QUIC

Why Should I Care About

Quick UDP Internet Connections

Loading Web Pages Quickly

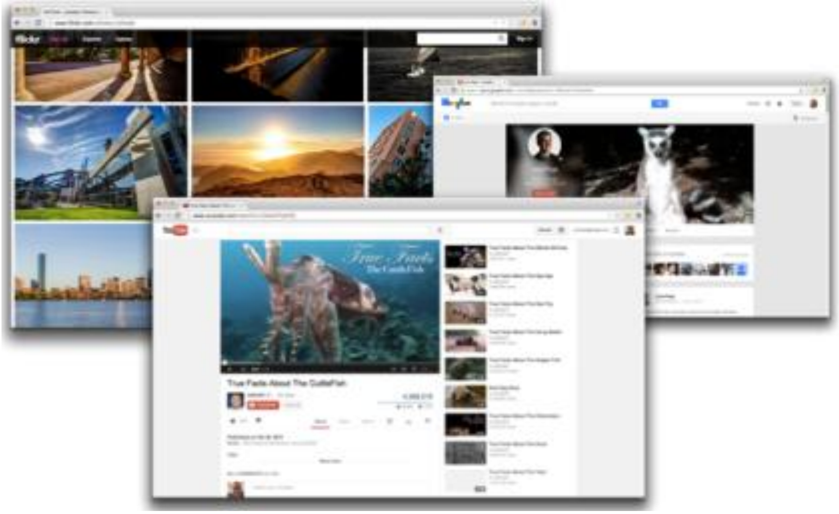
Delay	User Reaction
<100 ms	instant
100 – 300 ms	reasonable
300 ms – 1 sec	Getting tedious
> 1 sec	Close tab

Per High Performance Browser Networking (Grigorik 2013)

Modern Web Site

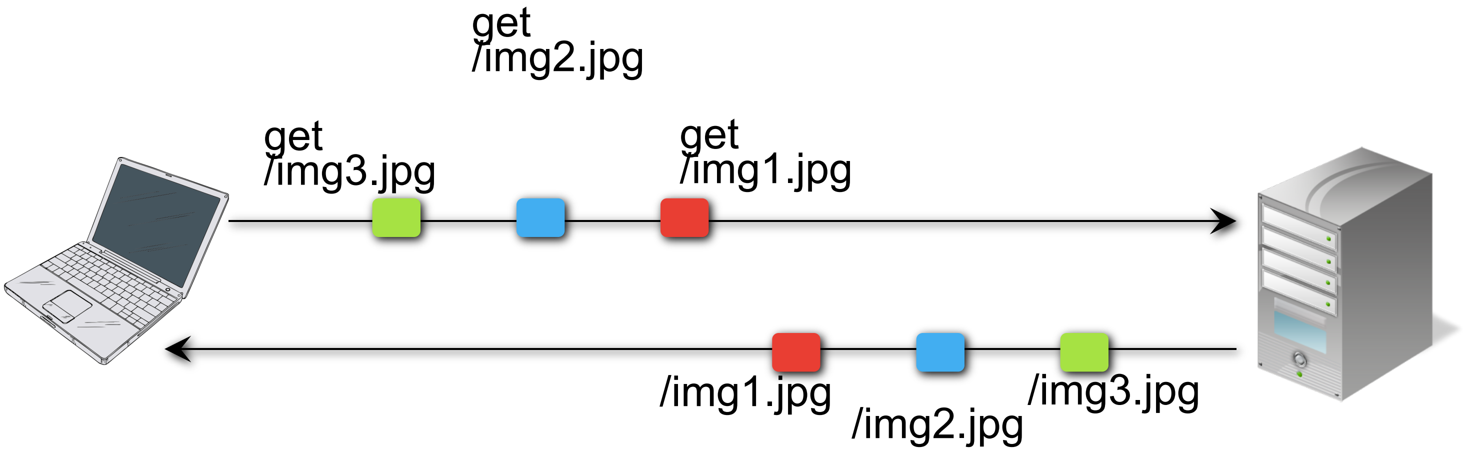
- 1200 KB
- 80 resources
- 30 domains

Data from httparchive.org



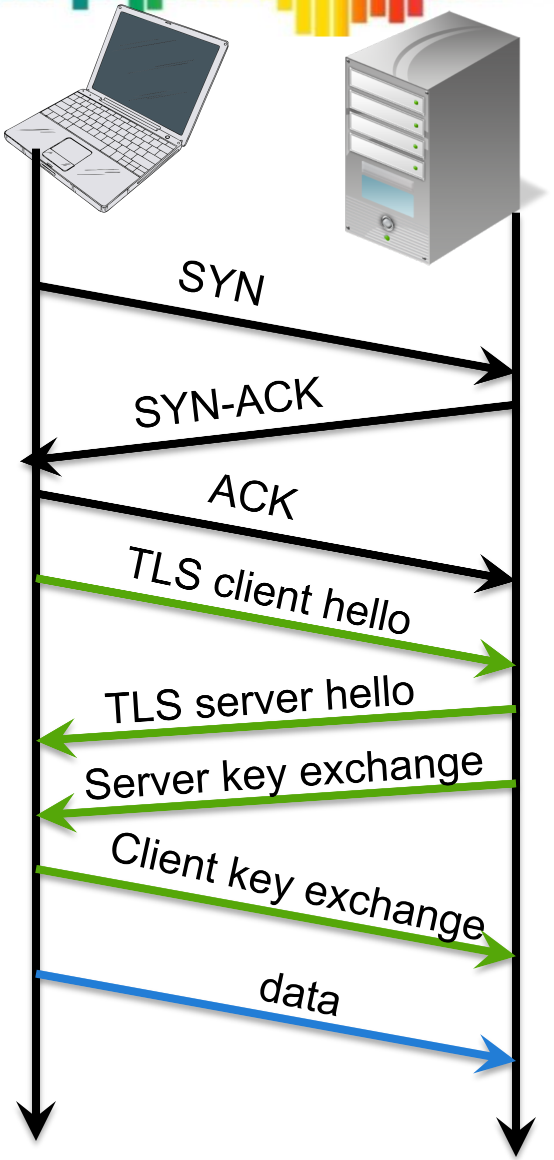
How To Make This Go Faster? TCP Pipeline

- Pipeline connections in a single TCP session
  - –Ask for all the elements from a particular server over a single session
  - –Elements in series
  - –Head of line blocking



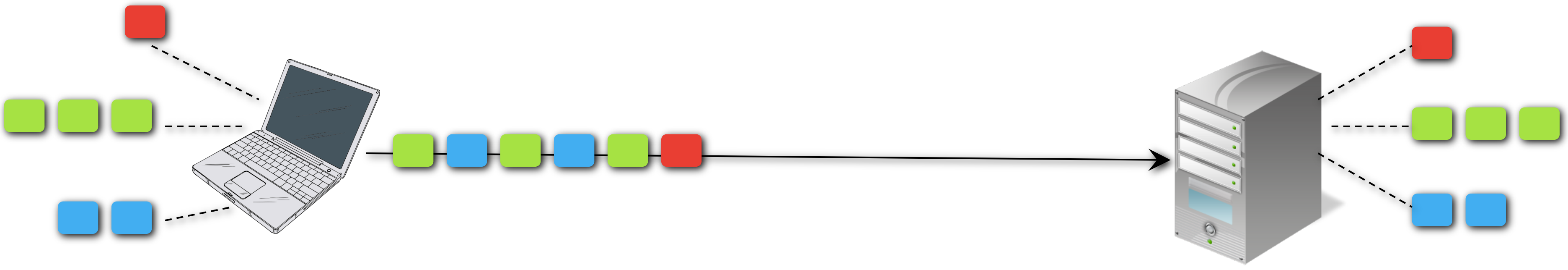
How To Make This Go Faster? Multiple Parallel Sessions

- Open lots of TCP sessions
  - –Most modern web browsers open 6-8 session
  - –More than 6-8 sessions is not helpful
    - TCP syn, syn-ack, ack
    - TLS client hello, server hello, server key exchange, client key exchange
    - TCP window doubling
  - –An increase to 10 sessions results in a 5% worse performance for total page loads



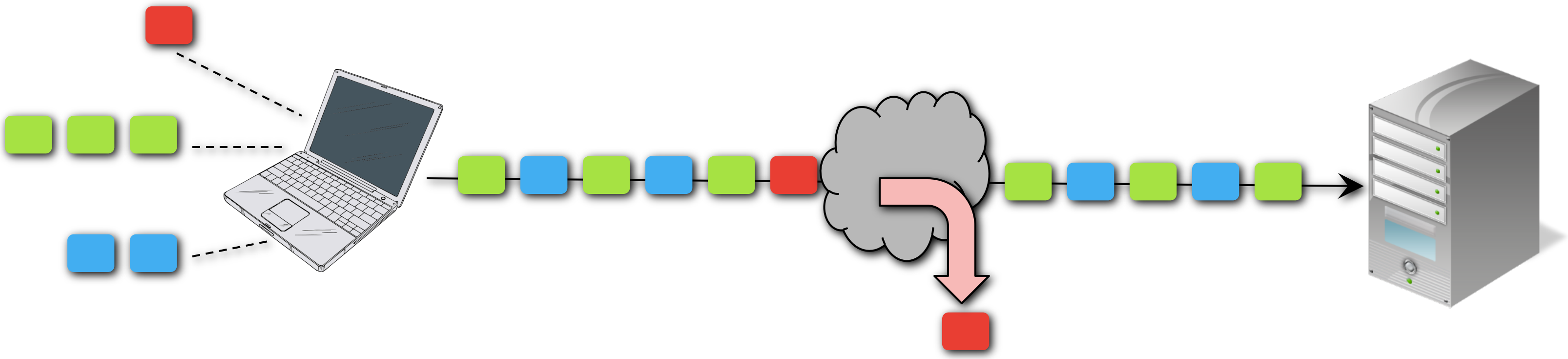
How To Make Things Go Faster? SPDY

- Multiplex sessions over a single TCP session
  - –Shared TCP windowing
    - Decreased overhead, shared speed up



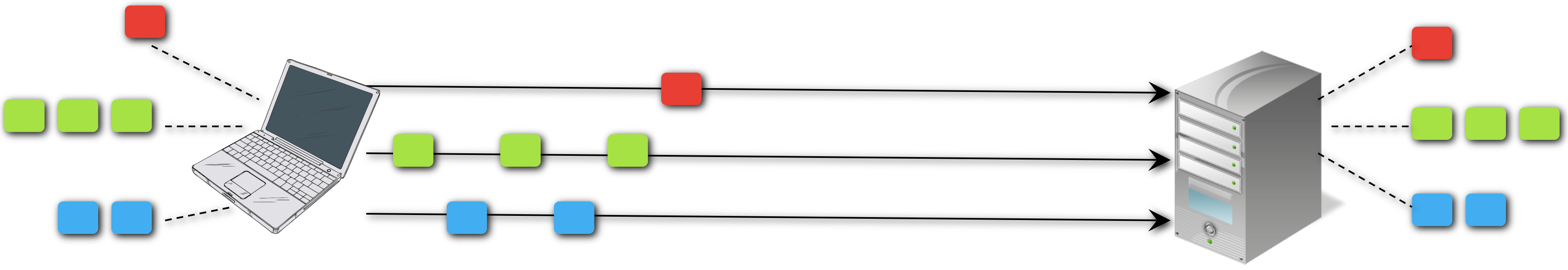
How To Make Things Go Faster?
SPDY

- Multiplex sessions over a single TCP session
  - –Shared TCP windowing
    - TCP packet loss requires retransmit and deliver of lost packets
    - Later numbered packets are queued and delivered in order



How To Make Things Go Faster?
QUIC

- Multiplex sessions over a single UDP session
  - –Move the connection oriented parts of TCP to the application on a per stream basis
    - No TCP retransmit blocking



How To Make Things Go Faster? QUIC

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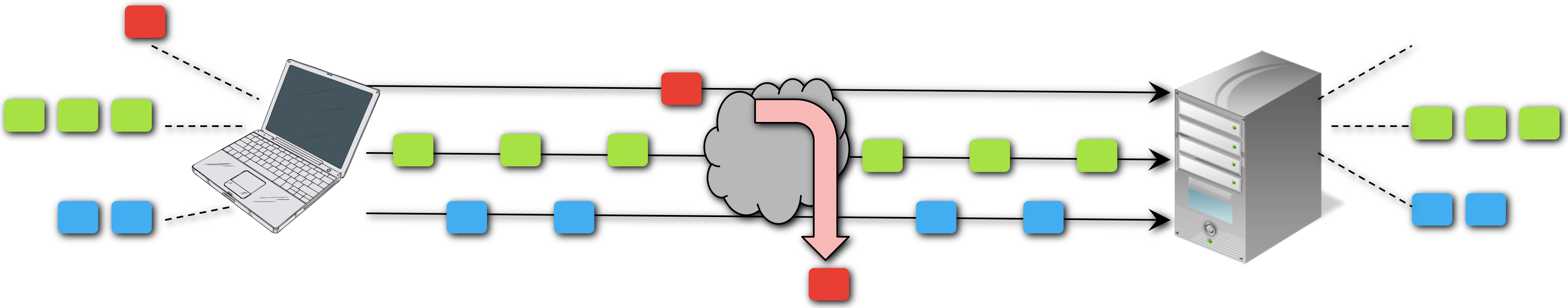

QUIC

- Quick UDP Internet Connections
- Multiplexed transport over UDP
- Reduced latency
- Open source development in Chromium

QUIC

- Compression
- Encryption comparable to TLS
  - https://docs.google.com/a/google.com/document/d/1g5nIXAIkN_Y-7XJW5K45IblHd_L2f5LTaDUDwvZ5L6g/editRapid reiteration
  - Cryptographic Nonce
  - Signed Proof of IP address
- Forward Error Correction (FEC)
- Packet pacing
- Adaptive congestion control

Why Should I Care About QUIC?

- Chrome Dev channel already supports it
  - QUIC will become the default in future releases of chrome
- Many Google properties already support QUIC
- Could see a non-trivial ramp of of chrome user → Google traffic switch from TCP to UDP
  - Impact of increase of UDP on stateful FW / NAT
  - PMTUD issues not previously seen due to TCP SYN MSS value
  - QoS handling of UDP traffic different than TCP?
- Could see an increase in IPv6 traffic

Questions?

- Questions?
- Concerns about an increase in UDP traffic?