

Mobile TCP Evaluation

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Quick Recap....



Introduction

- Data connections are MUCH slower than WiFi connections on mobile devices.
- We can analyze this problem through TCP.
- Look at RTT, Throughput, Packet Loss..etc
- Scenarios: PC-Wifi, PC-Wired, Mobile-Data, Mobile-WiFi, Mobile-Data on moving train.

Motivation

- Want to have data networks work with the same performance as WiFi.
- Show lack of performance in controlled scenarios to narrow down improvement areas.
- Propose future work in specific areas of TCP.

Research Questions

- Does performance of TCP deteriorate in mobile environments?
- Is performance of TCP affected by mobility of mobile devices?
- If so, why does this occur? Is it an inherent problem with TCP or is this due to some external factors?

Hypotheses

- Lack of performance happens due to continuous need to rebuilt TCP connection.
- We can possibly get over this by using state migration and/or indirect TCP sockets (as used with WiFi routers) but with cell towers.

Tools

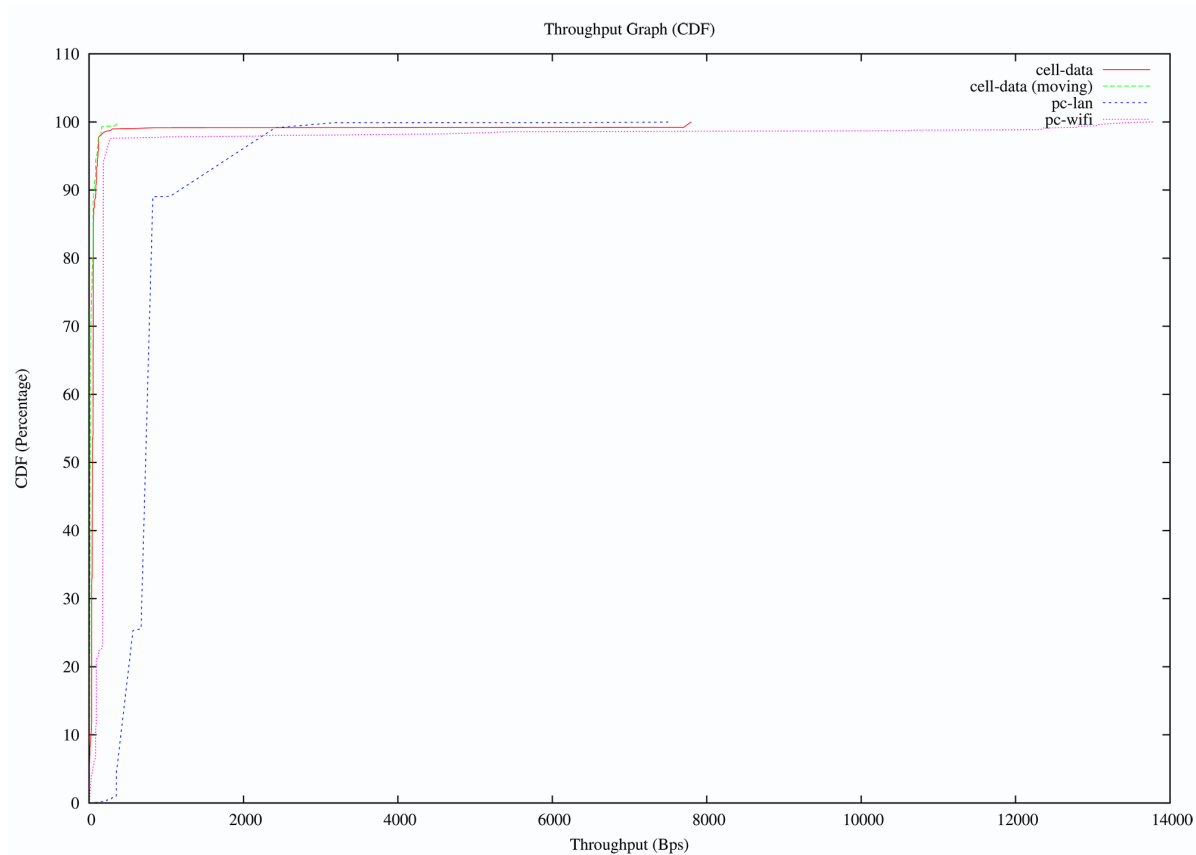
- Ruby Script - TCPCAnalysis
 - TCPCDump, TCPTrace, GNUPlot
 - RTT & Throughput, CDF Graphs
- Wireshark
 - TCPCDump, GNUPlot
 - Packet loss, retransmissions, TCP congestion window recalculation, out of order packets, IO graphs

Method

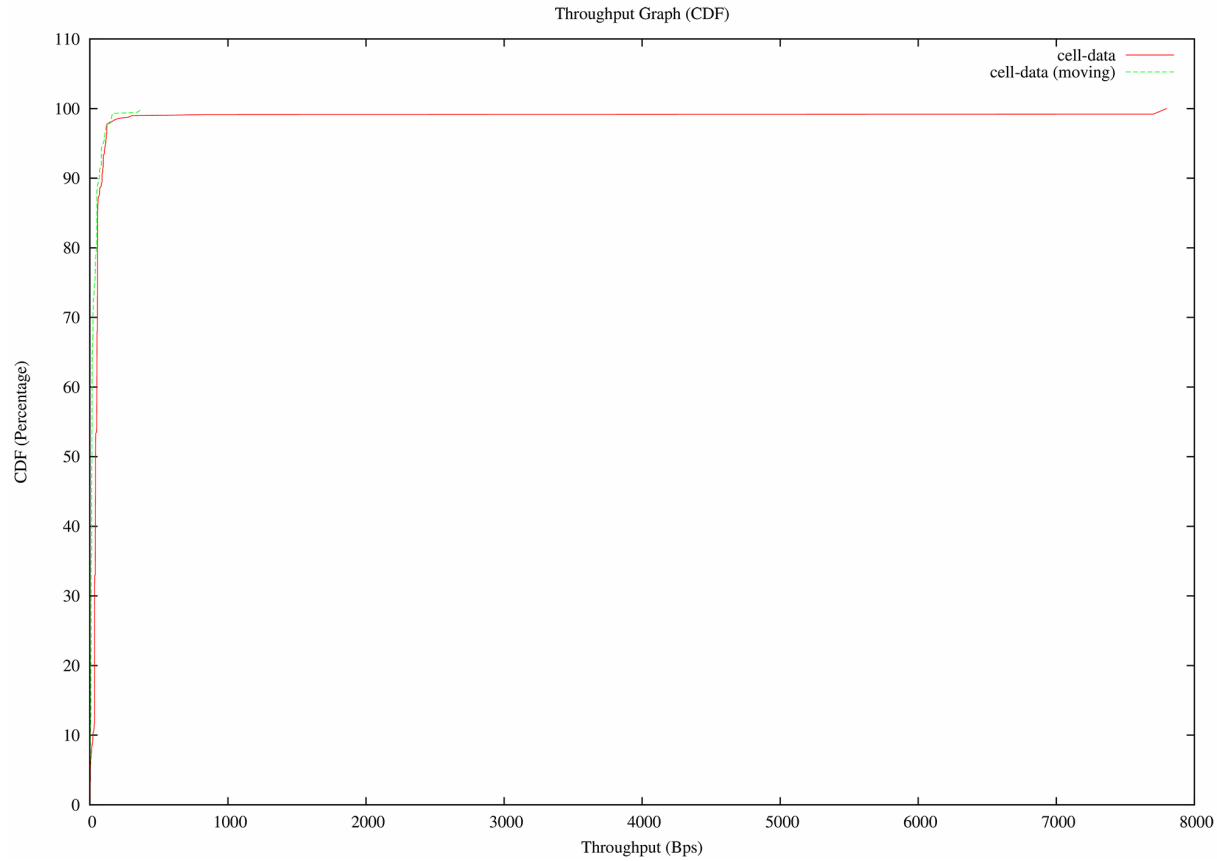
- Run Ruby script in the same location at home on the same YouTube video.
- Either run analysis through Ruby script to get RTT & Throughput, or give TCPDump output to Wireshark for other analyses.

Method (cont)

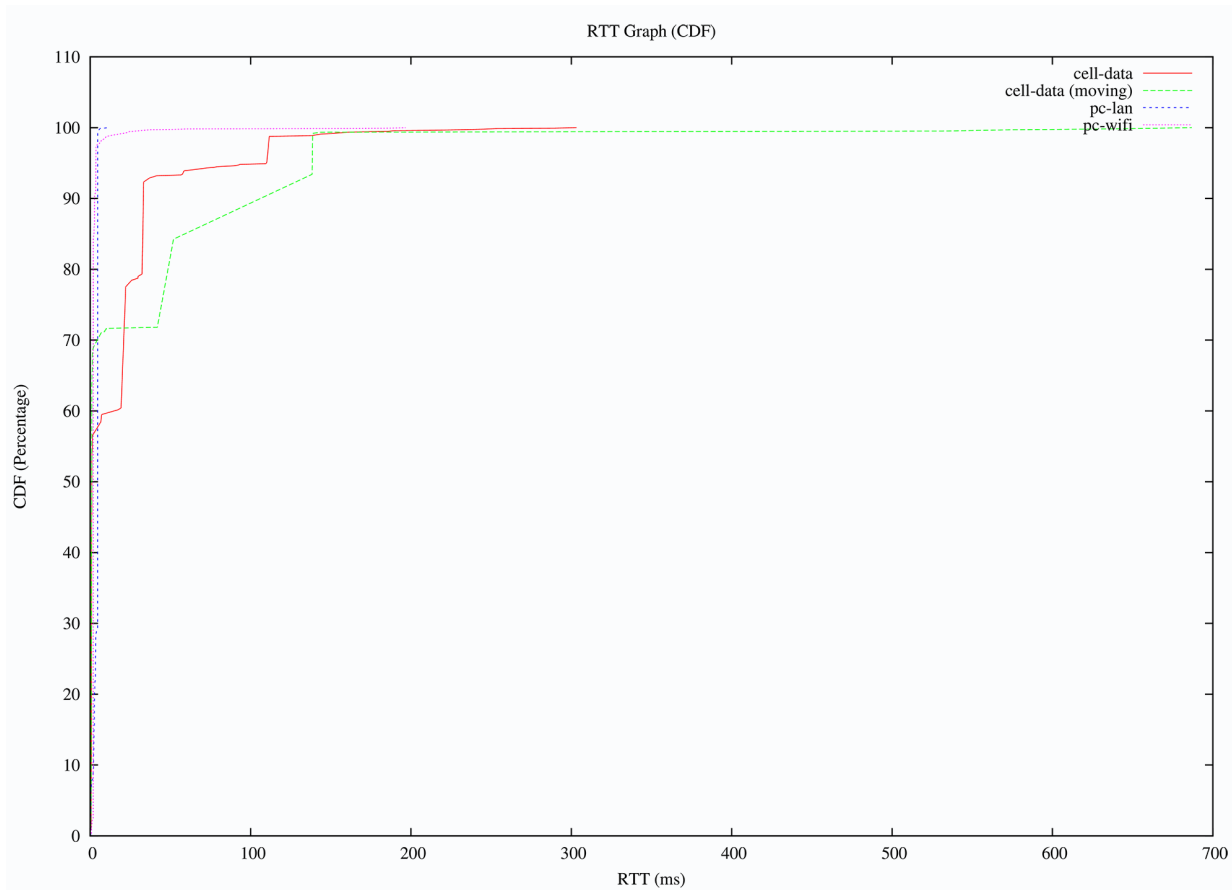
- Run the analysis on Wifi, Wired, and Data to have controlled scenarios. Run on both PC and Mobile phone.
- Run the analysis while moving to see how TCP handles it.



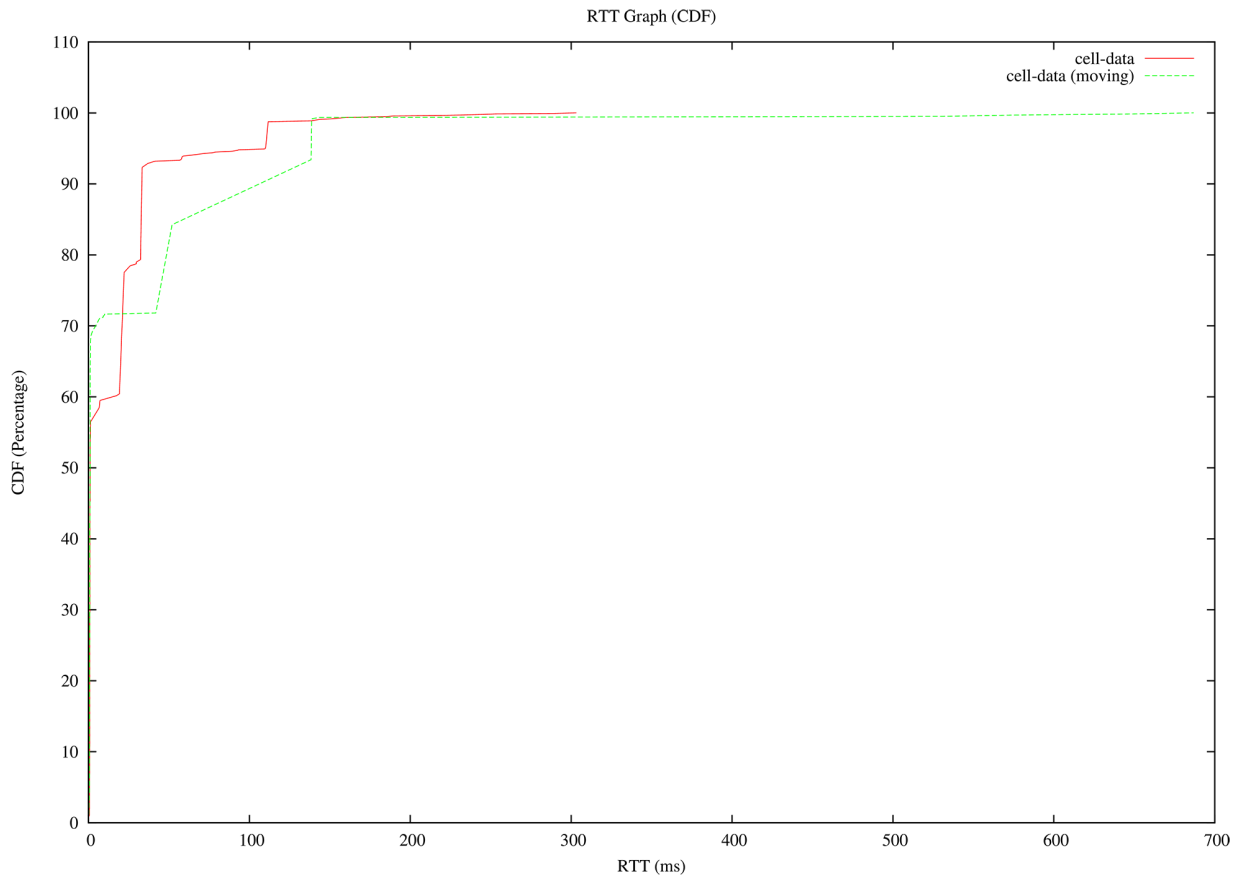
TCP performance in cell is worse than PC



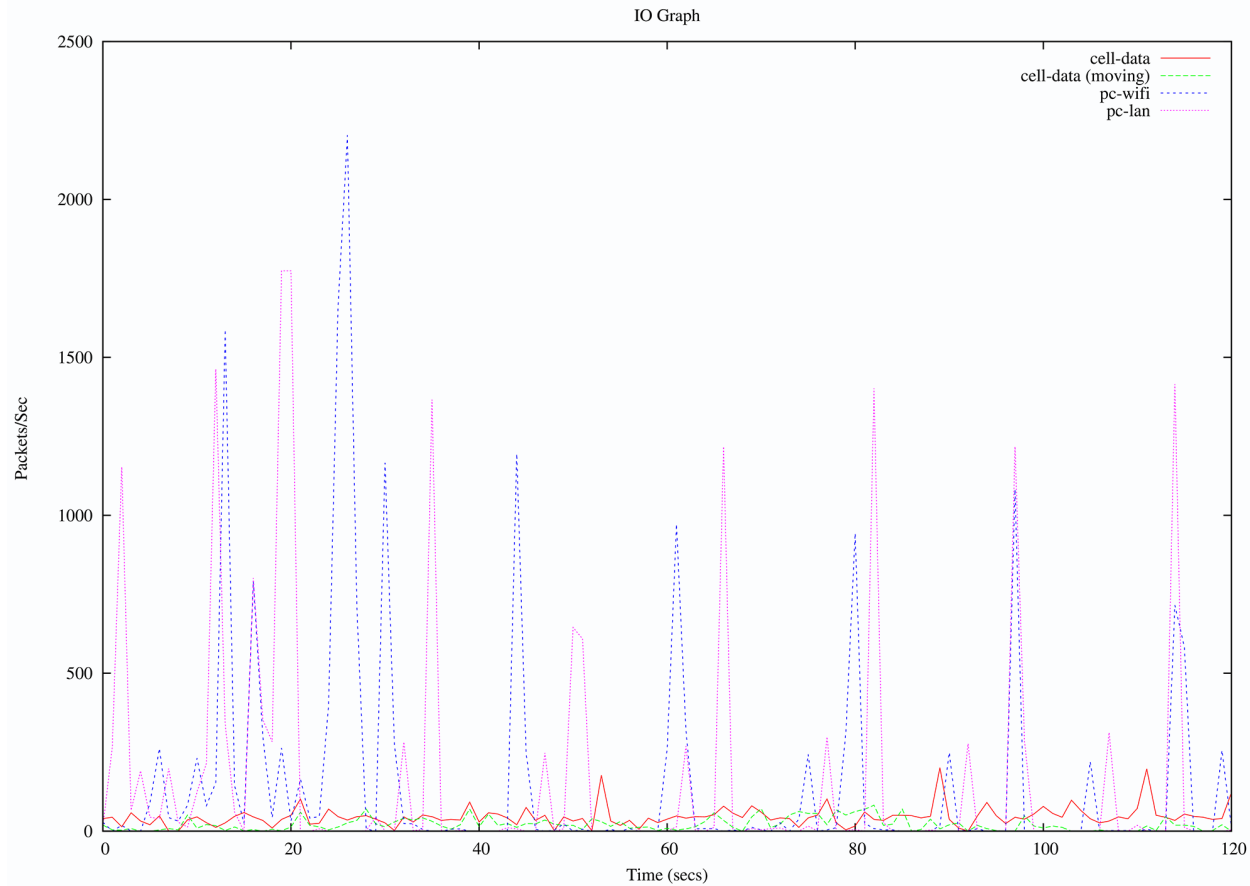
When moving, TCP performance in cell is worse



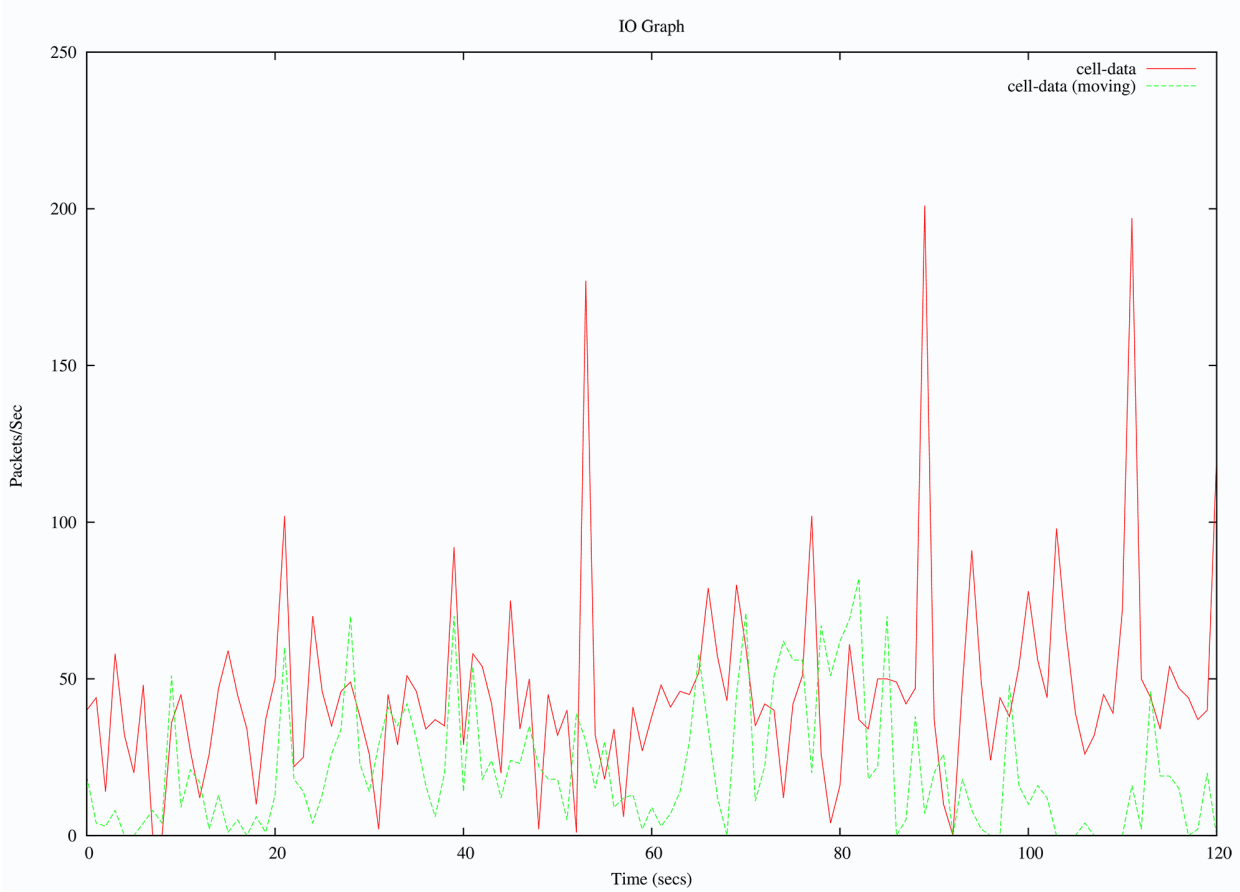
RTT is significantly higher in cell data than PC



Mobility in devices makes RTT mostly higher



Thus, less packet transmission causing high latency in cell



Similarly, when moving latency is high in cell devices

Same number
of packets
received for
each
experiment

Environment	Sample	Packet Retransmitted (percentage)
Cellular-Data	1	0.85%
“	2	0.7%
“	3	1.2%
Cellular-Data (Moving)	1	3.9%
“	2	3.1%
“	3	2.7%
Cellular-Wifi	1	0.4%
“	2	0.2%
PC-Wifi	all	0%
PC-Lan	all	0%

TCP encounters “congestion” more while moving

Environment	Packet Loss (Percentage)	Out of Order Packets (over all samples)	Connection Reset (Percentage)
Cellular-Data	0.387%	4	0.601%
Cellular-Data (Moving)	0.39%	8	0.806%
Cellular-Wifi	0.215%	17	0.111%
PC-Wifi	0.096%	1	0.128%
PC-Lan	0.195%	0	0.07%

PC drops less number of packets than cell

TCP Congestion & Flow-Control problem

- Packet retransmissions, connection resets and packet losses are mostly caused by TCP thinking there is “congestion”.
- Variant of TCP has been/is being proposed to mitigate this problem.

However.....

Proposal

- Why is it that the TCP connection is reset when we're **moving** with our mobile devices?
- WiFi routers already guarantee a continuous connection while moving around within their radius of reach.
 - State migration. Indirect TCP sockets.
 - <http://www.ccs.neu.edu/home/rraj/Courses/6710/S10/Lectures/TCPForWireless.pdf>
- Need solution for ***continuous connection*** with ***3G/4G/LTE*** TCP connections.

Thanks!!

Questions?