BBRv2 Update:

QUIC Tweaks and Internet Deployment

TCP BBR: Neal Cardwell, Yuchung Cheng, Kevin Yang
Soheil Hassas Yeganeh, Priyaranjan Jha, Yousuk Seung, Luke Hsiao, Matt Mathis
Van Jacobson

QUIC BBR: Ian Swett, Bin Wu, Victor Vasiliev

https://groups.google.com/d/forum/bbr-dev

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The following tweaks have gotten QUIC’s BBRv2 close to BBRv1 Video QoE and on par for Search Latency

Core issues:

- Setting inflight_hi
- Early PROBE_UP exit
- Excessive time in PROBE_RTT
Exiting STARTUP due to loss:

\[
\text{Inflight}\_hi = \text{BDP}();
\]

Setting \text{inflight}\_hi to BDP => likely to be CWND limited before max bandwidth

Once \text{inflight}\_hi is low, it can be difficult or impossible to grow (see later)
Exiting STARTUP due to loss:

Inflight_hi = max(BDP(), max_delivered_in_round)

Bytes delivered in a round indicates the pipe is at least that large

Less bandwidth crash with aggregation
Early PROBE_UP exit

PROBE_UP can exit early due to ‘queuing’

Exit if:

In PROBE_UP for at least min_rtt AND bytes_in_flight >= 1.25 * BDP() + 2*MSS

If you’re not in PROBE_UP, you can’t increase inflight_hi

If inflight_hi doesn’t increase, you may never achieve original max bandwidth
Exit if:

In PROBE_UP for at least 1 \textit{round} AND
bytes\_in\_flight >= 1.25 \times BDP() + 2\times MSS + \textit{extra\_acked}

Avoids immediately exiting PROBE_UP in the presence of aggregation
Newer Idea

Instead of always adding extra_acked, what about checking for a persistent queue?

Exit if:

In PROBE_UP for at least \textbf{1 round AND}
\[ \text{min\_bytes\_in\_flight\_in\_round} > 1.25 \times \text{BDP()} + 2 \times \text{MSS} \]

Allows skipping the app-limited check

Can also be used for STARTUP exit ([code](#))

*Insignificant application data so far*
**Problem:** PROBE_RTT limits CWND to \(\frac{1}{2}\) BDP, so \(<\frac{1}{2}\) the bandwidth

**Observation:** Flows that go idle in PROBE_RTT come out in PROBE_RTT for one round trip

**Solution:** Exit PROBE_RTT upon exiting idle if the elapsed time is large enough

Avoids an extra round trip in PROBE_RTT

Turns out TCP independently landed this fix!