An endhost-centric approach to detect network performance problems

Good

Poor

Olivier Tilmans
olivier.tilmans@uclouvain.be

Maprg IETF 101, London
March 20, 2018

Joint work with Olivier Bonaventure
The performance of the transport layer is *indirectly monitored* in today's enterprise networks.

- Netflow tracks bandwidth usage
- Stateful middleboxes infer TCP flow states
“Authenticated and encrypted header and payload”
“Authenticated and encrypted header and payload”
Back to an end-to-end approach to understand transport layer performance
We instrument end-hosts transport stacks

End host

TCP

DNS

QUIC

RTP

Monitoring Daemon

eBPF code injection

Measurement Database

Analyzis

/end.pnum
We instrument end-hosts transport stacks and export generic statistics

End host

TCP

DNS

QUIC

RTP

Monitoring Daemon

Flow events
We instrument end-hosts transport stacks and export generic statistics.
We abstract protocols using a generic FSM and compute performance profiles on state transitions.

- New → Established
- Finished
- Network error
- Protocol error
We abstract protocols using a generic FSM and compute performance profiles on state transitions.

Each transition exports statistics, e.g.:

- Retransmissions
- Duplicated received segments
- RTT
- Jitter
- Time since the last transition
- IP nexthop/uplink ID
An endhost-centric approach to detect network performance problems

- Instrumenting end-host transport stacks
- Observing network performance
Prototype deployment on student lab computers

- Linux machines, with a non-intrusive instrumentation based on kprobes/eBPF
- TCP/DNS as examples to illustrate the methodology
- Data from the past month
- Few flows exhibit bufferbloat or reordering
Most connections are made over IPv6
Querying TCP connections experiencing SYN retransmissions across IPv4/IPv6
Comparing TCP connections experiencing more than one lost SYN
Querying TCP connections that failed to establish
Querying TCP connections that failed to establish

Most failed connections came from a weather applet
Comparing median TCP RTTs across cloud providers and IPv4/IPv6
Comparing median TCP jitters across IPv4/IPv6 and similar destinations
“Moodle is slow”
“Moodle is slow”
Data-center is 200 m away from instrumented hosts
“Moodle is slow”
Data-center is 200 m away from instrumented hosts
“Moodle is slow”
Data-center is 200 m away from instrumented hosts
“Moodle is slow”

Data-center is 200 m away from instrumented hosts

The load-balancer was overloaded
“Moodle is slow”
Data-center is 200 m away from instrumented hosts
An endhost-centric approach to detect network performance problems

olivier.tilmans@uclouvain.be

- Instruments end-host transport stacks
- Supports encryption transparently
- Defines a generic instrumentation approach
- Leverages existing tooling around IPFIX