Cake

sch_cake

Comprehensive Queue Management Made Easy

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Not a Mesh Protocol

- It's a Queue Discipline (`qdisc`) - or AQM.

- Use it with any protocol you like.

  - ...even standard static routing.

- Cake doesn't care.

Not Specialised

- Designed with wired edge nodes in mind.

  - ADSL

  - Cable

  - Fibre

- Not specialised for WiFi or LANs...

  - ...but works anyway!

Baseline

- Fq_codel is in Linux kernel mainline.
  - Codel "controlled delay" AQM
  - DRR++ flow isolation
- HTB is the de-facto standard shaper.
  - Some people use HFSC instead.
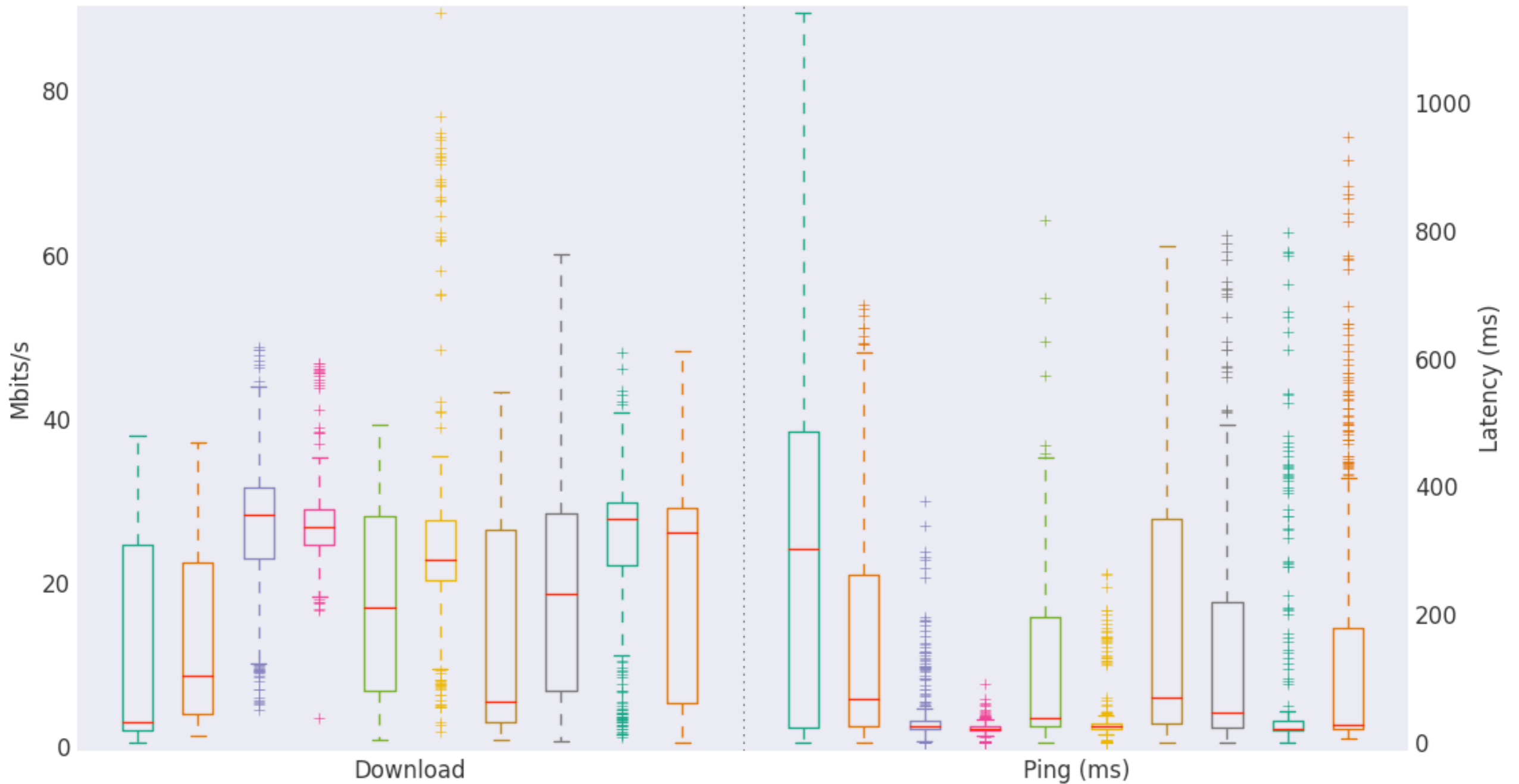- Combination requires expert setup.

AQM

- Unmanaged queue induces large delays...
  - Routinely several seconds...
  - Occasionally several minutes!
- Keep queue lengths short.
- Minimise induced delay under load.
  - Routinely around 10ms within flow.
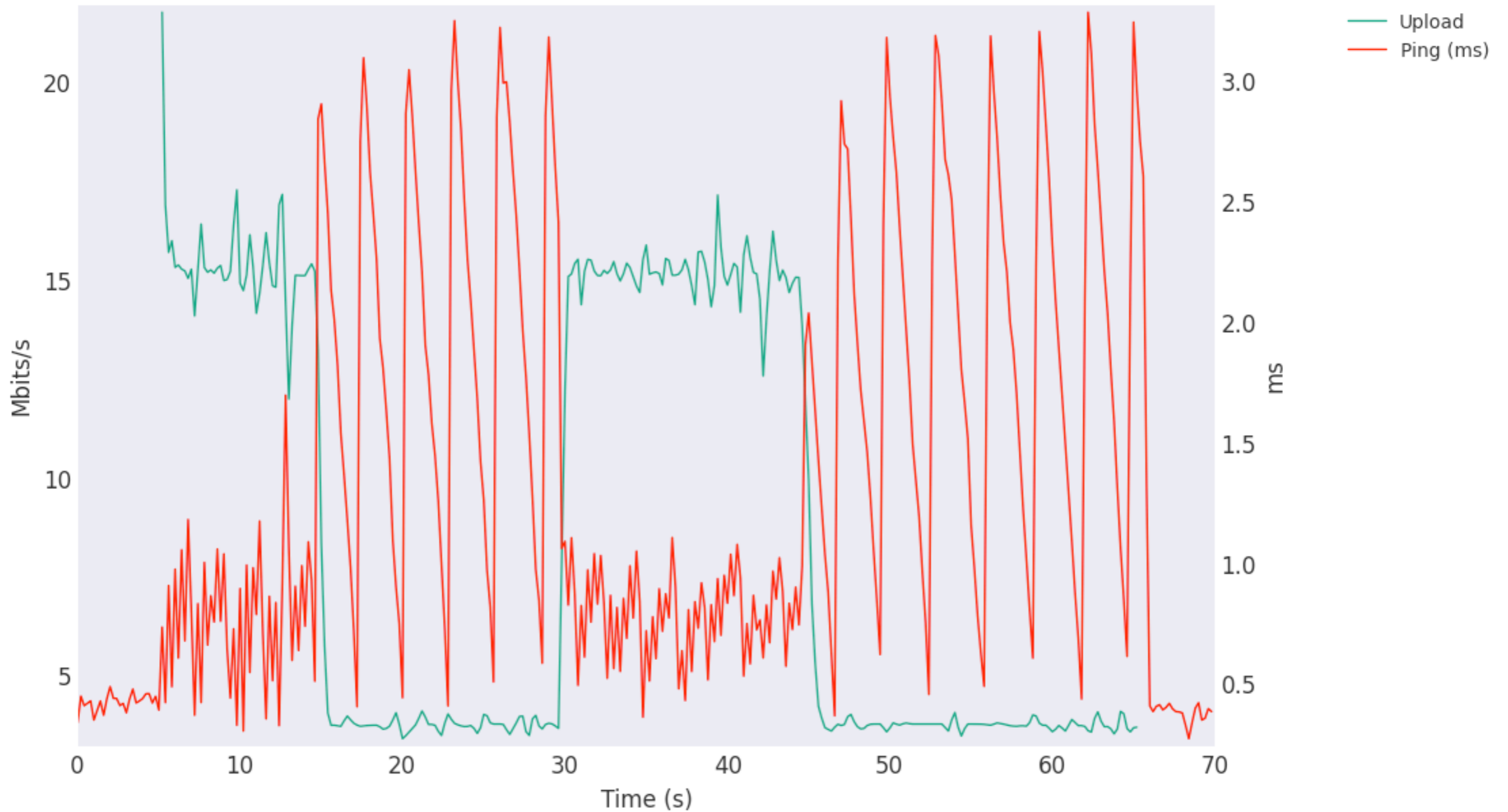
Life Without AQM
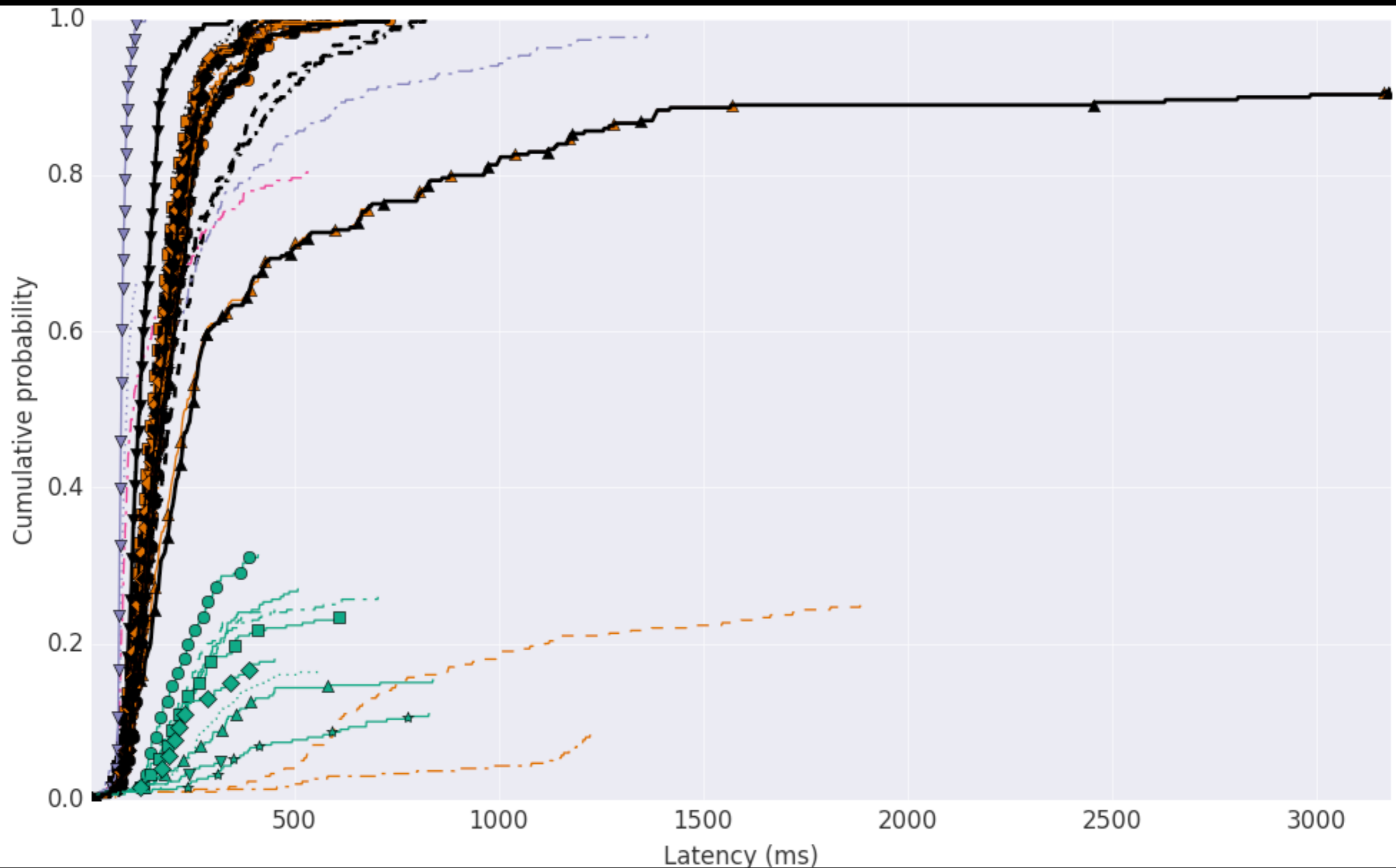
Life Without AQM

8 down - dslreports dsl test equivalent
Box plot of totals

With AQM

Single TCP upload stream w/ping
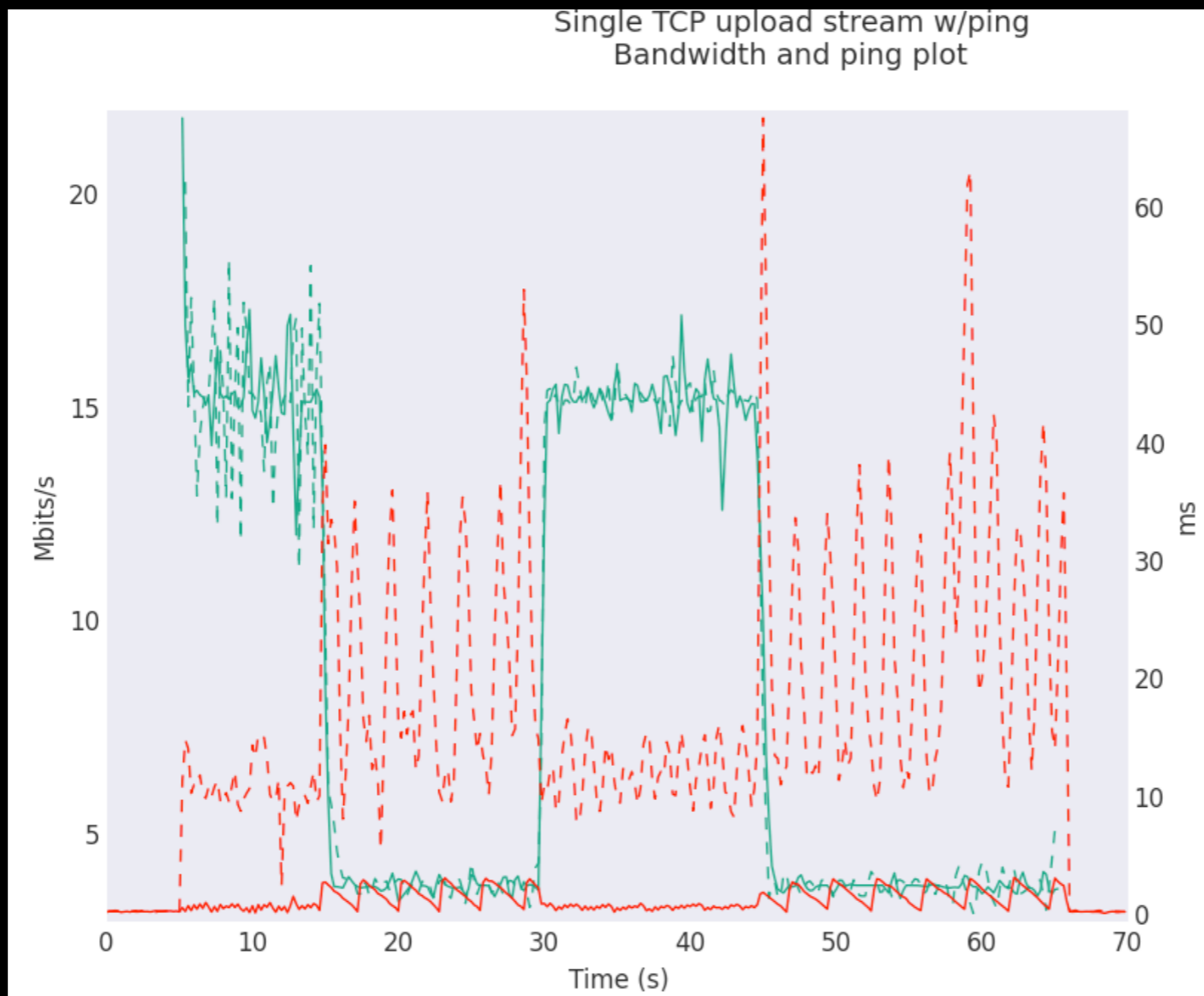Bandwidth and ping plot
4-16mbit-vary

Flow Isolation

- What most people call "fair queuing".

- Cake began with fq_codel as a core.

- Now has 8-way set-associative hashing.

- Hash collisions virtually eliminated!

Flow Isolation

Single TCP upload stream w/ping
Bandwidth and ping plot

Throughput
Delay (others)
Delay (TCP)

Priority Queuing

- DRR++

  - ...automatically promotes sparse flows.

  - Most latency-sensitive traffic is sparse.

- Four-class Diffserv support...

  - ...without strict priority.

  - ...with soft admission control.

Built-in Shaper

- Take control of the queue!

- Limit channel utilisation per node.

- Works in deficit mode - minimal bursting.

- Tight integration eliminates standing queue between flow-isolator and shaper.

Overhead Compensation

- On wire/air, IP packet encapsulated further:

  - Ethernet frame

  - PPPoE / PPPoA

  - ATM cell quantisation

  - RF pre/postamble

- Cake can account for (some of) these.

Lean & Mean

- 100+ Mbps on a WNDR3700.

- 300+ Mbps on a WRT1900AC v2.

- Less CPU per packet than HTB. Just HTB.

- Less RAM than multiple fq_codels.

- No compromises required.
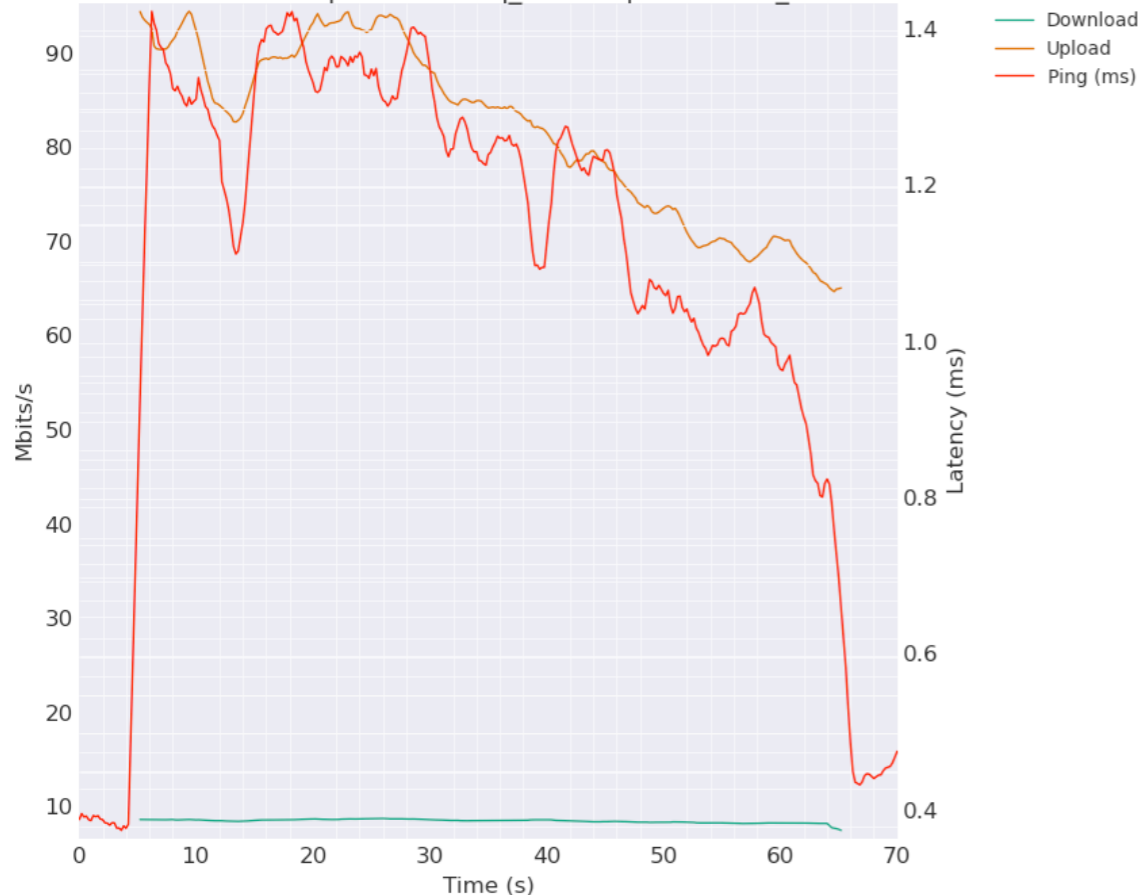
Archer C7
HTB can't shape at 115Mbps
Cake can.

HTB + fq_codel

Cake
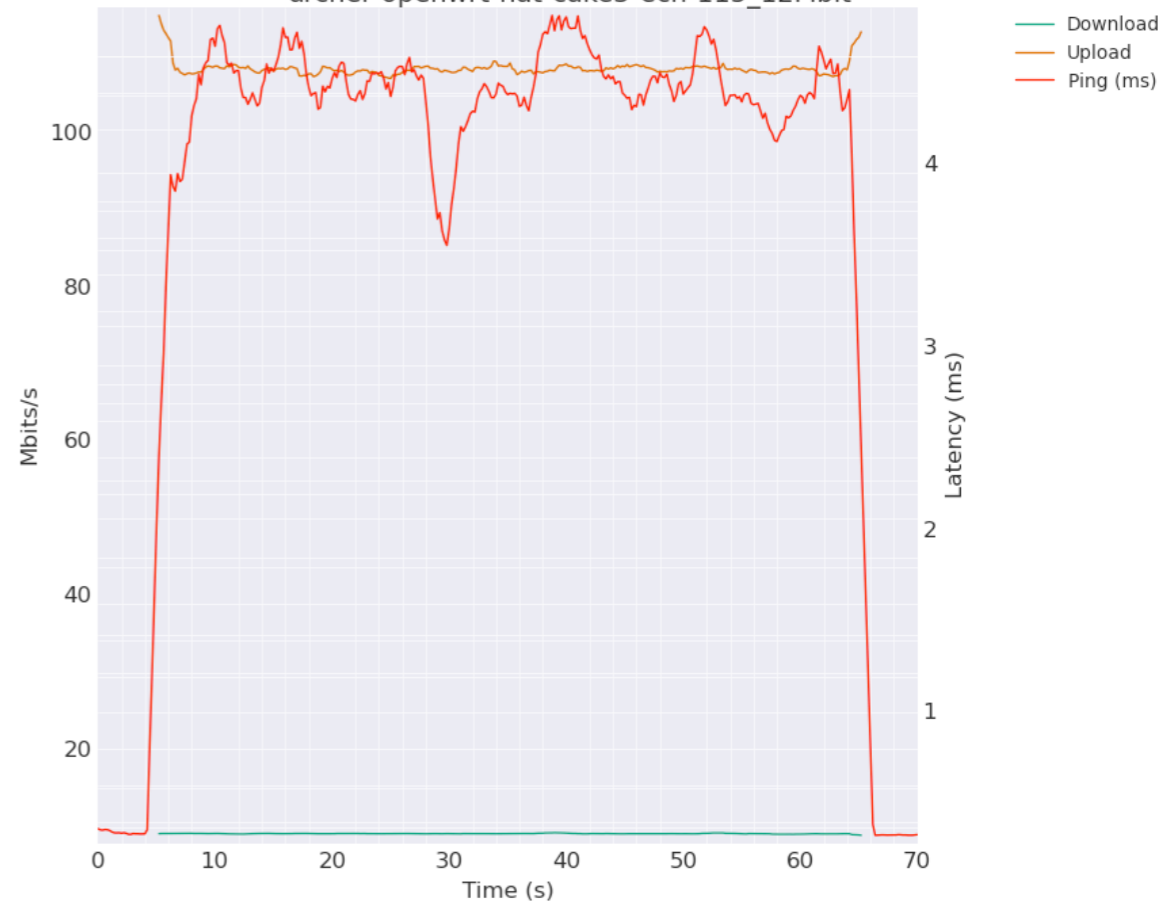
Lean & Mean

- Replace four 802.11e hardware queues...

  - ...each with their own buffer allocation...

- One queue

  - Less RAM

  - Less latency

  - No strict priority - no starvation!

Easy to Configure

- One stop shop - one 'tc' invocation _{per interface.}

- Sensible defaults for unspecified params.

  ```
  tc qdisc add dev eth0 root handle 1: cake bandwidth 10Mbit
  ```
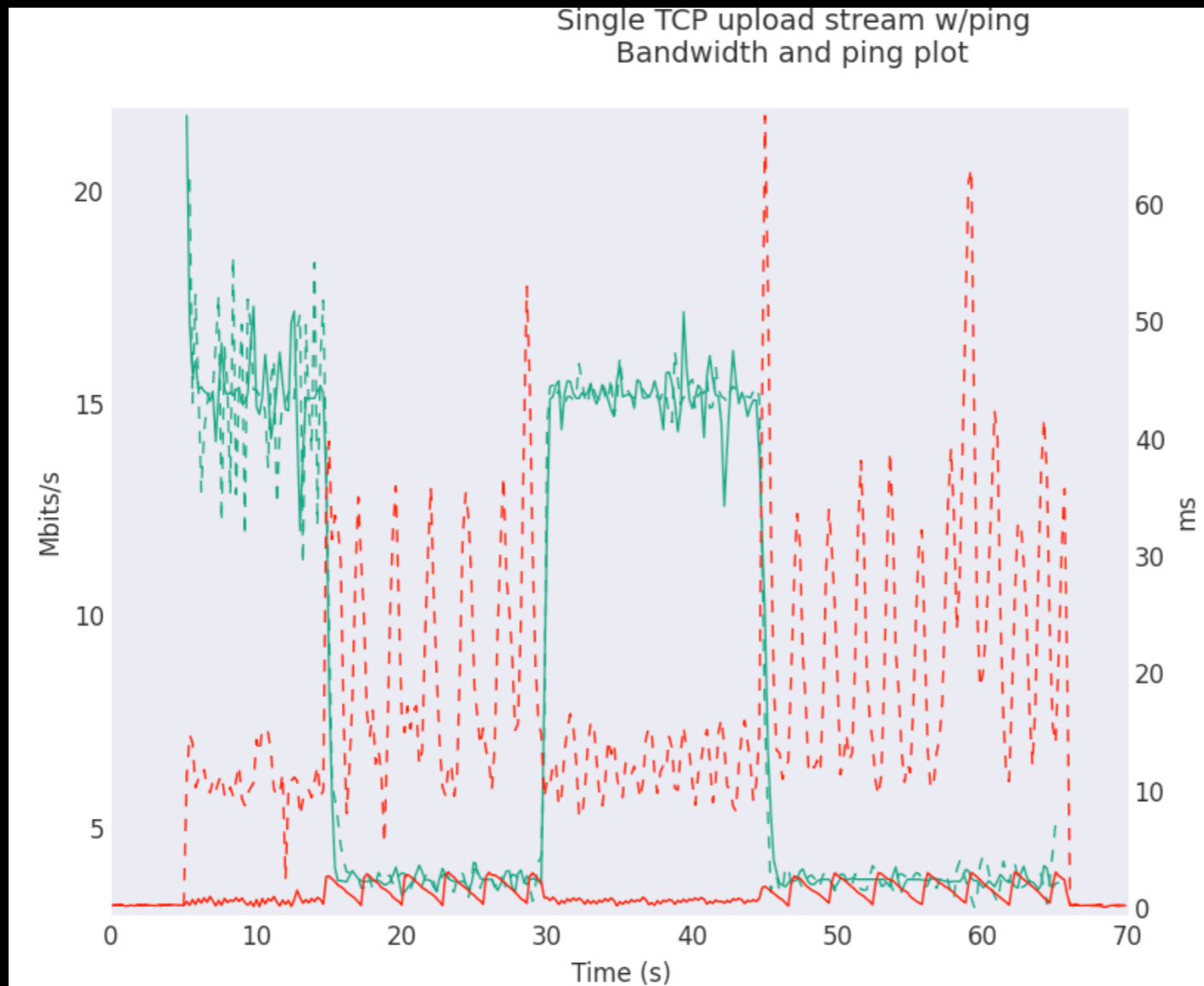
- Change parameters on the fly:

  ```
  tc qdisc change dev eth0 handle 1: cake ...
  ```

  Without losing packets!

Modelling Bandwidth Changes

- Change cake's bandwidth on the fly...

  - ...model a variable Wi-Fi link!

Easy to Configure

- One stop shop...

- Concise shortcuts for common ISP framings:

```
pppoa-vcmux    -> atm overhead 10    # Efficient ADSL

pppoe-llcsnap -> atm overhead 40     # Lazy ISP's ADSL

bridged-ptm    -> noatm overhead 19  # VDSL
```

...and more...

Summary

- Efficient shaper (replaces inefficient HTB)

- Diffserv support (which is halfway sane)

- Does everything fq_codel does (but better)

- Eating my own dogfood!

- Still being improved...

How?

- ## Get out-of-tree kernel module

```
git clone https://github.com/dtaht/sch_cake
```

- ## Get patched iproute2

```
git clone https://kau.toke.dk/git/cake/iproute2
```

- ## Get OpenWRT packages

```
git clone https://github.com/dtaht/ceropackages-3.10
        cd net/kmod-sched-cake
        cd net/tc-adv
```