Cubic Quiescence: Not So Inactive

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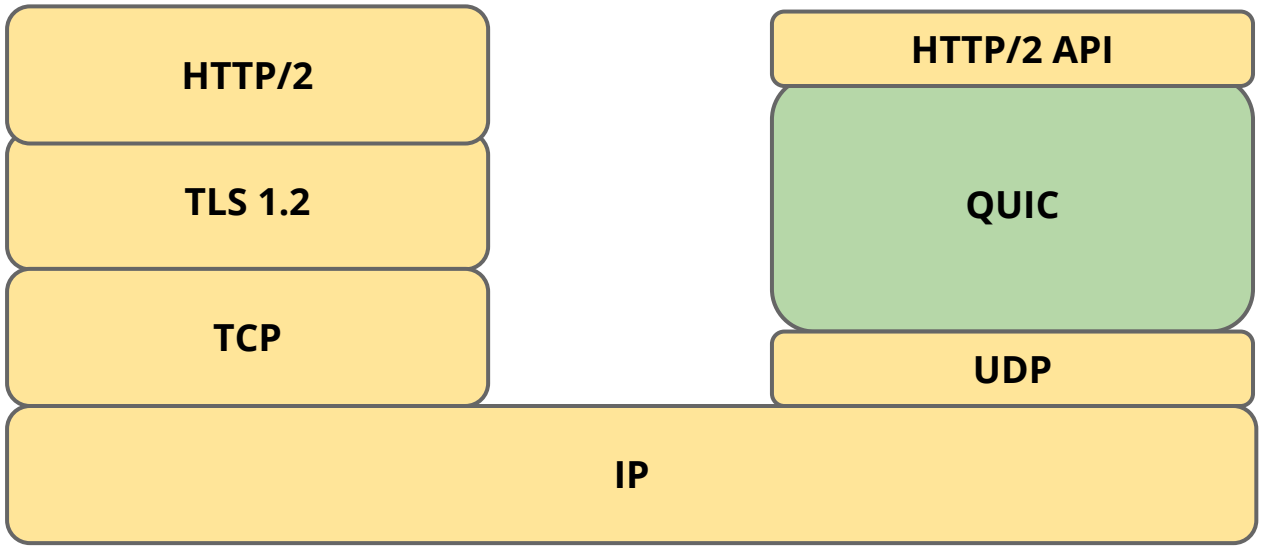
QUIC

Quick **U**DP **I**nternet **C**onnections

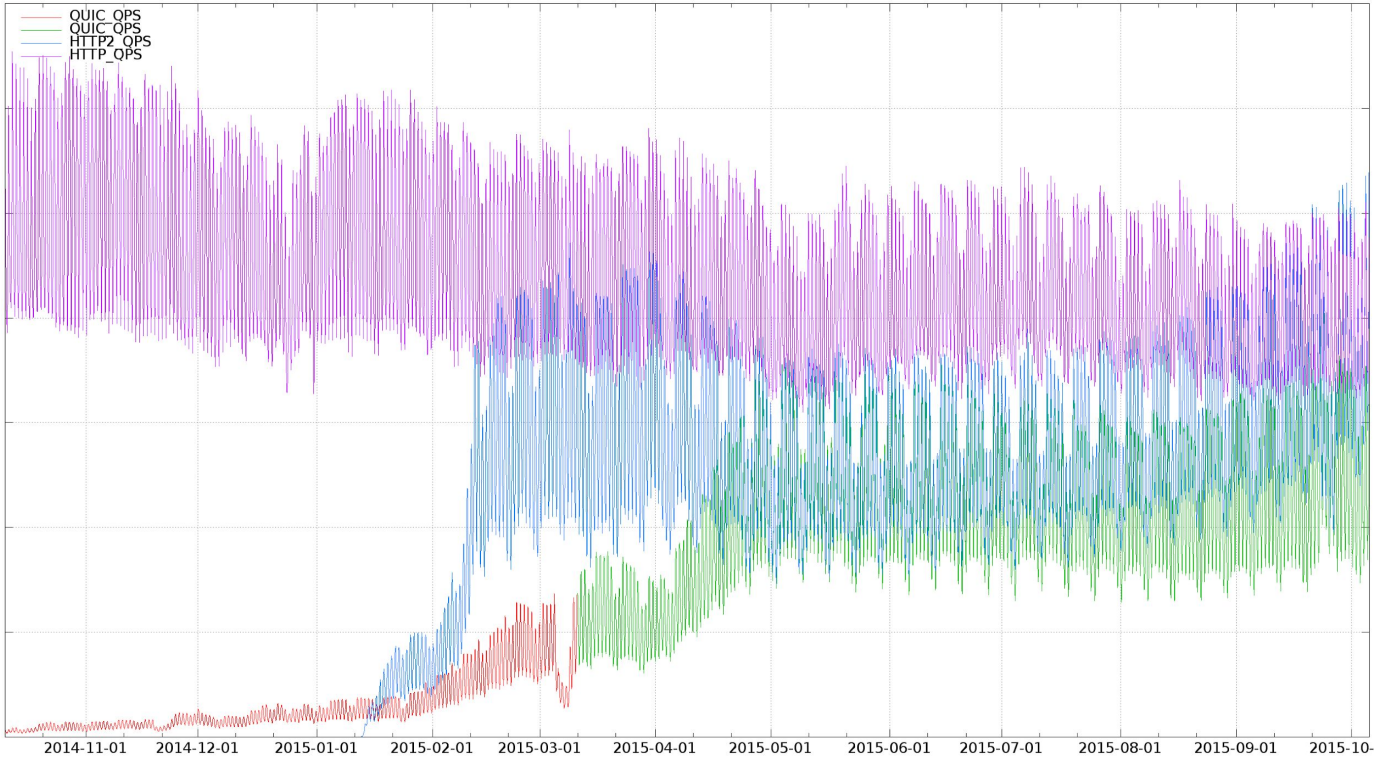
- A reliable, multiplexed transport over UDP
- Always encrypted
- Reduces latency
- Runs in user-space
- Open sourced in Chromium

What is QUIC?



Deployment over the last year

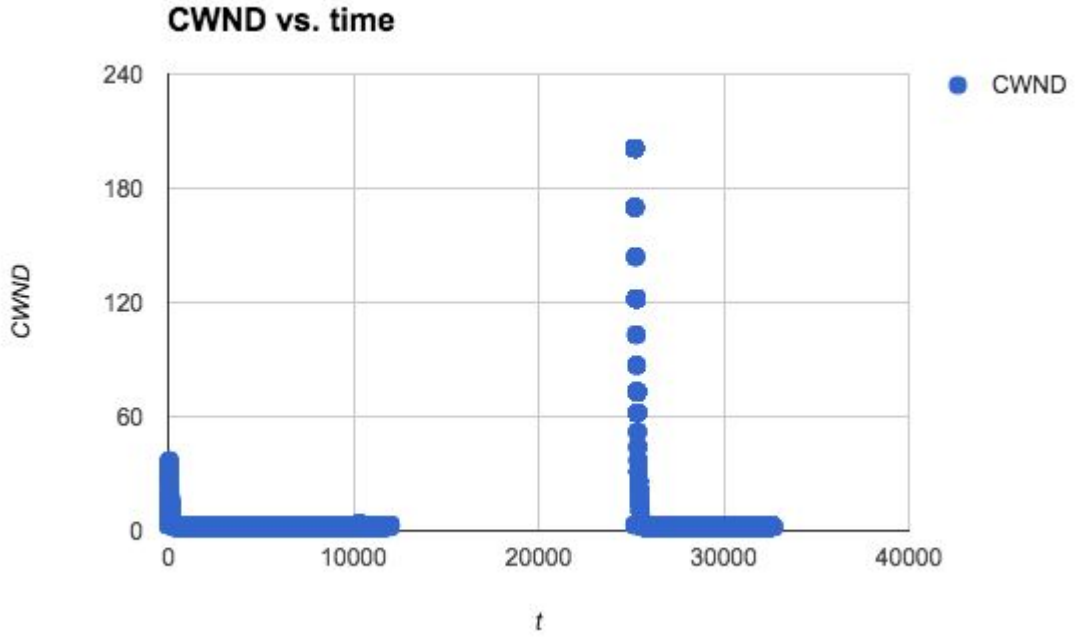
Used by the vast majority of Google services and Chrome



QUIC and the decade old Cubic Bug

- Cubic is the default congestion control in Linux
- QUIC has an independent implementation of Cubic
- QUIC also uses Cubic by default

Both had a bug that rapidly increased the congestion window during idle.



QUIC and the decade-old Cubic bug

From the Cubic paper:

More specifically, the congestion window of CUBIC is determined by the following function:

$$W_{cubic} = C(t-K)^3 + W_{max} \quad (1)$$

where C is a scaling factor, t is the elapsed time from the last window reduction, W_{max} is the window size just before the last window reduction, and $K = \sqrt[3]{W_{max}\beta/C}$, where β is a constant multiplication decrease factor applied for window reduction at the time of loss event (i.e., the window reduces to βW_{max} at the time of the last reduction).

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- Improved CPU efficiency for QUIC noticeably
  - fewer packets sent
  - fewer NACKs processed

- TCP Cubic fix upstreamed to Linux

A couple of takeaways

Running in userspace helps

- Bug discovered via packet-level logs inspection
- Cheap userspace memory allows detailed logging

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Cubic is a complex beast

- And its benefits for the Internet are not exactly clear-cut
  - many differences from NewReno, not all useful
  - some parts may be helping, should be isolated