北京 2019

遨游“视”界 做你所想
Explore World, Do What You Want

The Need for Dynamic Protocol Optimization

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Akamai
Experience the Edge

出品: LiveVideoStack 音视频技术社区 CSDN

深圳 2019

遨游“视”界 做你所想
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LiveVideoStackCon 2019 深圳

2019.12.13-14

出品：LiveVideoStack 音视频技术社区

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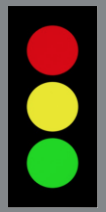
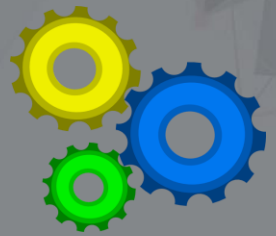
Our Adventure Awaits

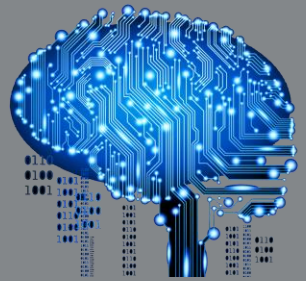
Network Performance



Congestion Control



Protocols



Dynamic Protocol Optimization (DPO)

Question

What does network performance mean to you?

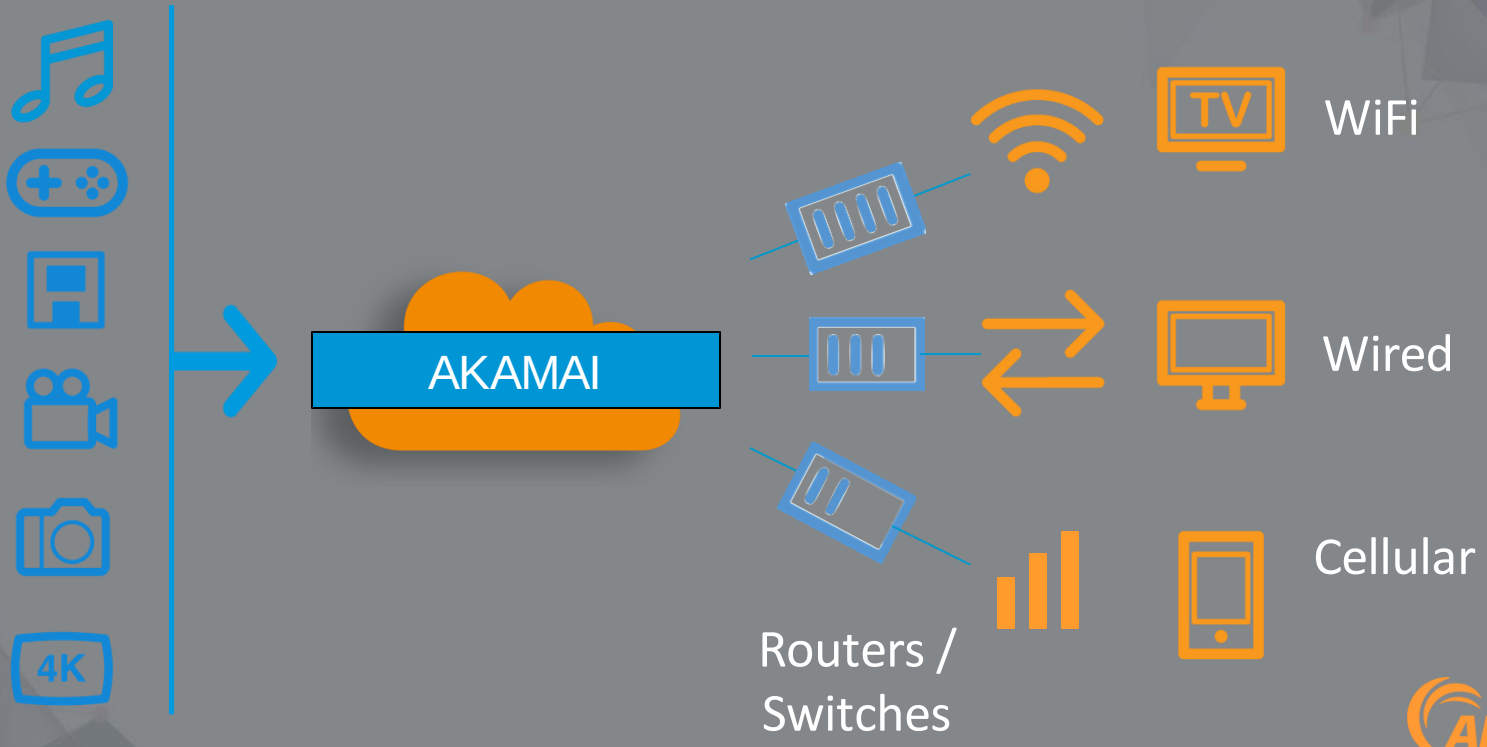
Network Performance Optimization

Metrics

1. Startup Time
2. Rebuffering
3. Bitrate (Video Definition)
4. Video Lag

1. Total download time
2. Cross traffic quality
3. Latency (Live gaming)

Network Performance is Complicated



Influences of Network Performance

Server	Network	Client
Characteristics • CPU • Memory • OS	Topology • Middle Devices • Buffers	Characteristics • CPU • Memory • OS
Network Bandwidth (1G/10G/100G)		
Network Technology (Mobile / WiFi / Ethernet)		
Data Availability / Application Performance		
Network Congestion		
Network Protocols		
…		

TCP Congestion Control

Server Outstanding Data Limit = min(

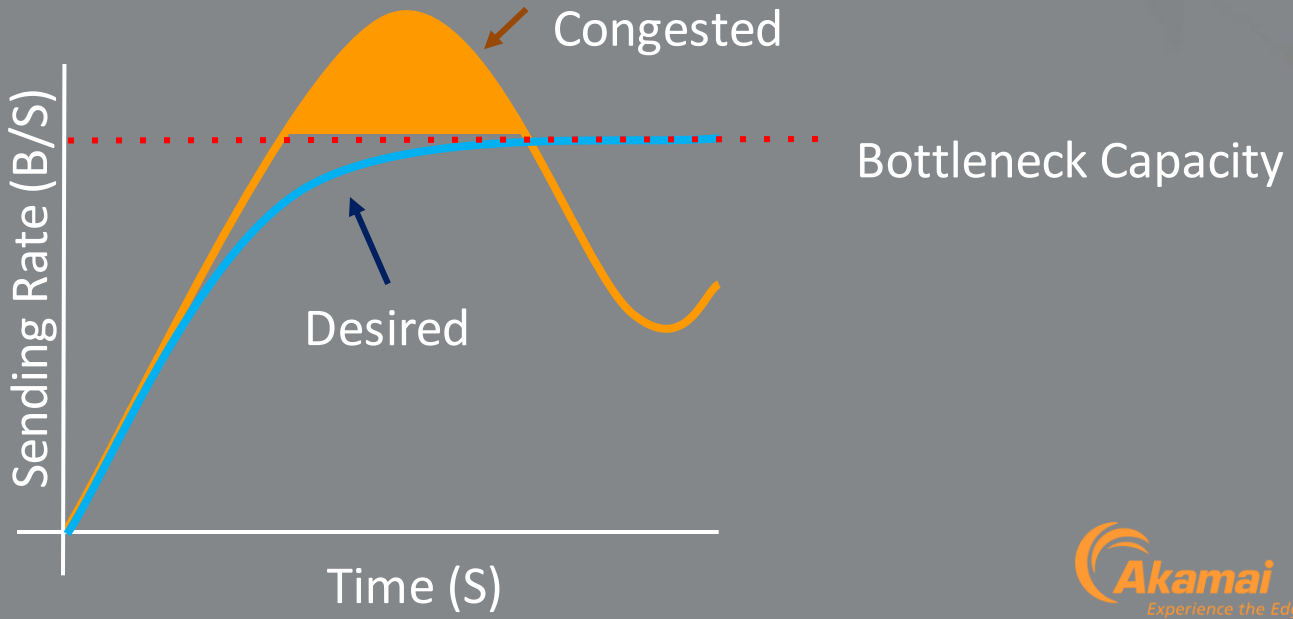
available data, // Server side application

congestion window, // Server side TCP stack / hardware

client receive window) // Receiver TCP stack / hardware

TCP Congestion Control

- Congestion Control is TCP/IP’s attempt to match performance with available network bandwidth.



TCP Congestion Control Algorithms

Loss Based

- Cubic
- Reno
- QDK

Packet loss is interpreted as network congestion.

RTT/Delay Based

- FastTCP
- BBR

Increase in flow latency / queuing is a signal of network congestion.

Question

Does One Protocol Fit All?

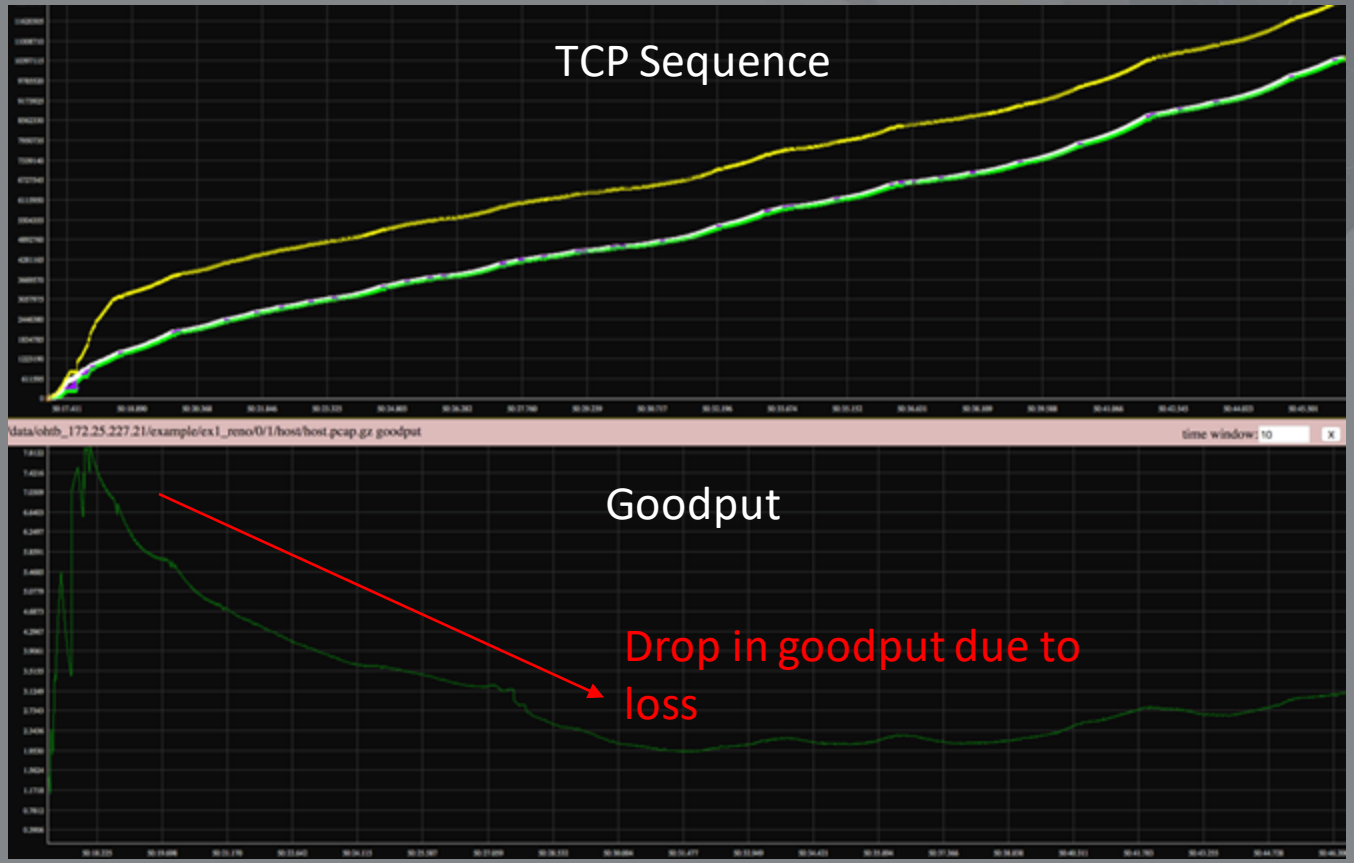
TCP Congestion Control - Loss

Reno

1% Loss
30ms Latency
0ms Jitter

10 MB File
10 Mbps Capacity

Average Throughput:
2.8 Mbps



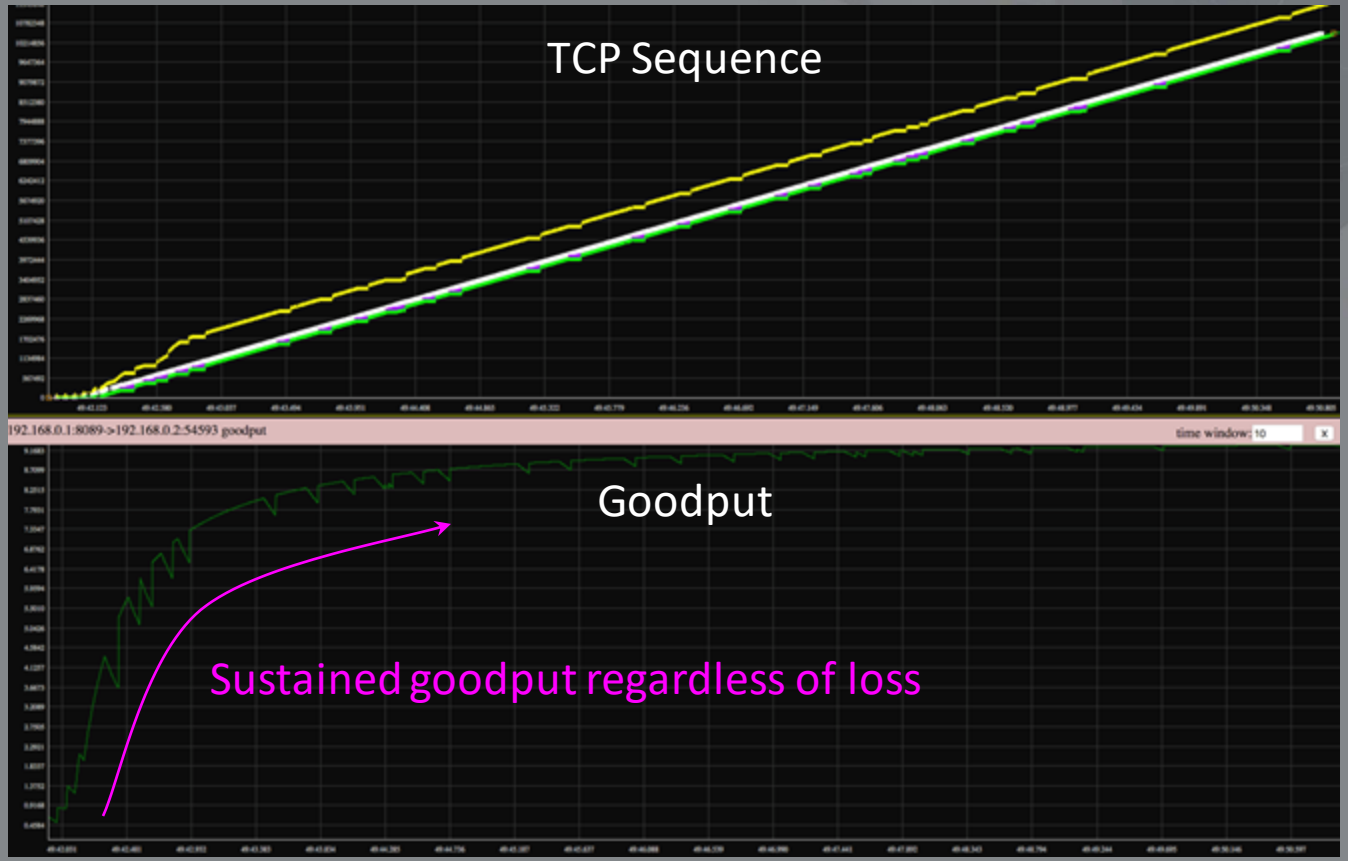
TCP Congestion Control - Loss

FastTCP

1% Loss
30ms Latency
0ms Jitter

10 MB File
10 Mbps Capacity

Average Throughput:
9.1 Mbps



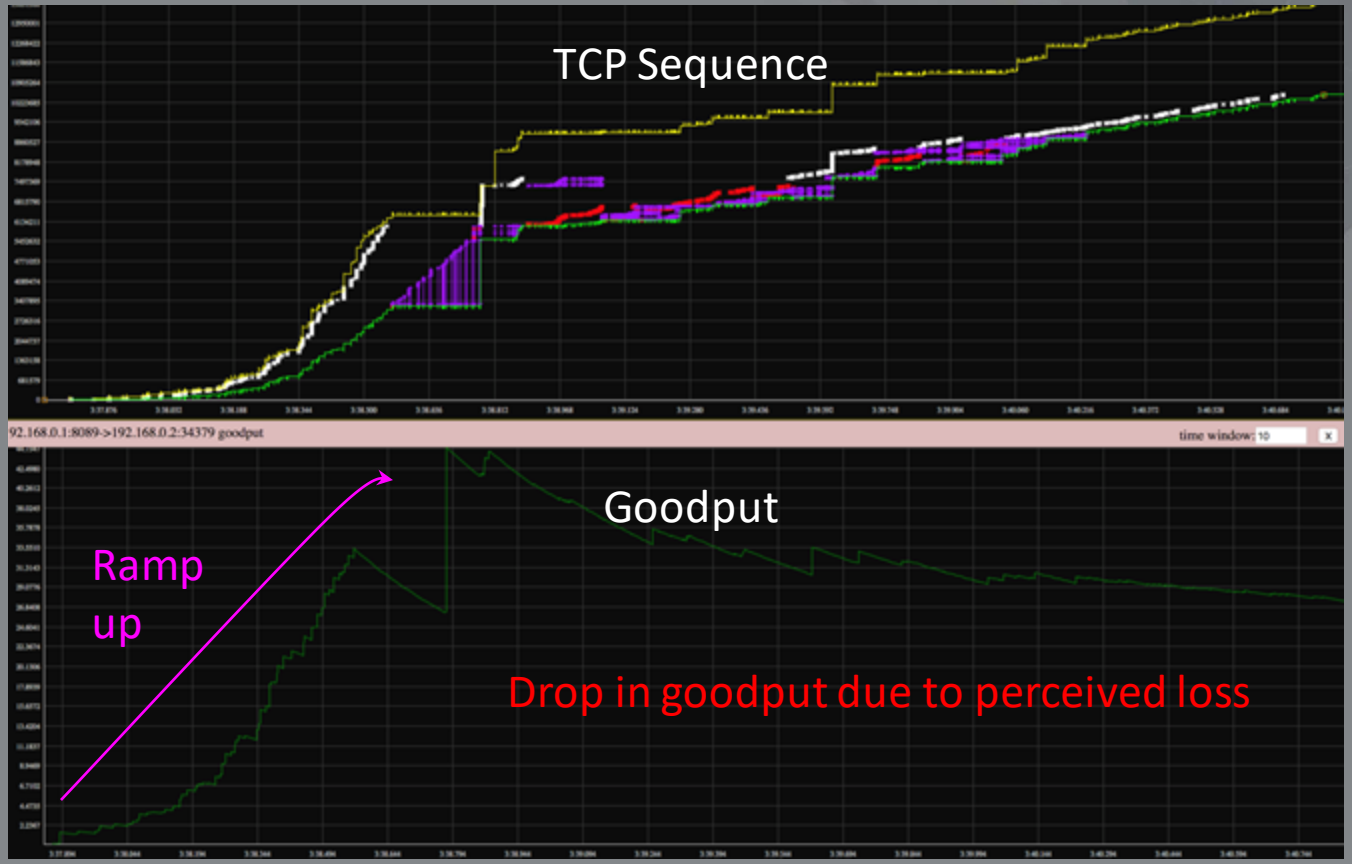
TCP Congestion Control – Jitter

Reno

0% Loss
30ms Latency
20ms Jitter

10 MB File
100 Mbps Capacity

Average Throughput:
26.9 Mbps



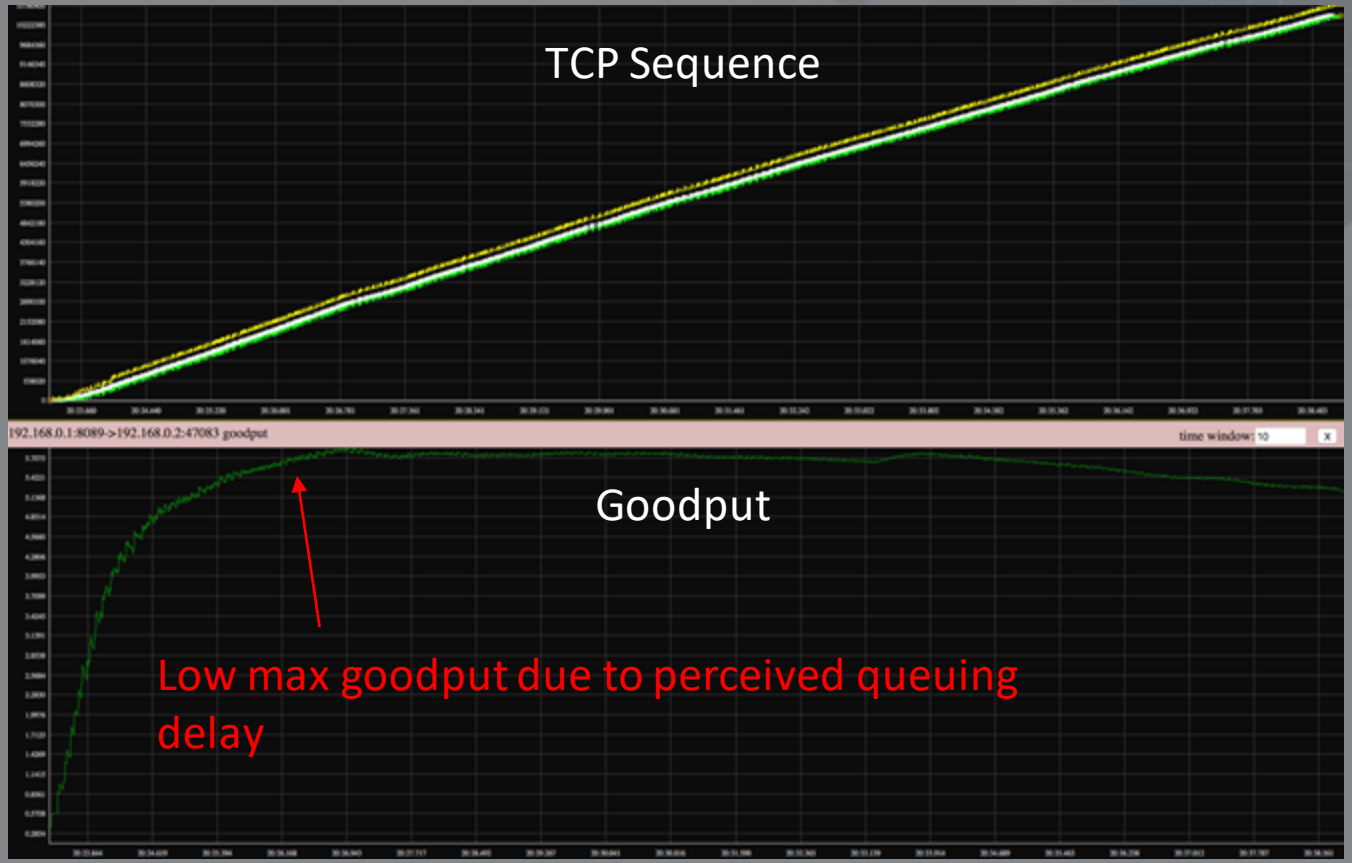
TCP Congestion Control – Jitter

FastTCP

0% Loss
30ms Latency
20ms Jitter

10 MB File
100 Mbps Capacity

Average Throughput:
5.4 Mbps



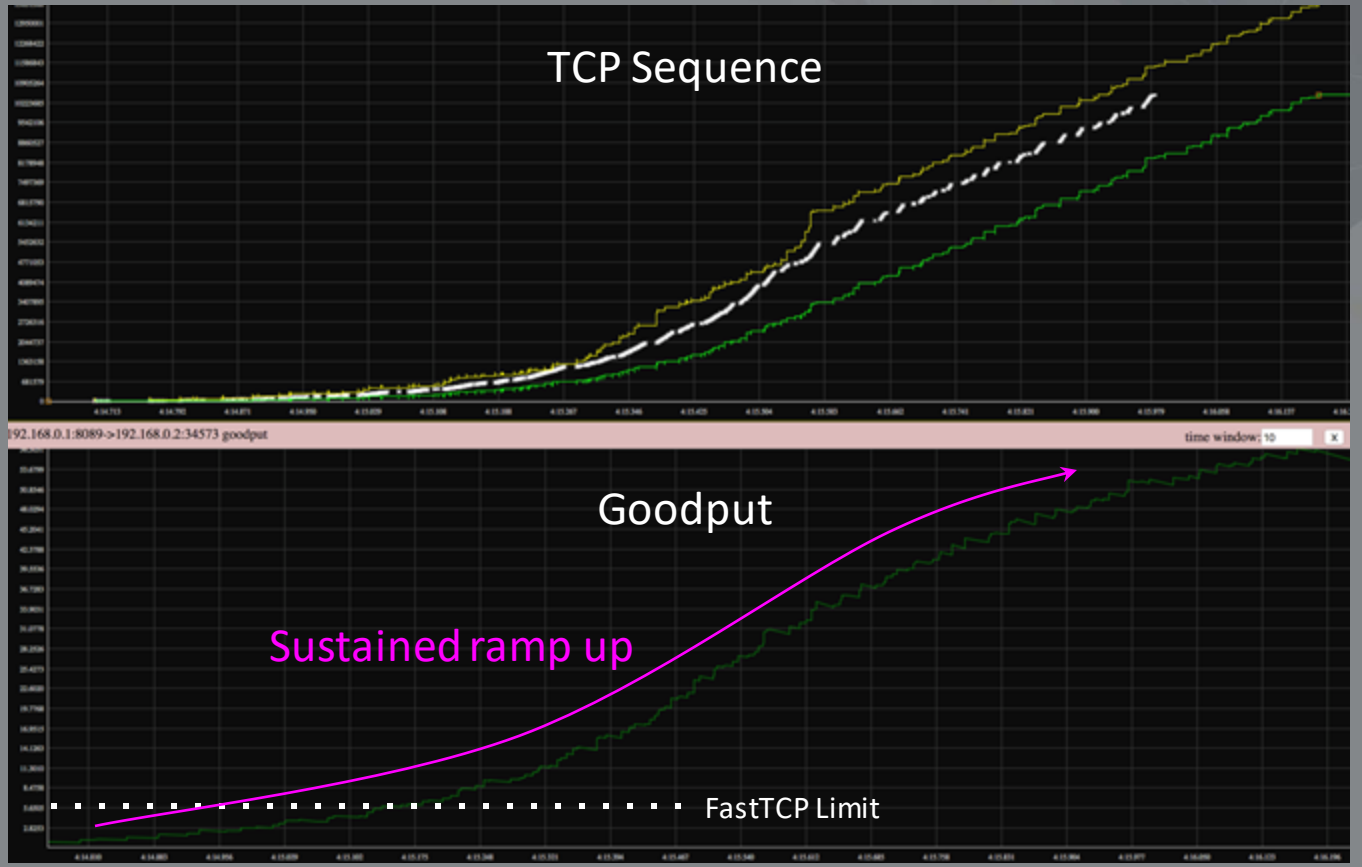
TCP Congestion Control – Jitter

BBR

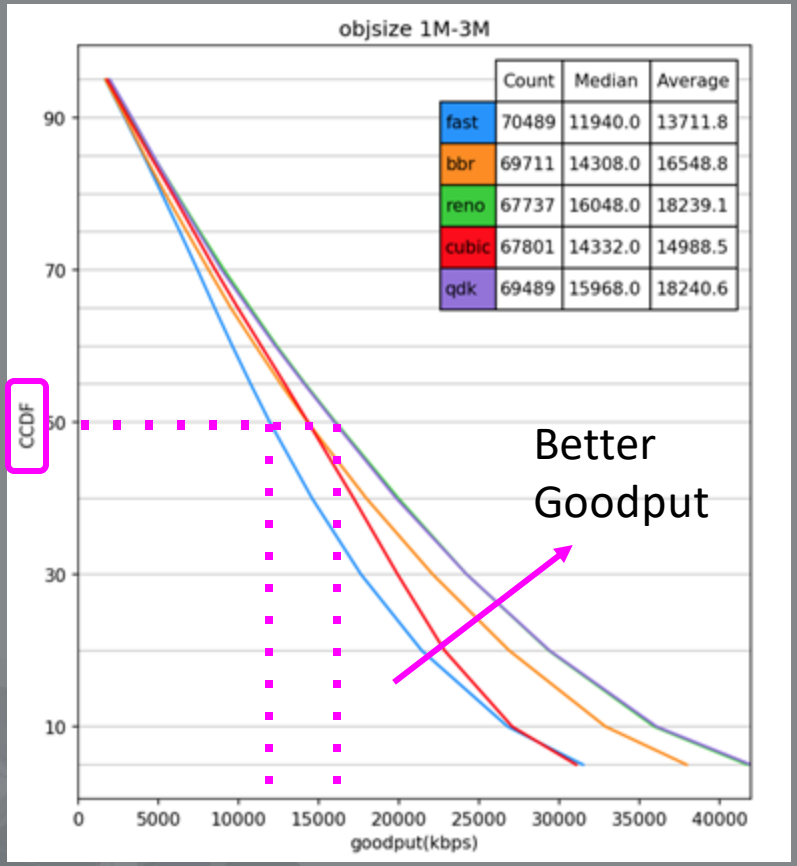
0% Loss
30ms Latency
20ms Jitter

10 MB File
100 Mbps Capacity

Average Throughput:
51 Mbps



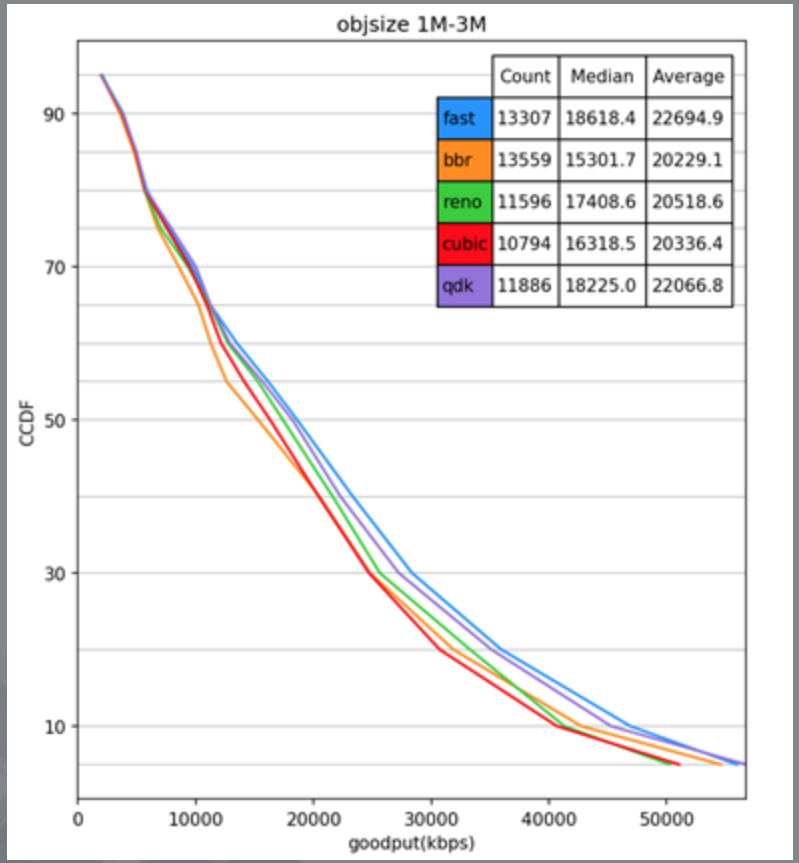
Protocol Performance Varies



Asia-Pacific Mobile Carrier

- Average goodput spread
  - 33% (Fast -> QDK)
  - 4.4 Mbps+ difference

Protocol Performance Varies



Asia-Pacific Network Provider

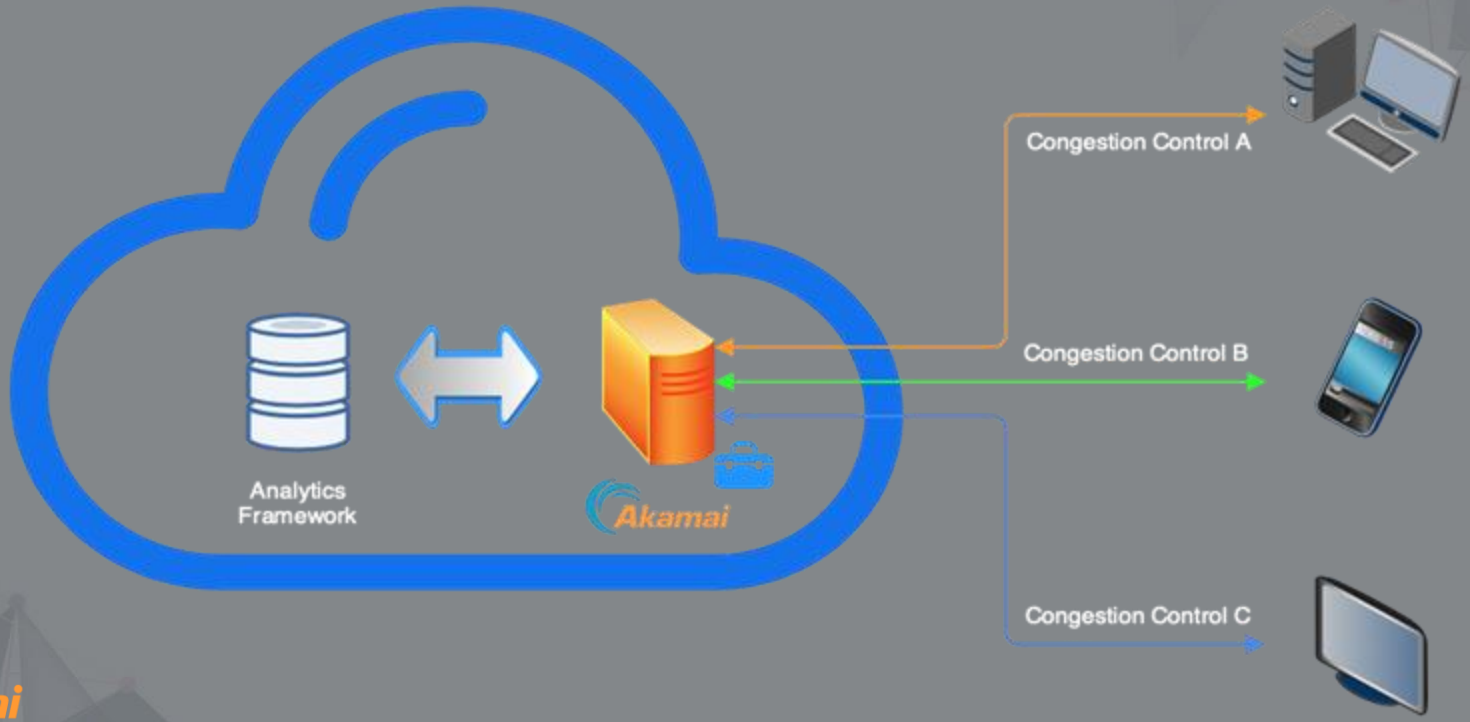
- Average goodput spread
  - 12% (BBR -> Fast)
  - 2.4 Mbps+ difference

Question

Does One Protocol Fit All?

No

Dynamic Protocol Optimization (DPO) Overview



DPO Components

Machine Learning

Automatically evaluating models and flow characteristics for optimal network performance.

Congestion Control Toolkit

Support for present (5) and future congestion control algorithms.

Analytics Framework

Gather performance metrics throughout Akamai’s network.

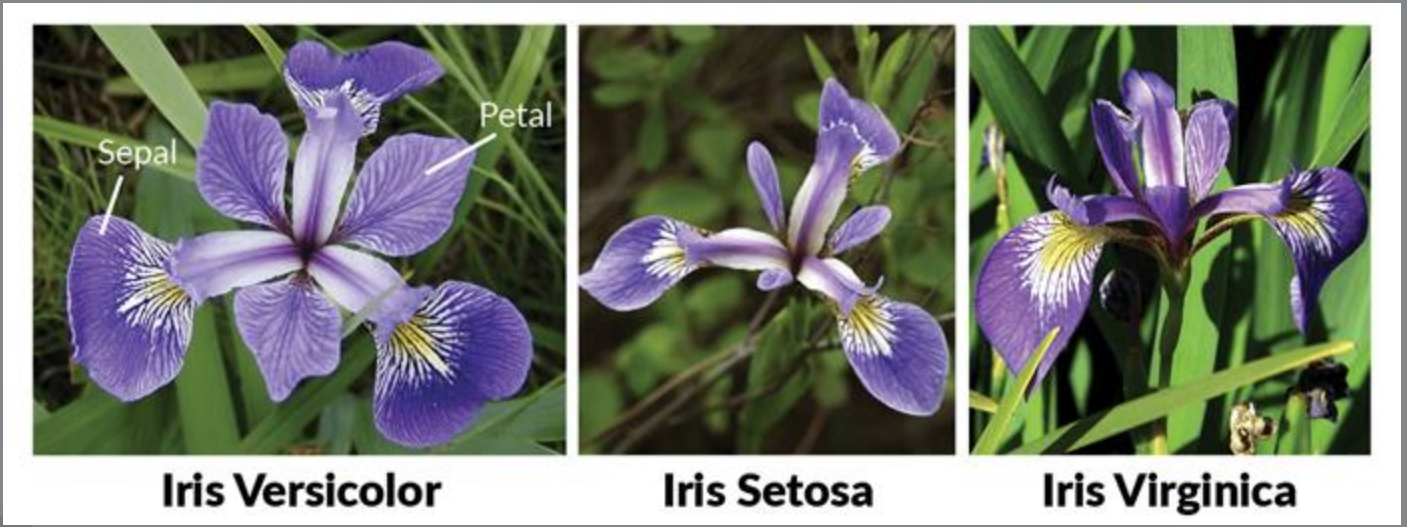
Create models for Machine Learning.

Machine Learning

A Definition:

Capability of a machine to improve its own performance by automatically “learning” from a dataset.

Example:



DPO Training

Model Training

Optimizing goodput

Input Signals

• Delivery Type	• Network Type
• Latency	• Geolocation
• Time of Day	• +15 others

Output:

Congestion Control and Settings

DPO – Where are we?

Dynamic Protocol Optimization (DPO) is needed to create a better network experience.

Using machine learning, DPO aims to pair a more optimal Congestion Control algorithm given the network conditions.

Under development.

Thank you