Improve Congestion Control mechanism with the help of Machine Learning Thesis

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Road map

Improve Congestion Control mechanism with the help of Machine Learning

What is Congestion control?

What is Congestion control? How can it be improved with ML

What is Congestion control? How can it be improved with ML Our contribution

Improve Congestion Control mechanism with the help of Machine Learning

What is congestion Control ?



Improve Congestion Control mechanism with the help of Machine Learning

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Issue

TCP Cubic, the main current algorithm is not able to achieve these 3 goals, especially over a satellite link.

Computer A

Computer B



Figure: TCP is connection-oriented communications protocol

Computer A

Computer B



Figure: TCP is connection-oriented communications protocol

The Congestion windows, is the maximum number of packets that the server can send without receiving any ACK packet. It is the

The slow start phase aims to reach the maximum throughput available.



The next phase is congestion avoidance.



Figure: That phase is based on additive increase/multiplicative decrease



Figure: The congestion control algorithm allows fairness between flows.

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It's a common trend now

With classic Congestion Control Algorithms, The optimal point is hard to reach.



Figure: Reaching the optimal point is a very hard task

New congestion control algorithm were developed

Some example of new CC algorithms

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 However it cannot be used, because it has to be trained for each topology Developed by Facebook, it tries to estimate the queue length

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We see the tendency of new CC algorithm to estimate the internal state of the network We see the tendency of new CC algorithm to estimate the internal state of the network

We tries to use the variation of the RTT, loss signal and the throughput to guess internal variables of the network through Machine Learning

What kind of metrics can we use?

We want to focus on more practical metrics, that are common among all flows:

- current utilisation of the network bottleneck
- at which pace?
- Total time spent in the queues (Used for COPA)



Experimental setup

Emulation

- Parking lot topology
- We have perfect information
- How did we generate traffic :
 - The sensing flow is not adaptative
 - TCP flows are used for the load
 - The number of tcp flows changes
 - The bottleneck changes
 - At each node we may have implemented some type of scheduling (by default fqcodel is used, unless specified otherwise)
 - TCP changes on a dynamic way

Experimental setup



Results

Y1 : Occupation of the largest bottleneck



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Results

Y2 : speed of evolution of the bottleneck



Results

Y3 : Total occupation of all the queues on the path

