Modeling Stateless Transport Protocols in ns-3

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- Originally from 1980s: in-order delivery, loss recovery, congestion control;
- Many major improvements: new congestion control algorithms etc.;
- Tons of minor improvements: bug fixes, specific corrections etc.
- **Store no application state on your servers**

  *AWS Tips I Wish I’d Known Before I Started*

  *(https://wblinks.com/notes/aws-tips-i-wish-id-known-before-i-started/)*

Must retain in-order delivery, loss recovery, congestion control.
Developed in Cornell in 2000s:

Sample implementation exists for Linux kernel (last commit in 2006)
- Trickle management: split, continue, terminate;
- Follows Reno congestion control algorithm: slow start, congestion avoidance, fast retransmit.
Trickles modeling

We need models for evaluating protocols:

- We need to capture only essential properties of the protocol.
- It is very hard to implement new protocols in OS kernel.
- Research community needs reproducible experiments.
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That’s why we need simulation tools.

Key features:

- Event-driven simulator.
- Contains many models of network entities, protocols etc.
- Implemented in C++.
Overview of Trickles model in ns-3

Source code is available at https://github.com/dchaly/stateless
Stages of modeling in ns-3

- Build a model of your own protocol or use existing ones.
- Describe an experiment using ns-3 classes.
- Compile, run and get a trace file:
Key insight: use data science methods. Use R!
- Raw data (traces).
- Clean data (R data frames).
- Analytic code (Markdown+knitr).
- Presentation code (Markdown+knitr).
Simple experiment

- \( r = \{1.0\,\text{Mb/s}, 2.0\,\text{Mb/s}, 3.0\,\text{Mb/s}\}; \)
- \( b = \{10\,\text{ms}, 55\,\text{ms}, 100\,\text{ms}\}; \)
- queue length varies from 70 to 100 with the step of 5 packets.

R Markdown source code is available at

https://github.com/dchaly/stateless/ns-3.20/ns3-stateless-report.Rmd
Experimental evaluation
Future work

- Evaluate model;
- Develop new stateless protocols;
- Performance analysis of stateless protocols in different settings: wired, wireless, SDN etc.