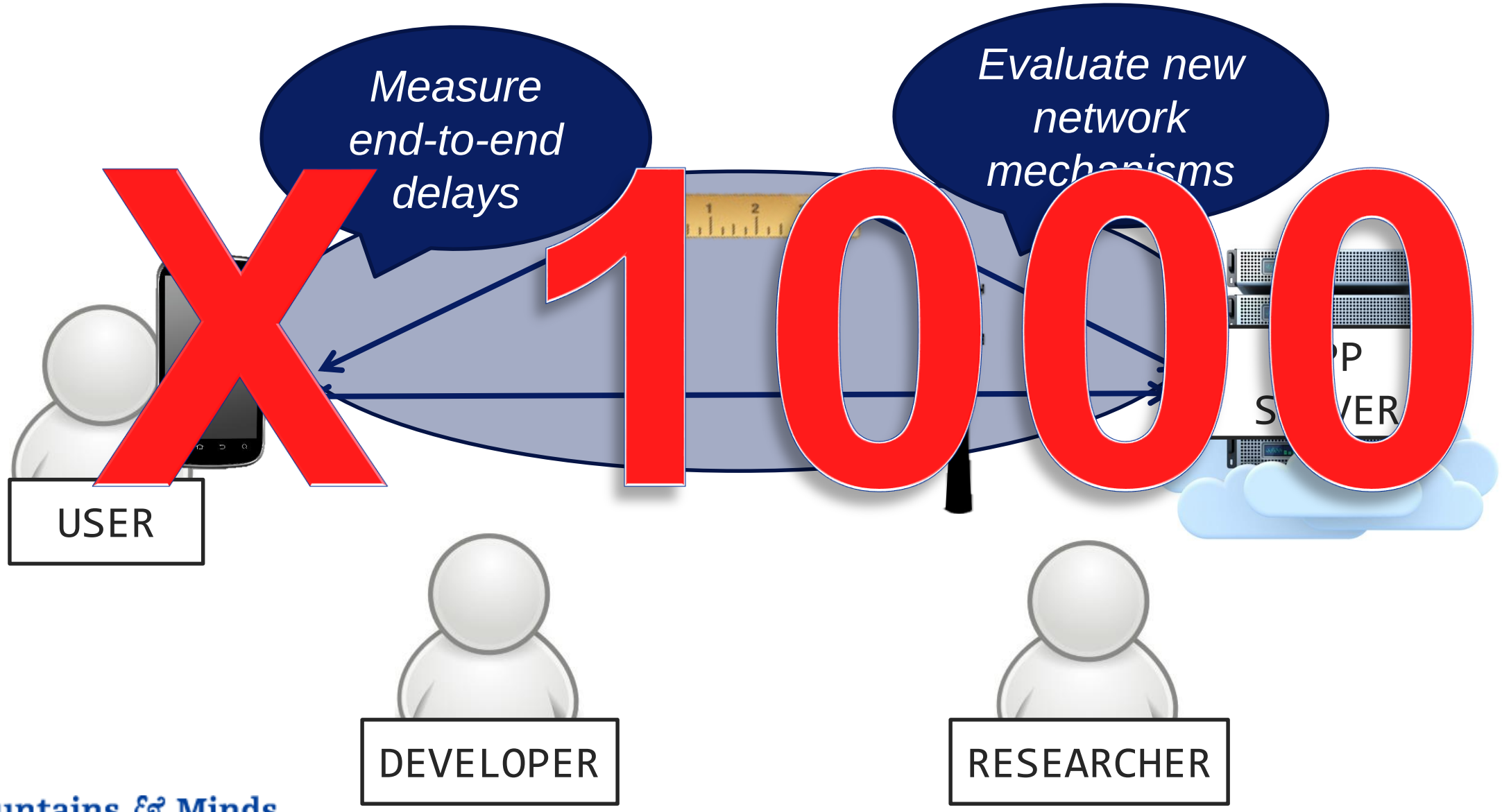
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Evaluate new network mechanisms
X 1000
USER
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MITATE

- A new platform for mobile application prototyping in live mobile networks.
- Allows experimentation with custom mobile application traffic between mobile devices and cloud infrastructure endpoints.
- A collaborative framework, in which participants contribute their mobile network resources and are allowed, in turn, to run their traffic experiments on others' devices.
- Open to the public and being deployed on Google's Measurement Lab (M-Lab).

Measurement without MITATE

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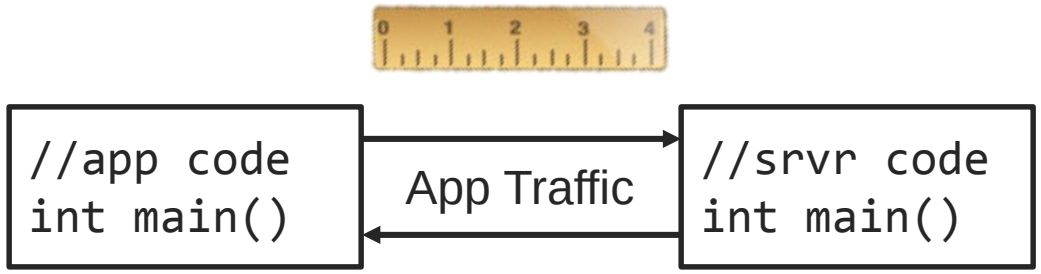
Application Implementation

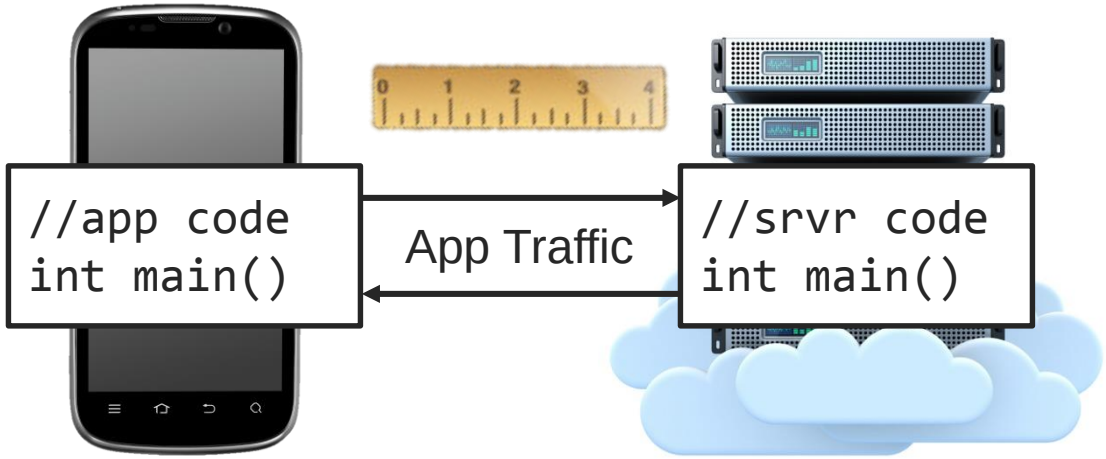
Want to measure traffic delays.



Mobile Devices

Back-end Servers

Have to deploy code to do so.



Downsides of code deployment

- Small number of volunteered devices
- Security concerns over untested code
- Restrictive APIs

How does MITATE help measurement?

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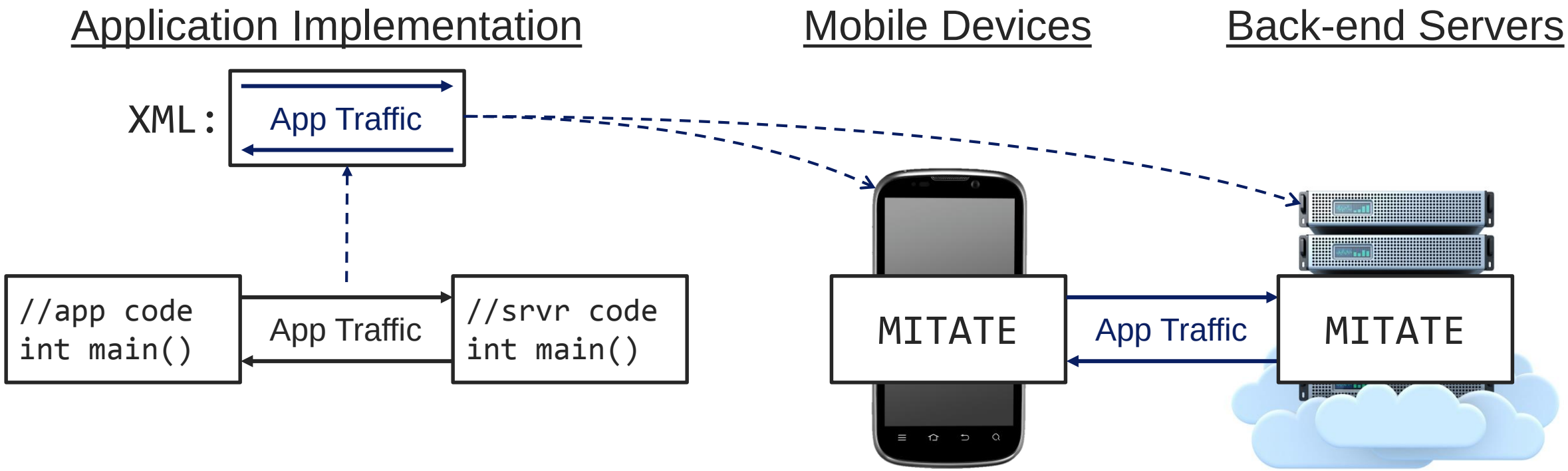
MITATE separates traffic generation from application logic



MITATE's traffic definition

- Generate traffic definitions in a form of well structured XML that defines

  – *what* the traffic looks like?
  – *where* the traffic is going?
  – *when* the traffic is to be sent?
  – *which mobile device* should execute the experiment?

Defining a transfer

```
<transfer>
    <id>transfer1</id>
    <src>client</src>
    <dst>1.2.3.4</dst>
    <protocol>UDP</protocol>
    <dstport>5060</dstport>
    <bytes>20</bytes>
    <response>0</response>
</transfer>
```

other parameters include:

- Transmission delay
- No. of packets
- Explicitly defined content

Defining transfers with explicit content

```
<transfer>
    <id>dns_req</id>
    <src>client</src>
    <dst>DNS</dst>
    <dstport>53</dstport>
    <prot>UDP</prot>
    <bytes><![CDATA[0x0100be07de55...]]></bytes>
    <response>1</response>
</transfer>
```

Defining a criteria

```
<criteria>
    <id>criteria1</id>
    <latlong>"45.666 -111.046"</latlong>
    <radius>5000</radius>
    <networktype>cellular</networktype>
    <starttime>12:00</starttime>
    <endtime>13:30</endtime>
</criteria>
```

other parameters include:

- Network carrier
- Minimum battery power
- Minimum signal strength
- Device model name

Summing up all the definitions

```
<transaction count="10">
  <criteria>
     <criteriaid>criteria1</criteriaid>
  </criteria>
  <transfers>
     <transferid delay="10" repeat="1">transfer1</transferid>
     <transferid delay="20" repeat="2">transfer2</transferid>
     <transferid delay="10" repeat="1">transfer1</transferid>
  </transfers>
</transaction>
```

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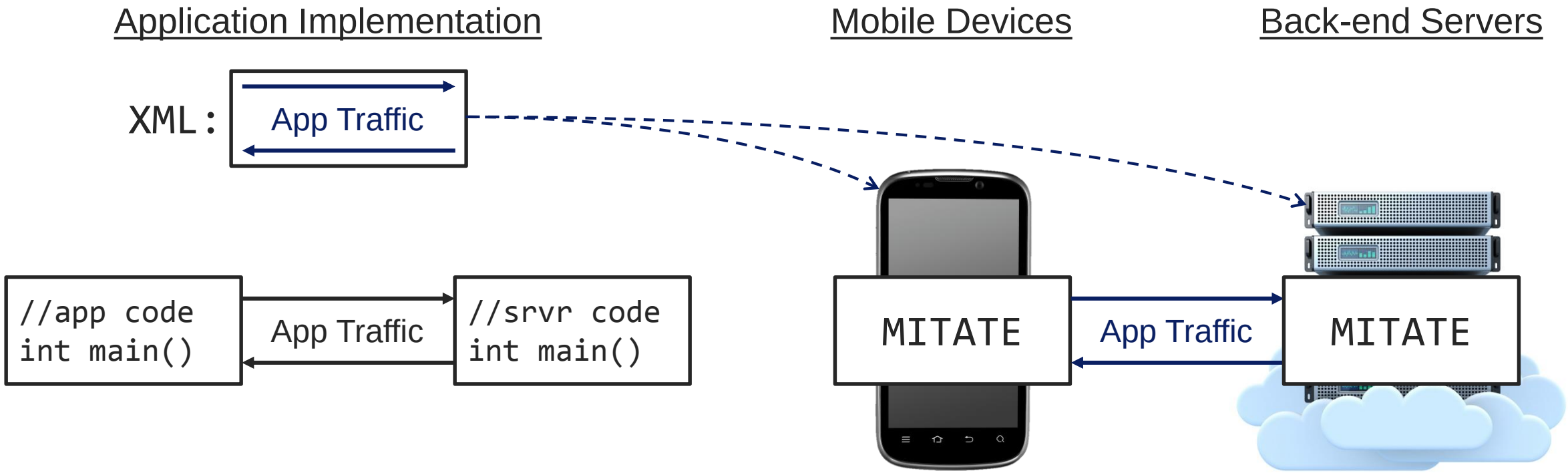

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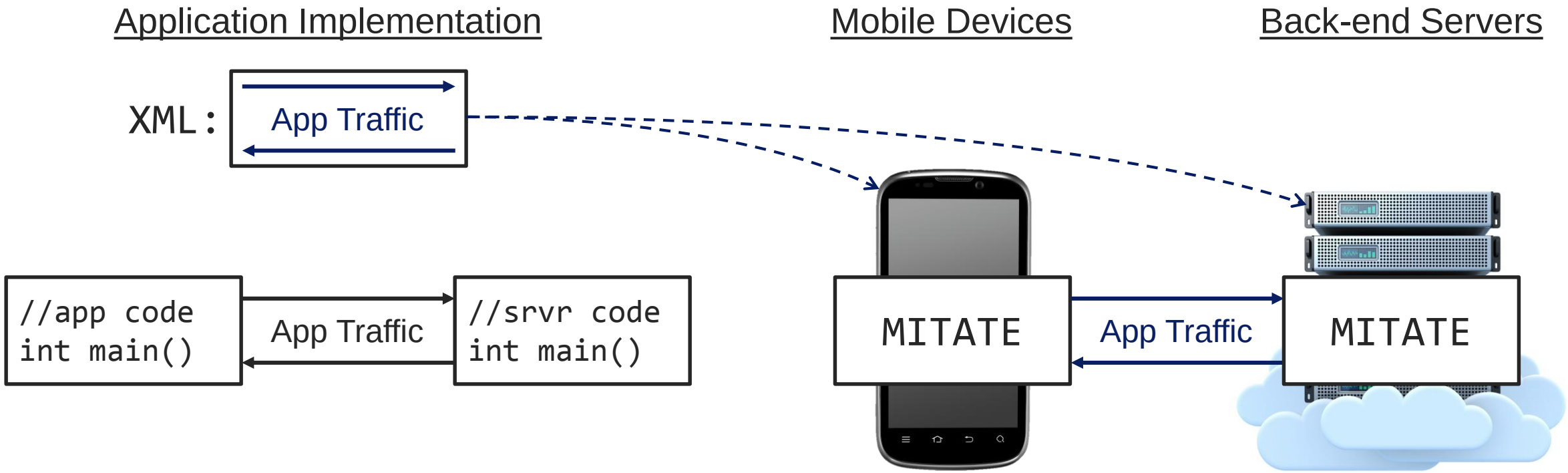

Upsides of using MITATE

- Large number of volunteered devices
- No mobile code – only traffic description shipped to mobiles
- Flexibility in traffic generation logic

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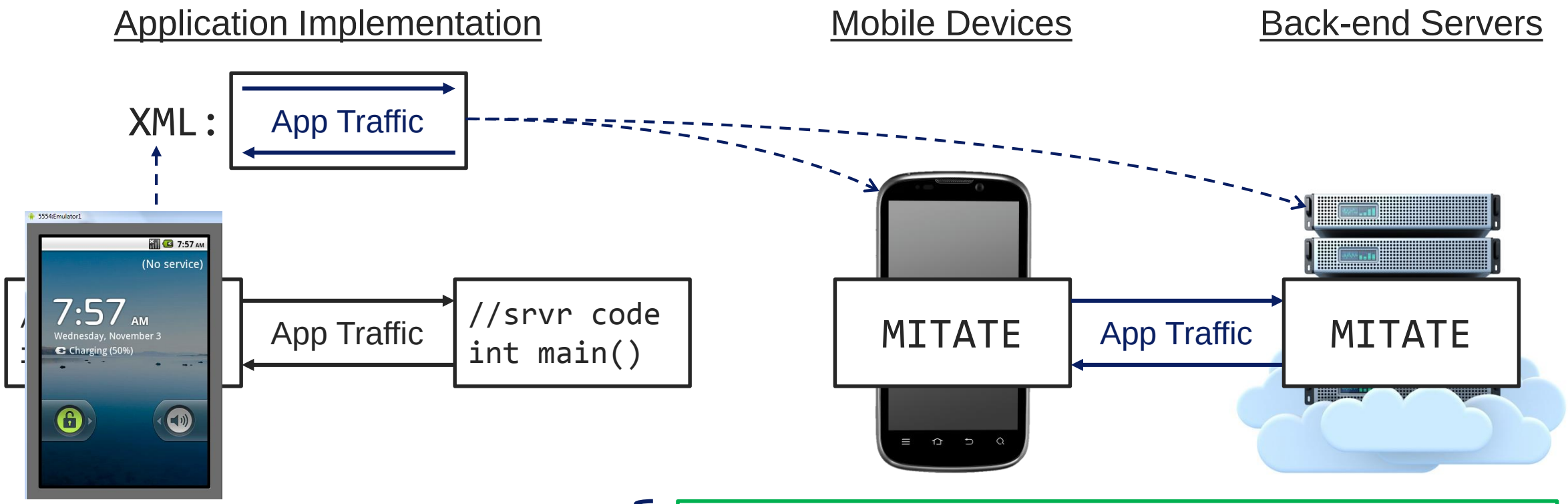

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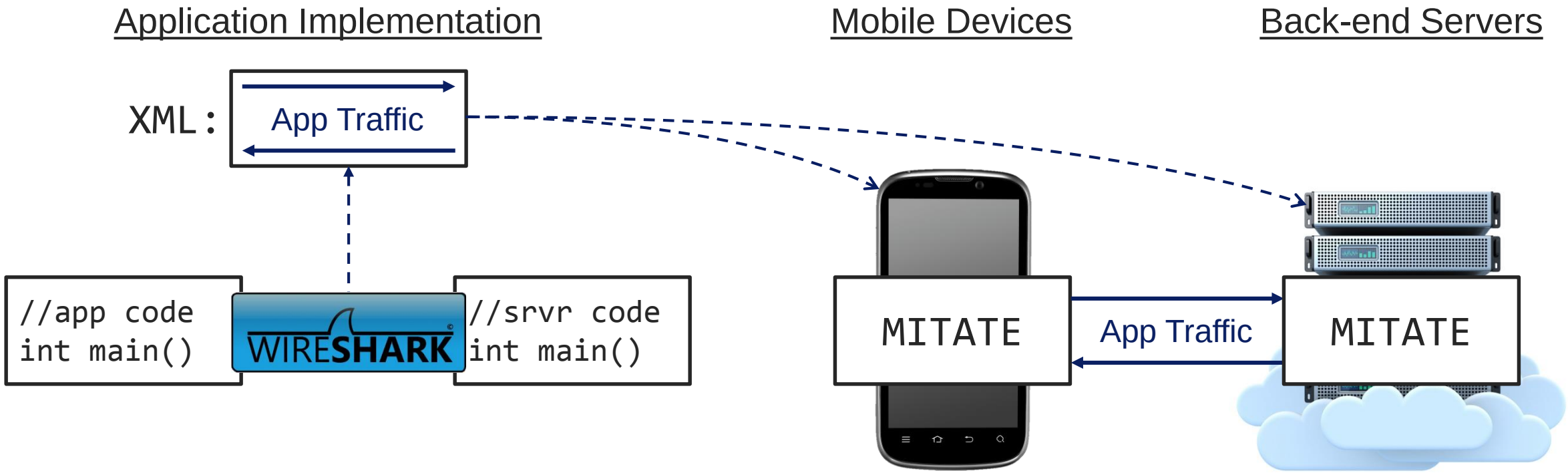

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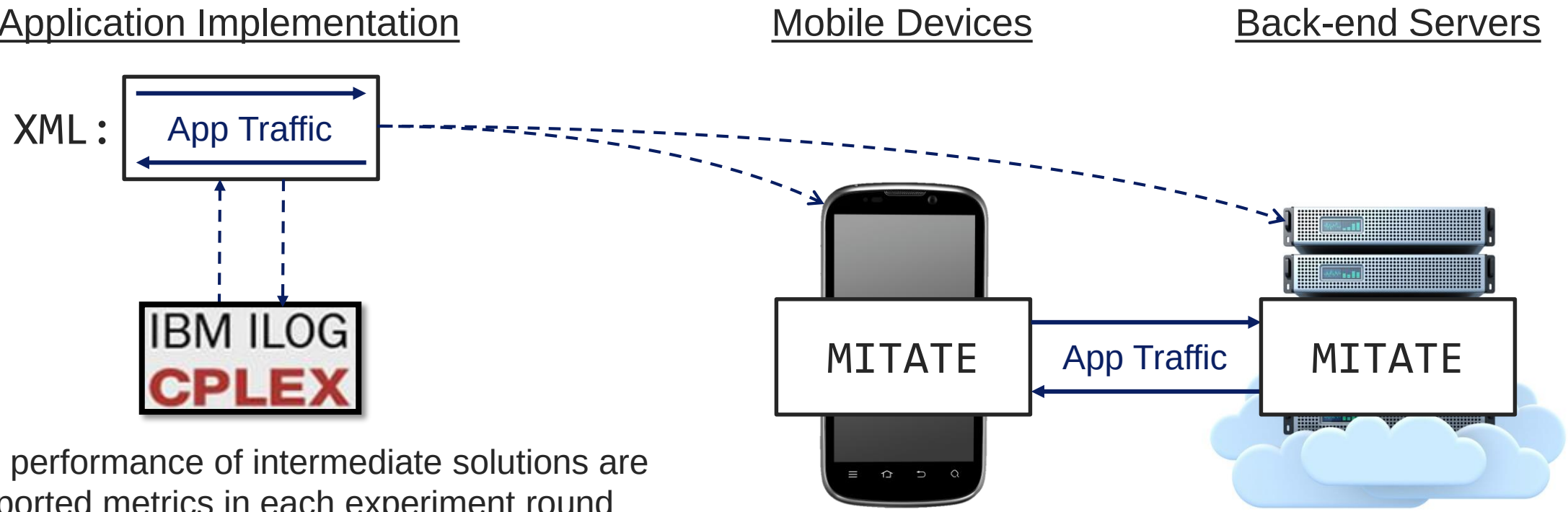

where performance of intermediate solutions are the reported metrics in each experiment round

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Challenges in deploying large scale testbed

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- Assure sufficient resource capacity for scheduled experiments.
  (Limiting resource is mobile data, subject to monthly caps)
  - Entice users to contribute resources
  - Prevent abuse of contributed resources

- MITATE jointly addresses both problems using a data credit exchange system inspired by BitTorrent tit-for-tat mechanisms

- Avoid DDoS attacks configured as MITATE experiments.
  - A MITATE user may request that multiple devices send data simultaneously, the user's credit will be rapidly depleted.
  - So even if the transmissions are malicious, they will be short-lived.

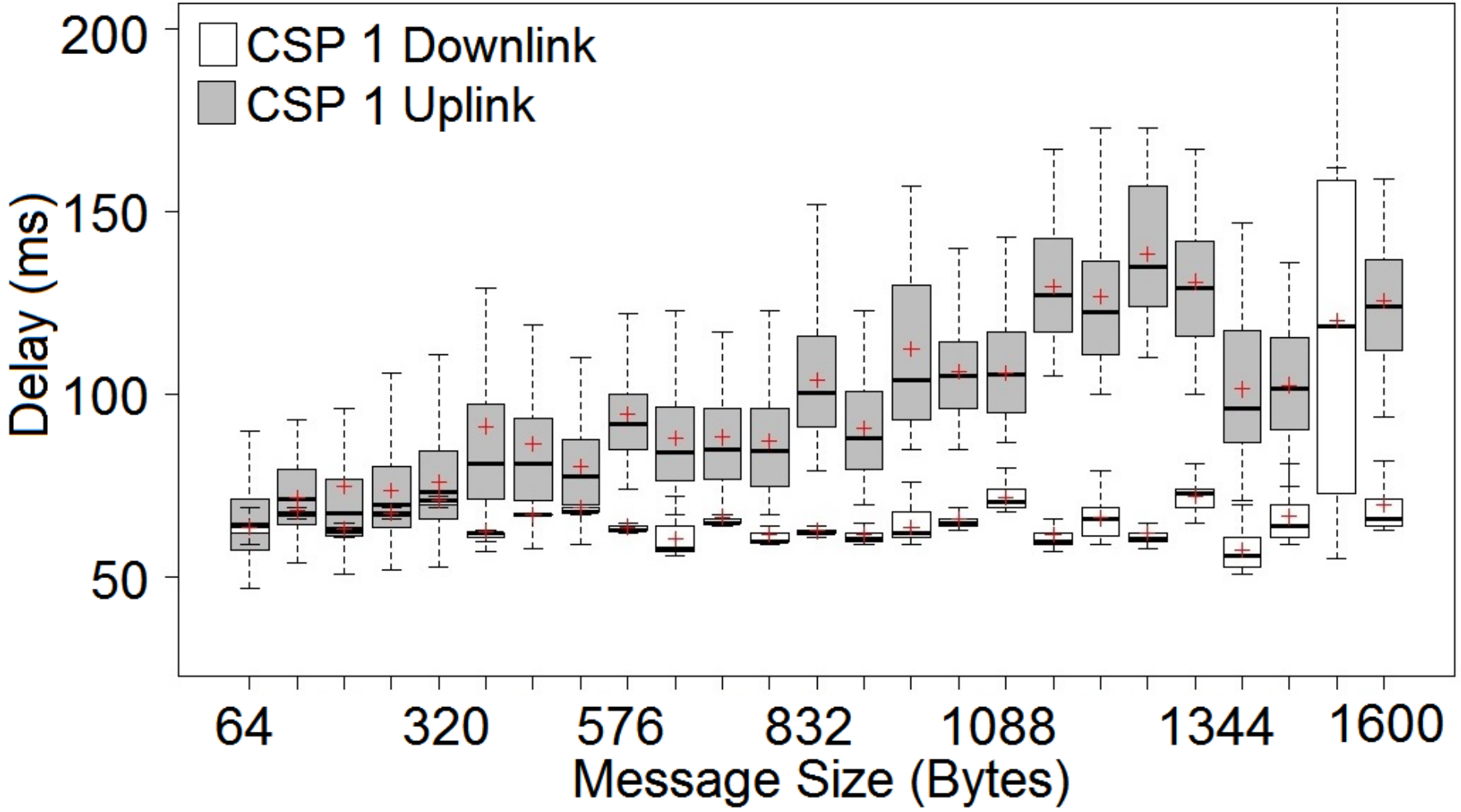
Measure of application performance

- What is the largest game state update message that can be reliably delivered under 100 ms?

- Does my application traffic need to contend with traffic shaping mechanisms?

- Which CDN provides fastest downloads through a particular mobile service provider's peering points?

Message delay vs. message size at 10AM on CSP 1 to a CA datacenter



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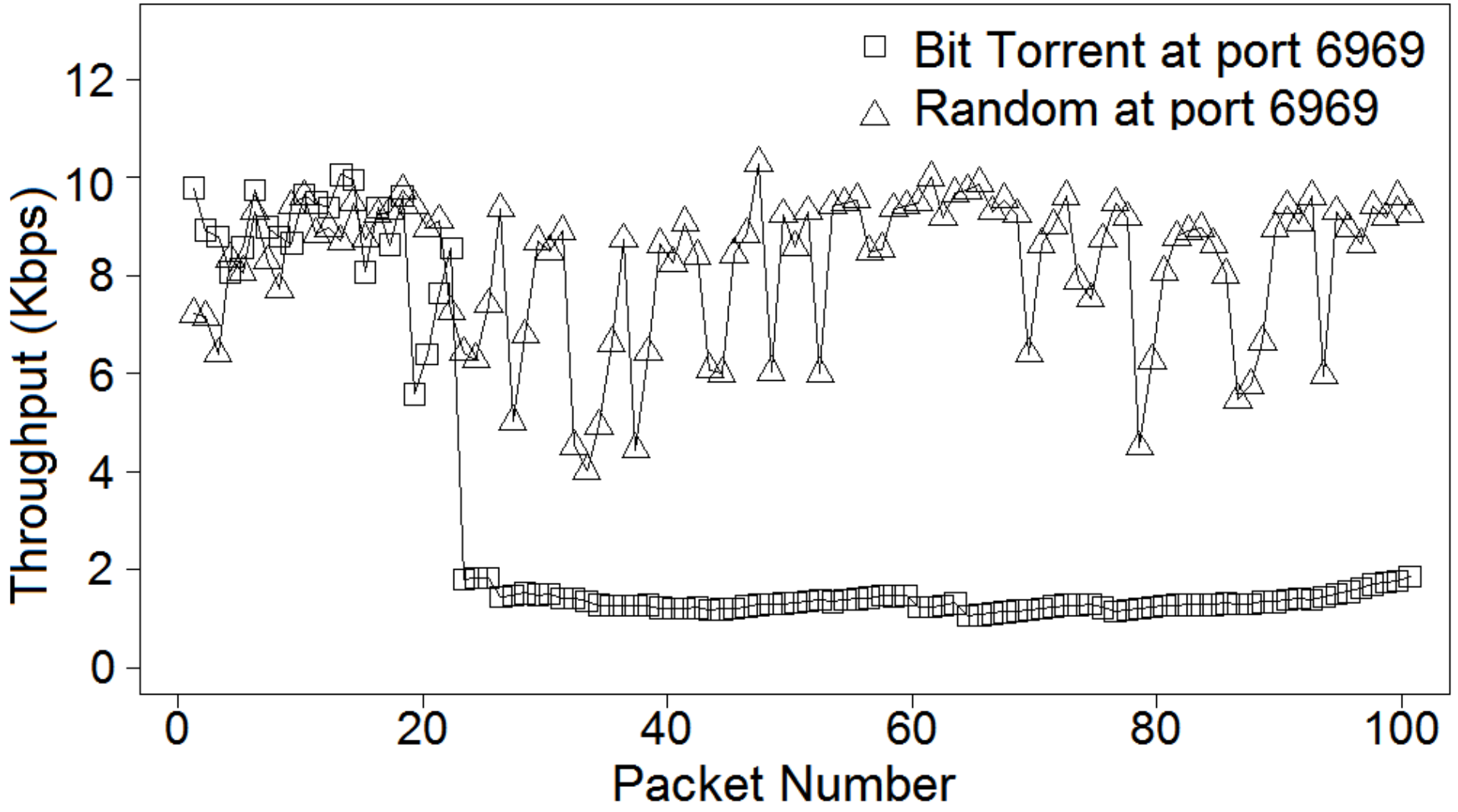
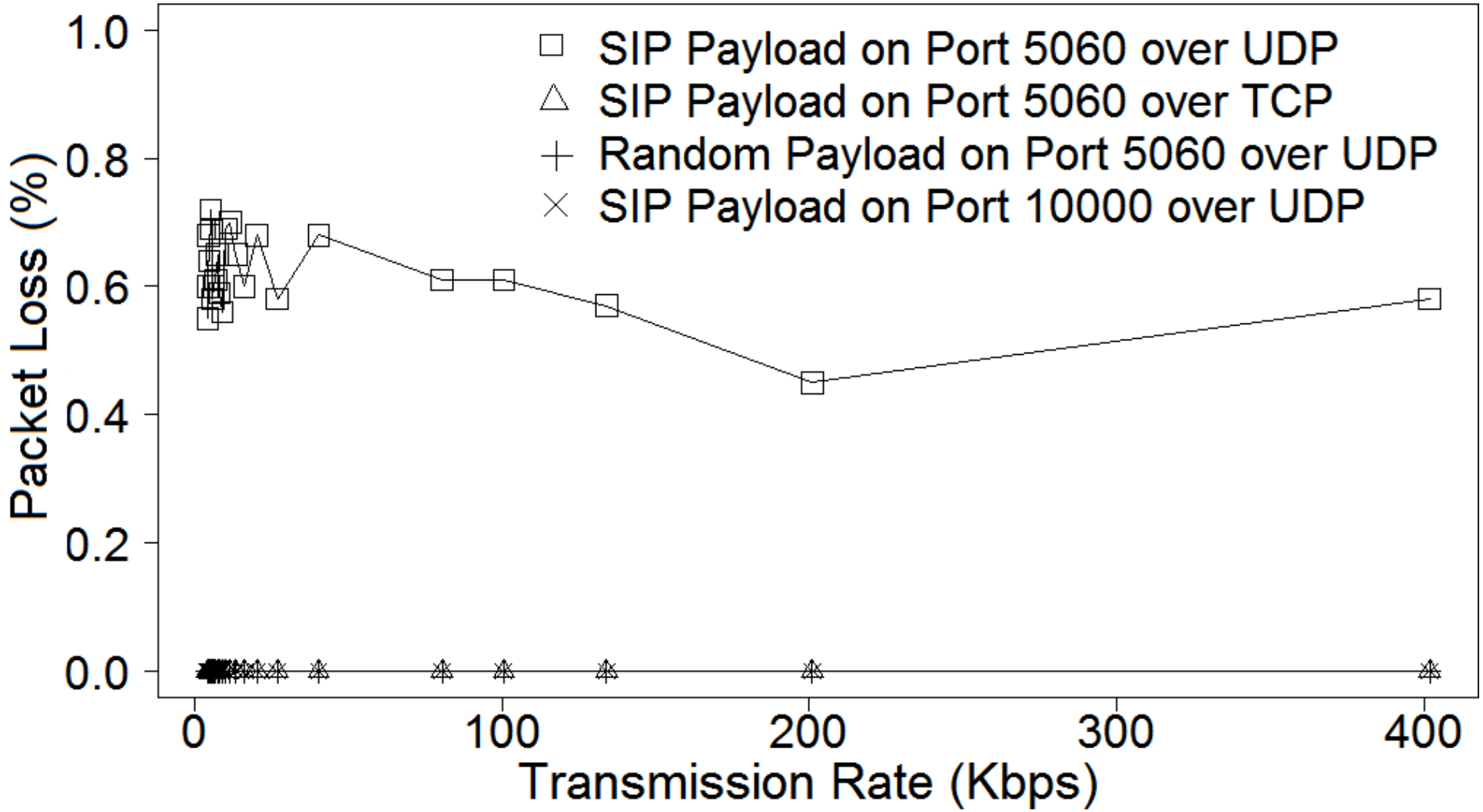
Effect of payload on CSP1



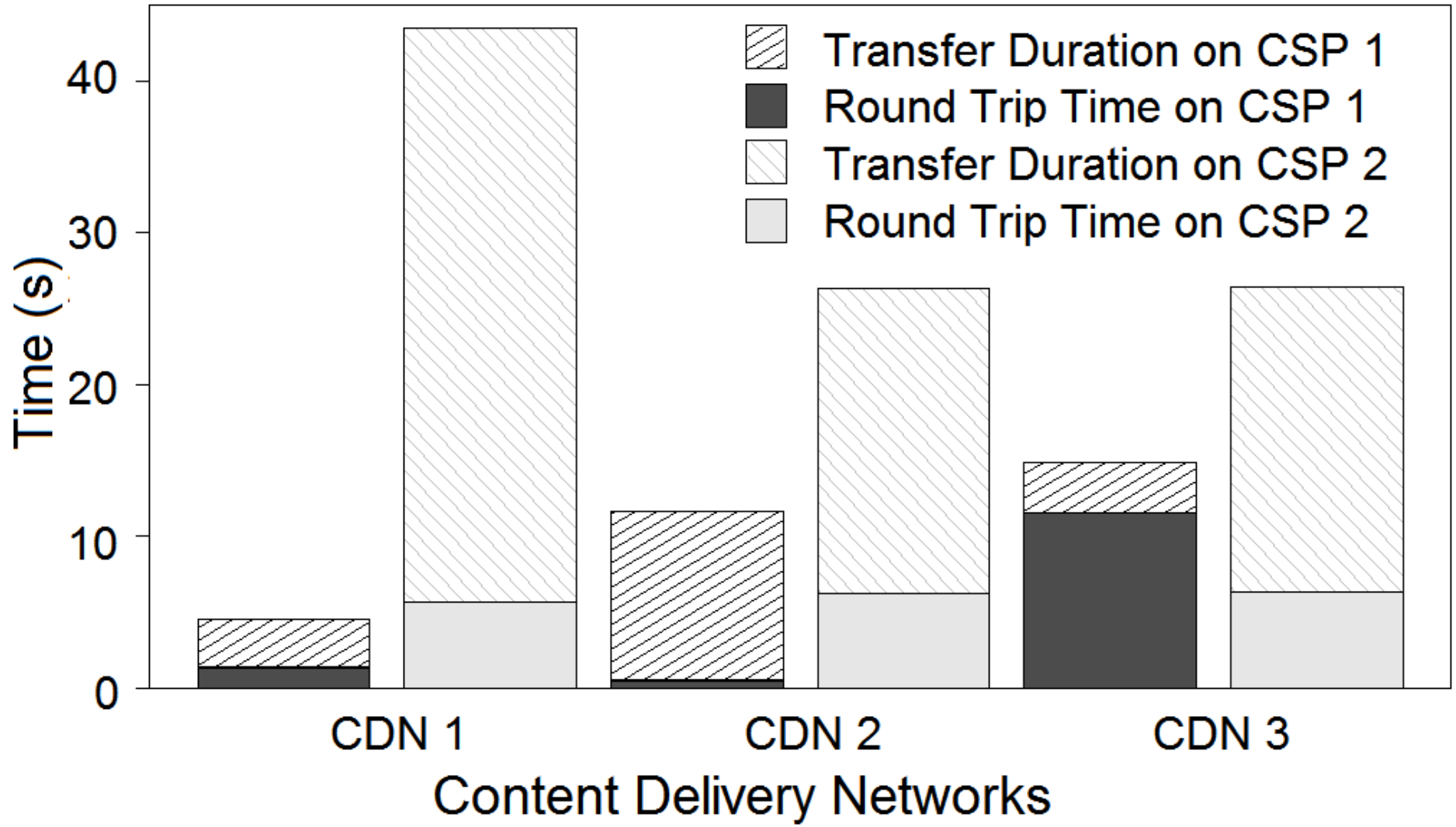
Effect of choice of transport protocols



Measure of application performance

- What is the largest game state update message that can be reliably delivered under 100 ms?
- Whether the delays are due to network allocation timeouts or due to the device entering power save mode?
- Does my application traffic need to contend with traffic shaping mechanisms?
- Which CDN provides fastest downloads through a particular mobile service provider's peering points?

Measurement based CDN selection



Conclusions

- MITATE is the first public testbed that supports prototyping of application communications between mobiles and cloud datacenters.
- MITATE separates application logic from traffic generation, which simplifies security and resource sharing mechanisms.
- We have presented data collected with MITATE experiments that affects mobile application message delay.

Requests to the audience

- Beta testers and collaborators within the mobile development and research communities to test MITATE

- Feedback on MITATE's functionality before making the tool public on M-Lab.

Learn more

- Details in our Mobiquitous'13 paper: http://www.cs.montana.edu/mwittie/publications/Goel13MITATE.pdf

- Web URL: http://mitate.cs.montana.edu
- Email: mitate@cs.montana.edu
- Code Repo: https://github.com/msu-netlab/MITATE

Thank you

Questions?

Why “MITATE”

- *Mitate* is a technique used in ukiyo-e images, as well as in other creative forms, in which many layers of meaning are layered atop one another

- MITATE allows the discovery of multiple types of mobile network performance data

A mitate-e painting by Hokusai, depicting a courtesan juxtaposed with Daruma, the founder of Zen.

http://wiki.samurai-archives.com/index.php?title=Mitate