SMALL ISLAND, BIG POTENTIAL

Richard Lee | COMPSCI 289

CAN WE IMPROVE OUR INTERNET PROTOCOL TO INCREASE INTERNET PERFORMANCE?

Introduction

- Remote island’s internet problem
- They are slow / unreliable / usually overcrowded
- Difference between TCP and UDP
- Is TCP actually better? And why? (UDP are usually blocked)
- Simulations to collect data
- What about satellites?

Goal

- Increase the speed and improve the reliability of satellite internet
- Achieve this by improving the algorithms / protocols instead of purchasing new hardware

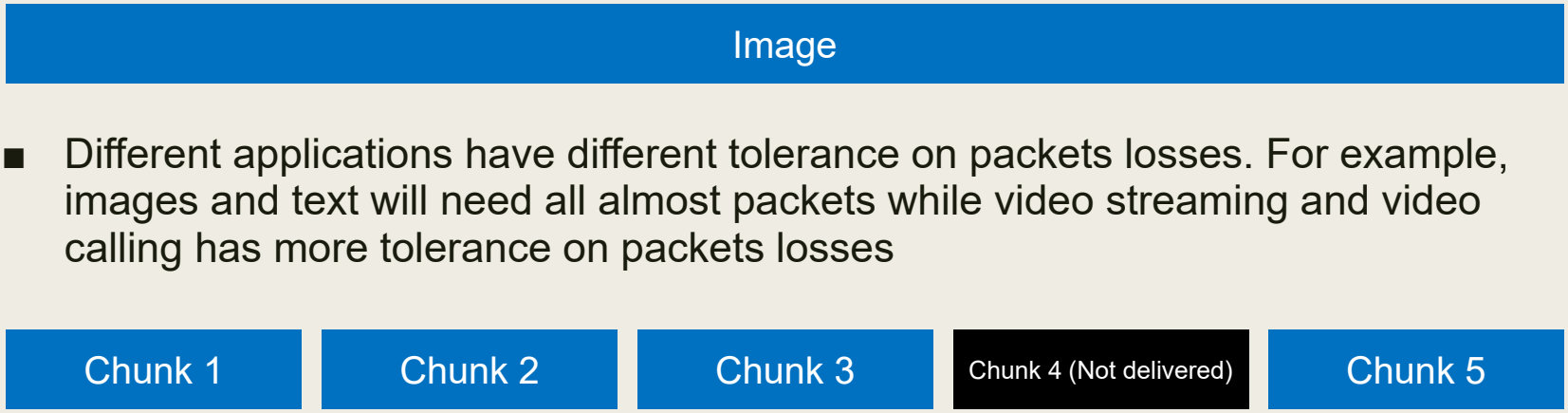
TCP VS. UDP

Problems

- Packets do get lost
- Packets get mixed up / corrupted
- Servers must deal with huge amounts of conversations / users
- Servers must deal with **flow control**

Data is made from chunks of packets

- For example, when one device sends an image to another. The image will be divided into a number of chunks. This image has been divided into **five** chunks



- Different applications have different tolerance on packets losses. For example, images and text will need all almost packets while video streaming and video calling has more tolerance on packets losses

Transmission Control Protocol (TCP)

- Heavy weight
- Connections need to be created and terminated (Three-way handshake)
- Queue management
- Packets arrive in order
- Autodetect if the packet has been sent successfully
- Stop immediately when detected a packet loss

User Datagram Protocol (UDP)

- Light weight (~60% smaller header)
- No connection required to create
- No flow management
- Packets can arrive out of order
- No compensation on packet losses
- Detects errors, but no error recovery

Which one should we use?

- Depends on the application, environment and so on.
- Depends on the congestion window and RTT (Round-trip delay)
- The “15 Kilobyte” rule

15 Kilobyte? (76.3%)

- Web Pages (HTML, CSS, JS)
- IMAP mails
- Text-based messages
- API requests
- …

Solid flows acts like UDP

Solid flows are flows within the congestion window that didn’t get delivered

We don’t want them, but they are there

Simulation

- Mock network stacks and a separate timebase
- Using the Auckland Satellite TCP/IP Traffic Simulator
- 96 Raspberry Pi
- 10 Intel NUC
- 22 separate servers

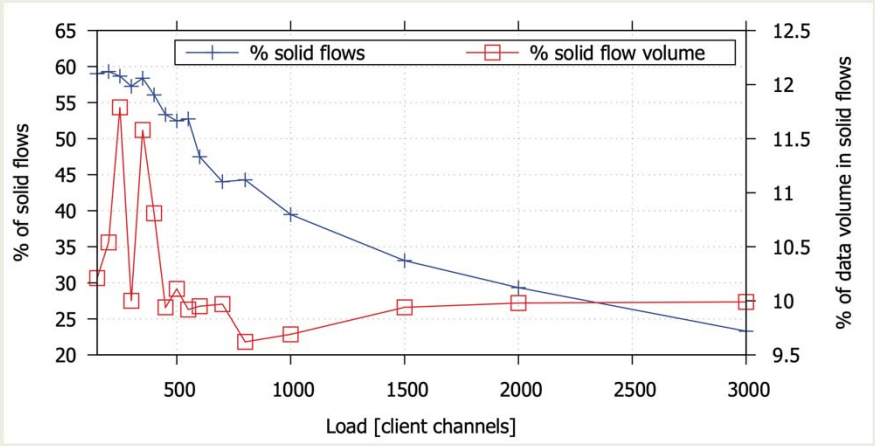
Conclusion on the experiment

- Data is very accurate
- Cost is relatively low compare to other methods
- The setup process can be relatively complicated

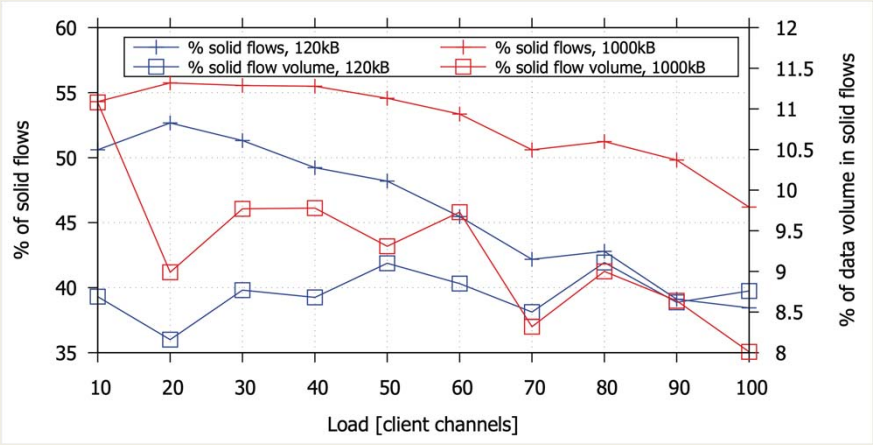
Results

- Each experiment investigates a simulated MEO or a GEO link at a certain demand level

MEO 10-12%



GEO 8-9.75%



- Around 10-12% of the link capacity occupied by TCP “behaves” like UDP

Fun Fact

- Usually, UDP accounts for just under 12% of all combines traffic
- Applications such as Skype have their own version of “UDP protocol”

“Overall, the extent of these “solid” flows suggest that adding UDP to the traffic mix may not necessarily be as problematic as it is sometimes made out to be”

Different protocols have different strengths and weaknesses, there is no “one better protocol”

Reference

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