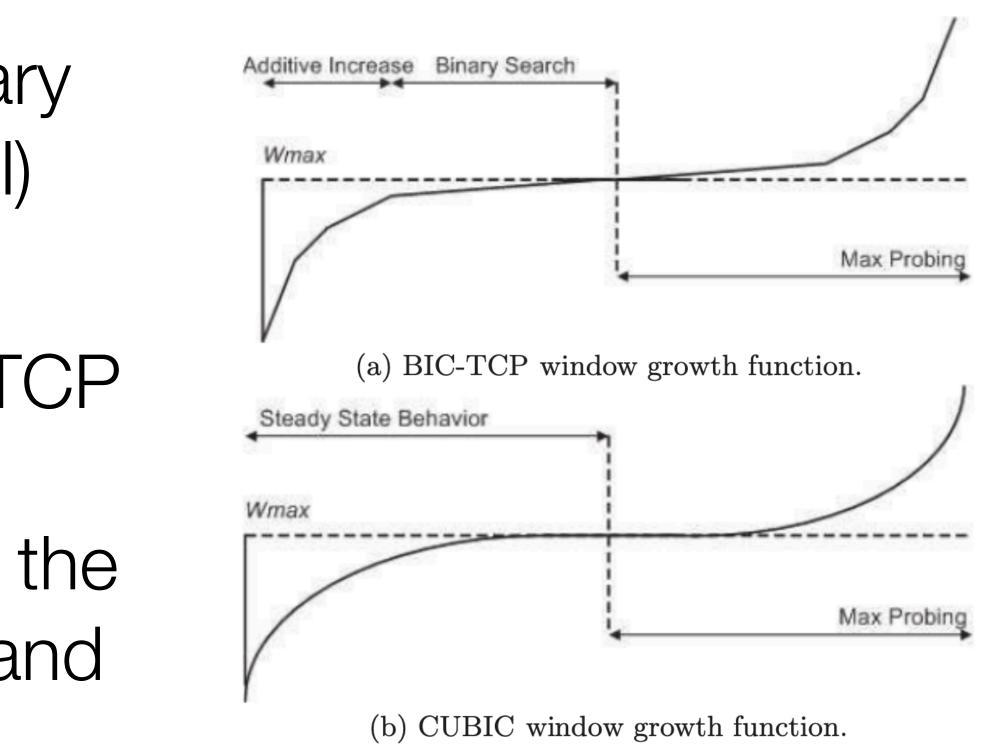
CS 925Lecture 12 TCP Congestion Control

Thursday, February 29, 2024

TCP CUBIC

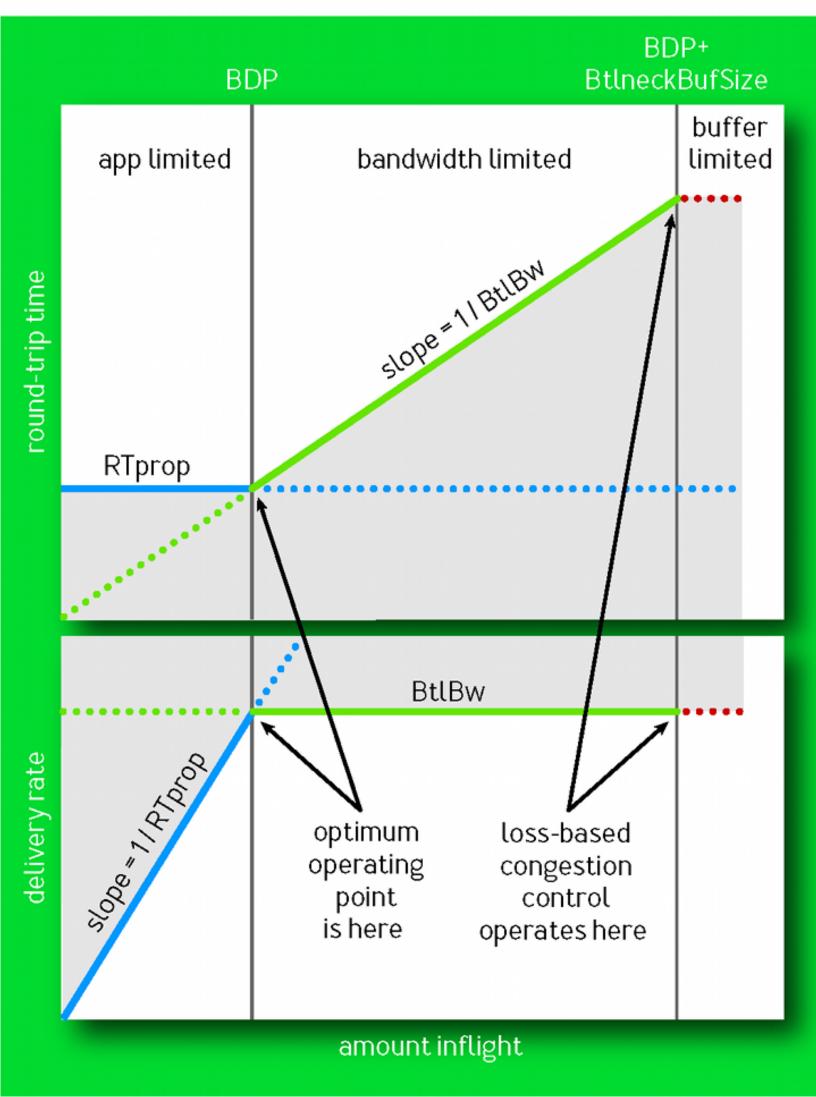
- An update of TCP BIC (Binary Increase Congestion control)
- "modifies the linear window growth function of existing TCP standards to be a cubic function in order to improve the scalability of TCP over fast and long distance networks"



From: Sangtae Ha, Injong Rhee, and Lisong Xu. 2008. CUBIC: a new TCP-friendly high-speed TCP variant. SIGOPS Oper. Syst. Rev. 42, 5 (July 2008), 64–74. DOI:https://doi.org/ 10.1145/1400097.1400105

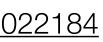
\square \vdash

- Bottleneck Bandwidth and Round-trip propagation time
- Designed by Google (~2016)
 - with YouTube as the motivating use case
 - available in Linux kernel 4.9+
- As the protocol name suggests:
 - "BBR congestion control computes the sending rate based on the delivery rate (throughput) estimated from ACKs" (comment in tcp-bbr.c in Linux kernel)

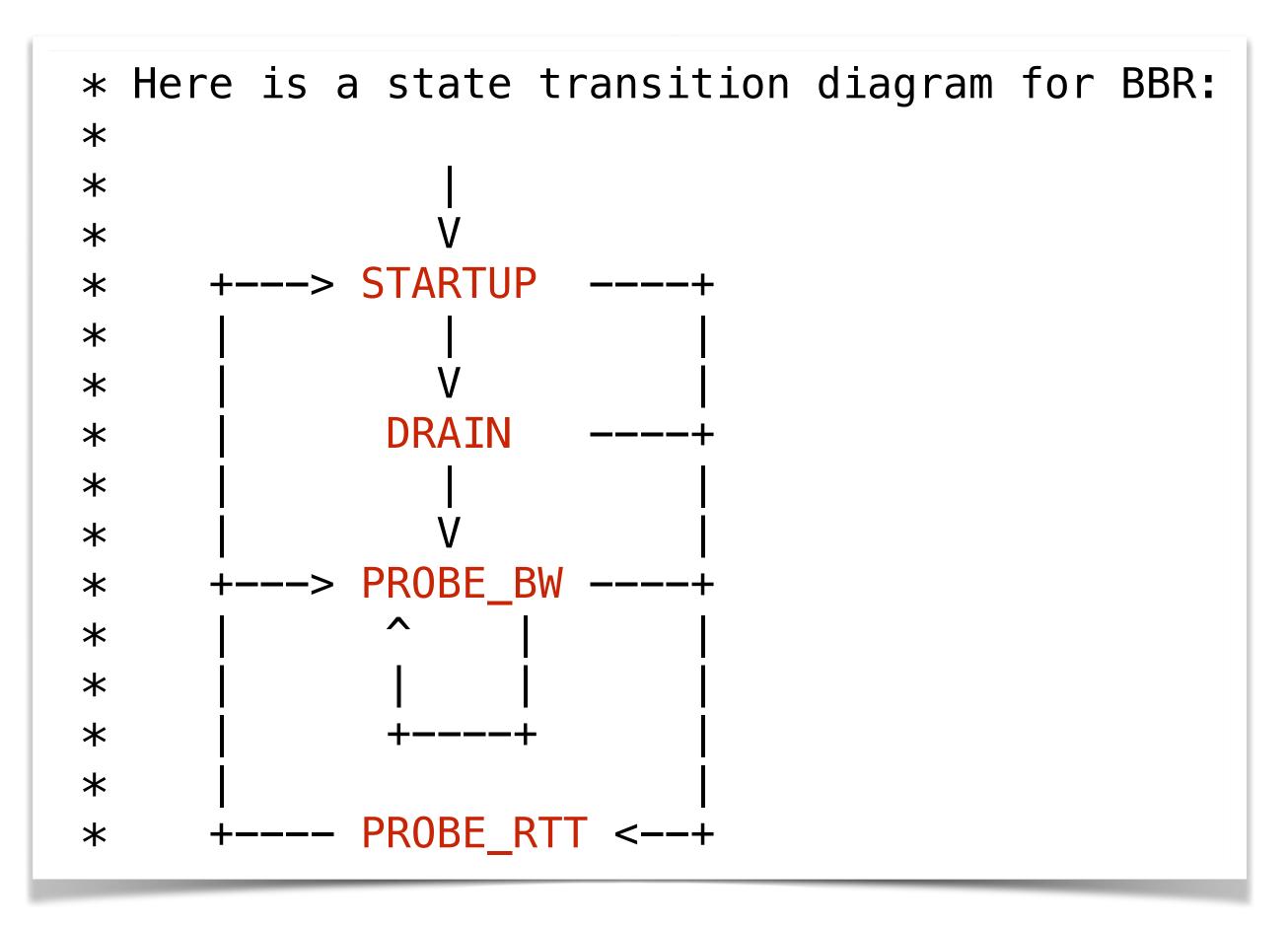




Source: https://queue.acm.org/detail.cfm?id=3022184



Congestion control state diagram:



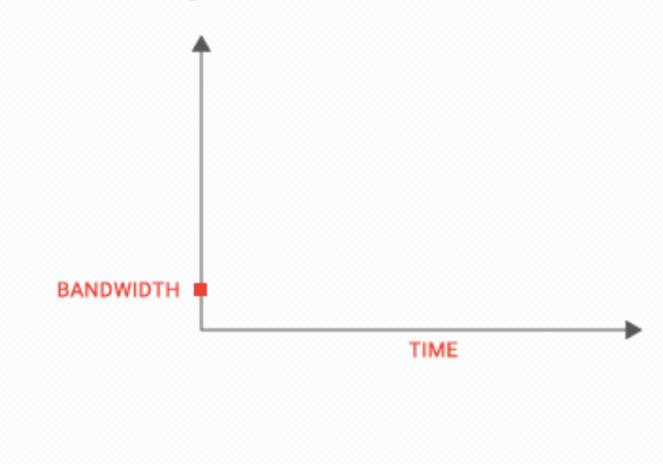
Source: comment in tcp-bbr.c in Linux kernel https://git.kernel.org/pub/scm/linux/kernel/git/netdev/net-next.git/tree/net/ipv4/tcp_bbr.c



One has to be careful when making claims:

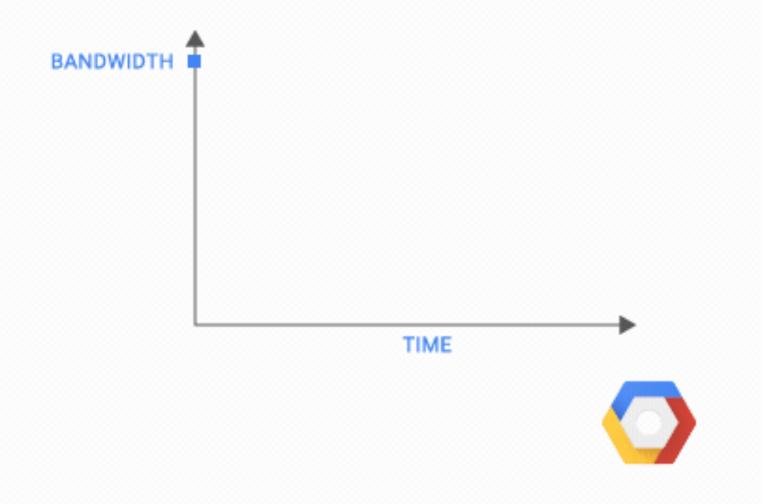
TCP before BBR

Today's Internet is not moving data as well as it should. TCP sends data at lower bandwidth because the 1980s-era algorithm assumes that packet loss means network congestion.



TCP BBR

BBR models the network to send as fast as the available bandwidth and is 2700x faster than previous TCPs on a 10Gb, 100ms link with 1% loss. BBR powers google.com, youtube.com, and apps using Google Cloud Platform services.



Real-Time Traffic

- Elastic vs inelastic traffic
- Real-time transport
 - timing is critical (low latency and jitter)
 - perishable data
 - (often) constant rate of delivery
 - (rate adaptation)
- Hard vs soft real time...





Media Delivery

- Challenges
 - multitude of formats
 - multitude of server and player (client) capabilities
 - multiple simultaneous streams (video, audio, text) delivered
 - synchronization between streams
 - stream control (play, pause, fast-forward, ...)
 - changing network conditions
 - security and content protection
 - real-time, near real-time, on-demand (VOD)