Communication Networks

Spring 2021

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https://comm-net.ethz.ch/

ETH Zürich

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Your TAs for the semester

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A typical exercise session

Introduction of current exercise

Brief overview and some hints

Interactive part (discuss solutions, demos)

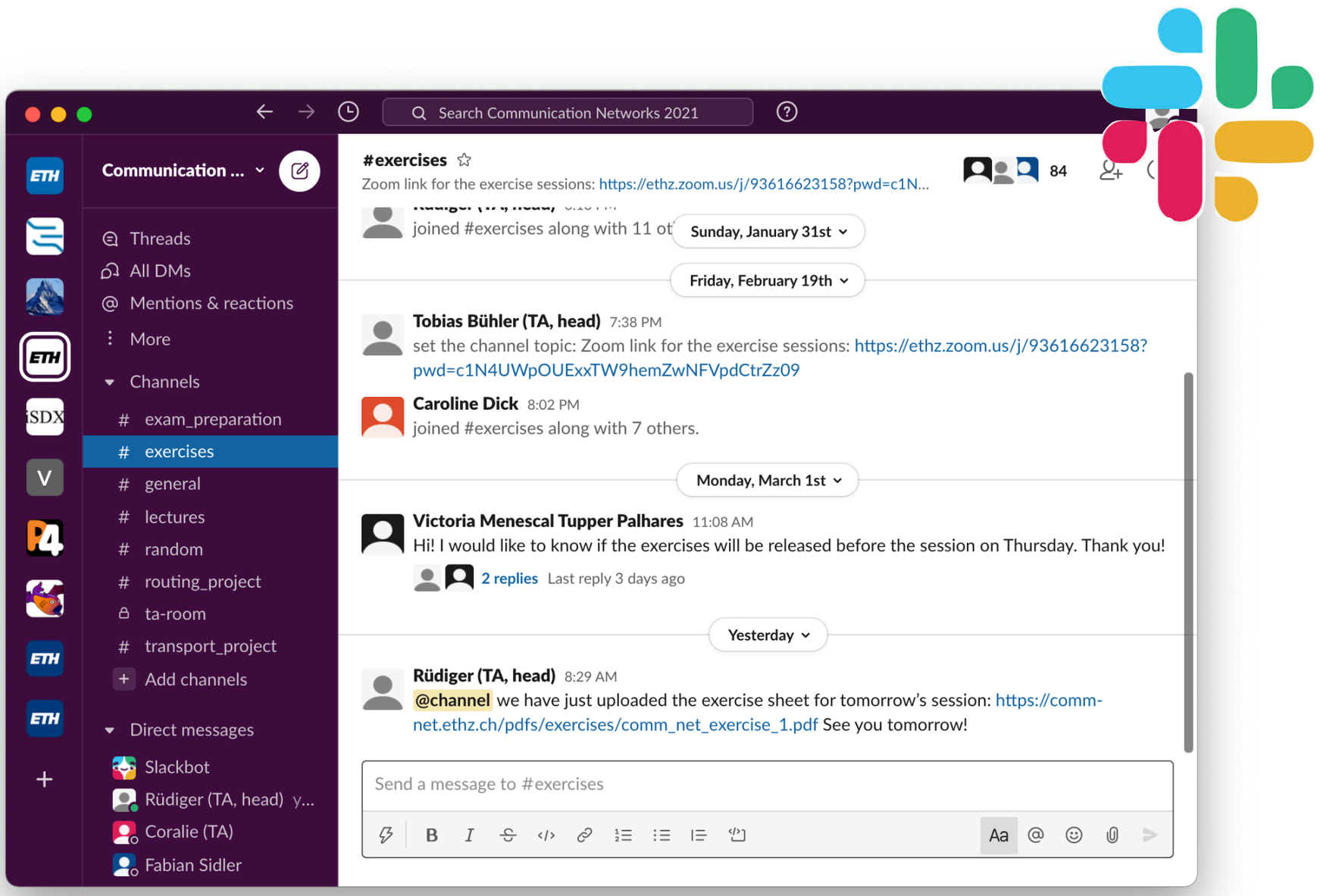
Let us know, if we should discuss specific topics

Time to solve the exercise

We are available on Slack/Zoom

We'll use Slack (a chat client)

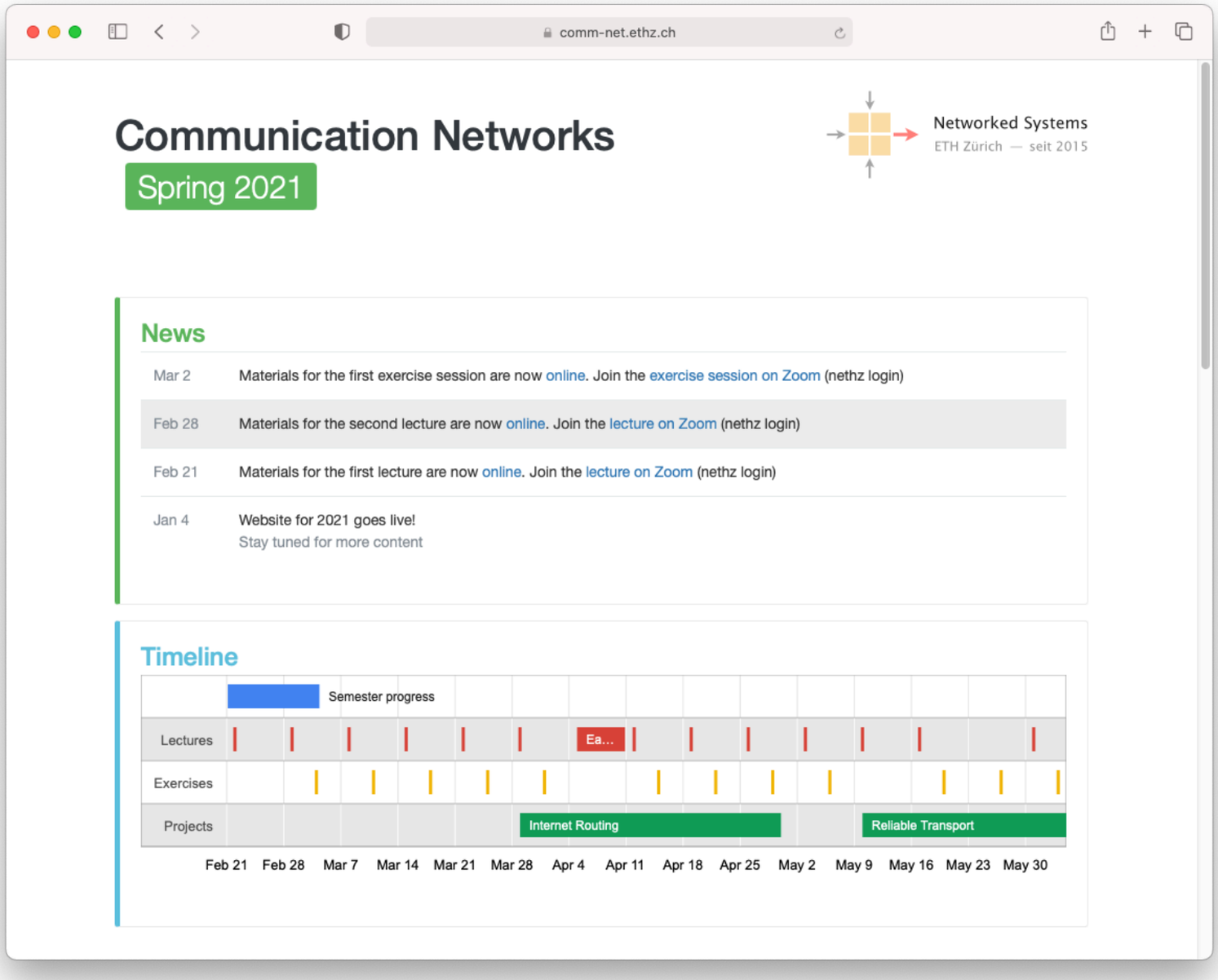
to discuss about the course and assignments



Web, smartphone and desktop clients available

Our website: https://comm-net.ethz.ch

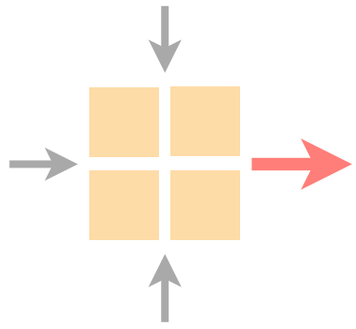
check it out regularly!



Slides, exercises, projects, extra readings, previous exams, …

Communication Networks

Exercise 1



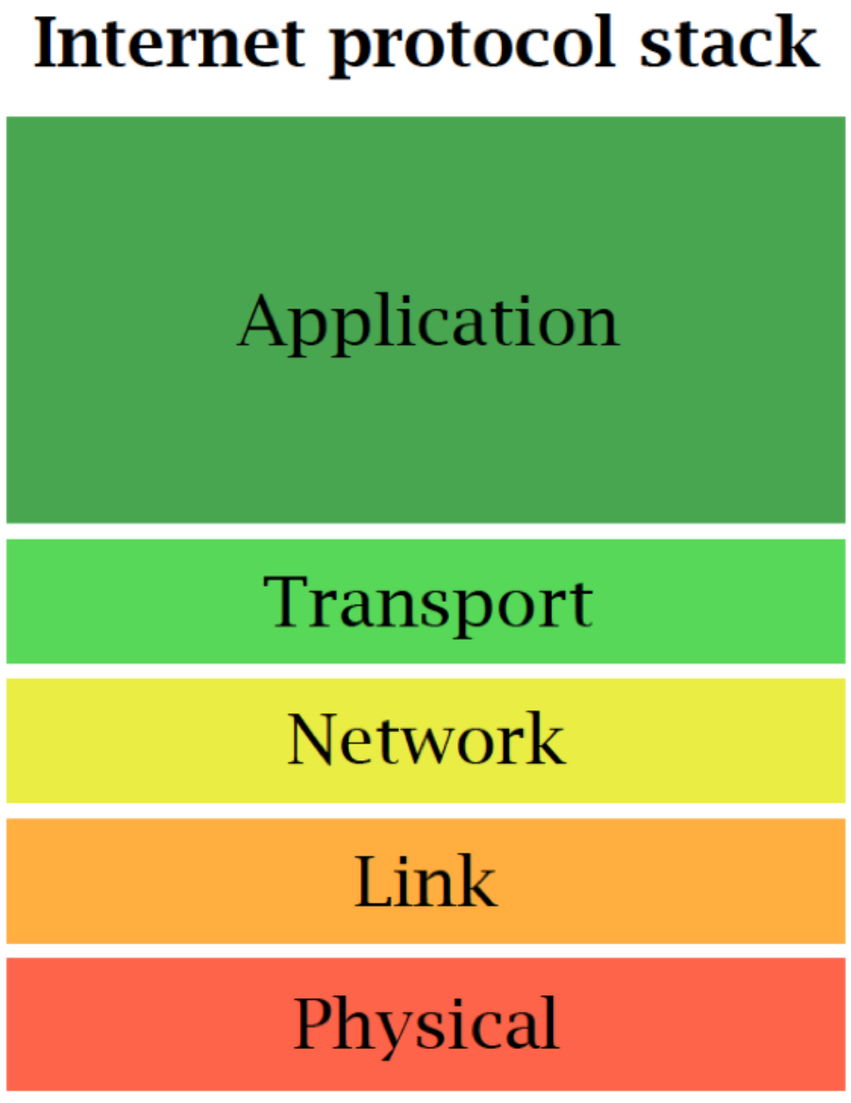
Overview current assignment

Discussion of Task 5

Time for you to solve the tasks

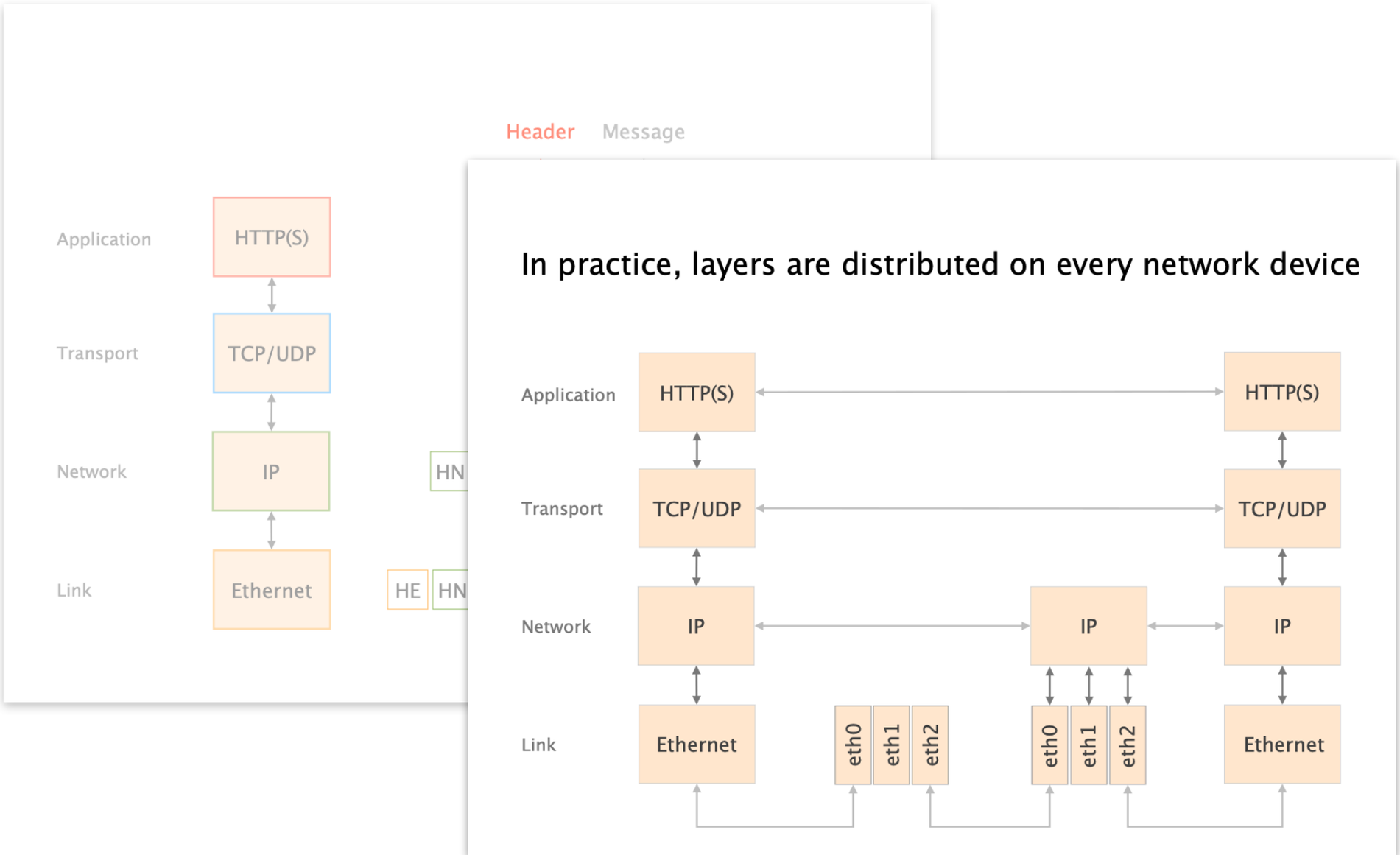
Solutions will be published next week

Task 1: Layer Model

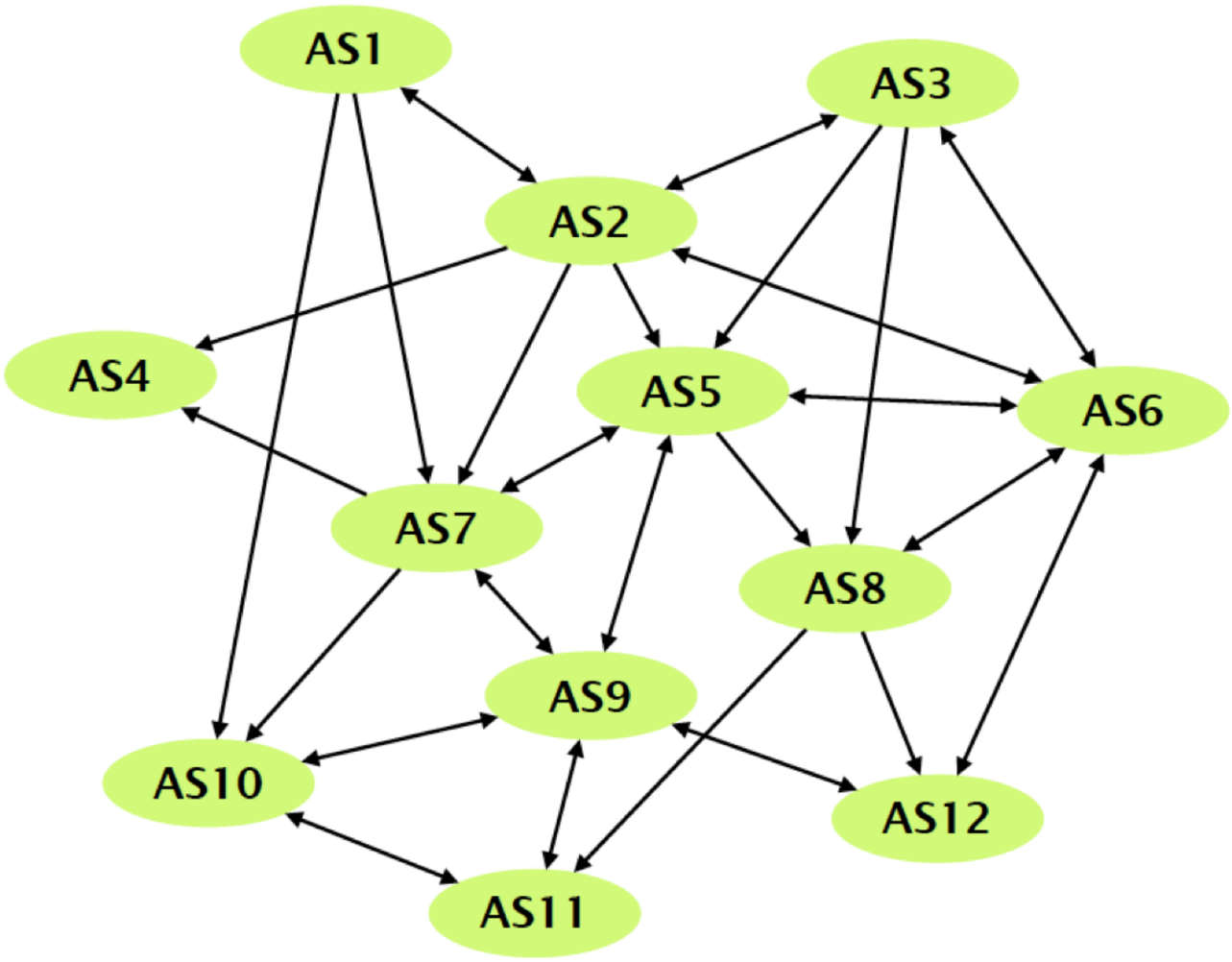


Slides: Week 2, 17–36

Network protocols are organised in layers



Task 2: Internet Organization



Slides: Week 1, 133–143

Task 3: Internet Communication

48 bits

64:a0:e7:42:2e:c2
78:4f:43:6c:b7:e2
0x0800

32 bits

4	5	2	657
1622		2	0
64	6	63144	
10.2.120.16			
82.130.102.210			

32 bits

51236	80
3710236014	
866143669	
4 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0	4117
4370	0

```
GET / HTTP/1.1\r\n
Host: comm-net.ethz.ch\r\n
Connection: keep-alive\r\n
Cache-Control: max-age=0\r\n
Upgrade-Insecure-Requests: 1\r\n
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_12_3) ...
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,...
Accept-Encoding: gzip, deflate, sdch\r\n
Accept-Language: de-DE,de;q=0.8,en-US;q=0.6,en;q=0.4\r\n
...
```

Look at your own traffic with Wireshark

https://www.wireshark.org/

Packet capturing and replaying

Similar command line tools: *tshark* or *tcpdump*

Automatically detects various protocols and packet formats

Task 4: Network Characterization

vs.

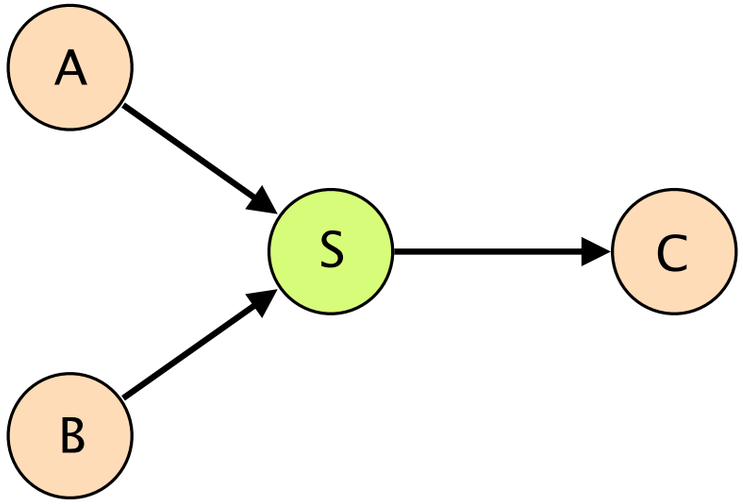
vs.

Delay? Bandwidth?

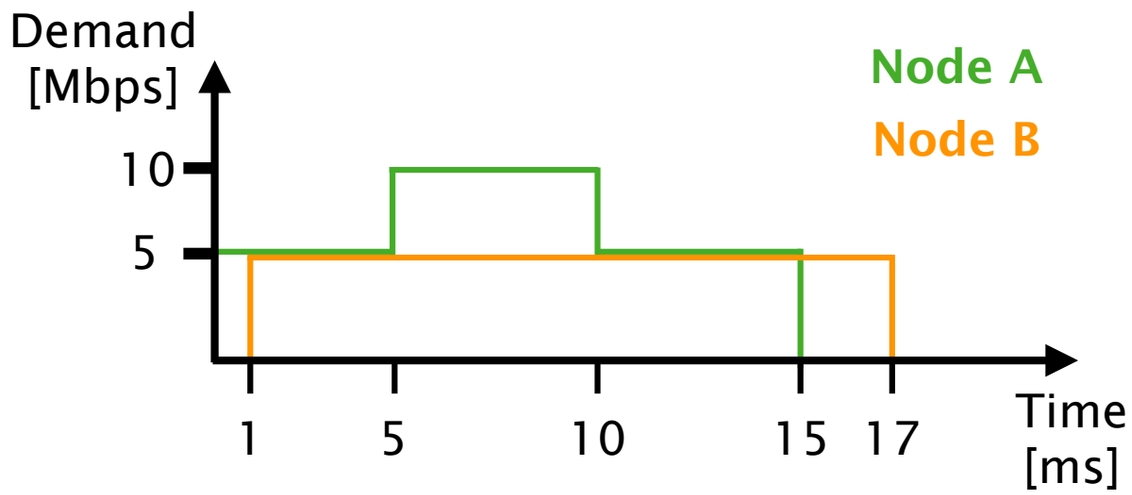
Task 5: Types of Delay

Slide: Week 2, 41

Task 6: Packet vs. Circuit Switching



Network with a shared link

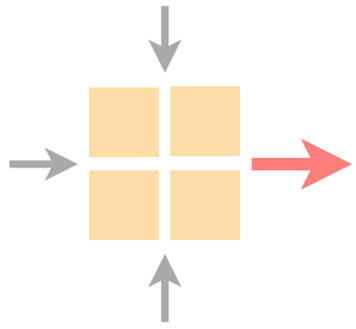


Different traffic demands

Slides: Week 1, 101–127

Communication Networks

Exercise 1



Overview current assignment

Discussion of Task 5

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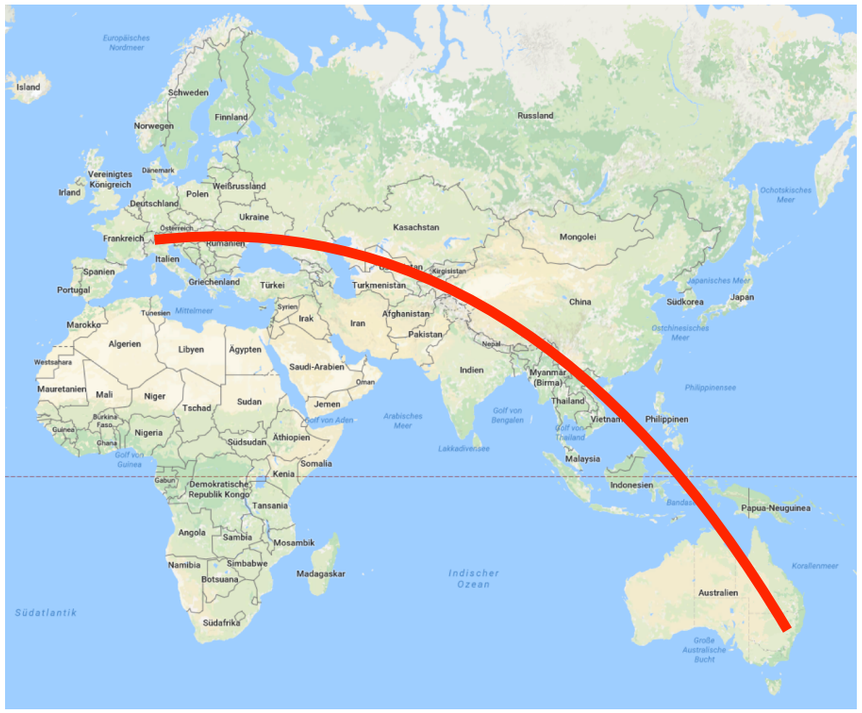
Task 5: Types of Delay



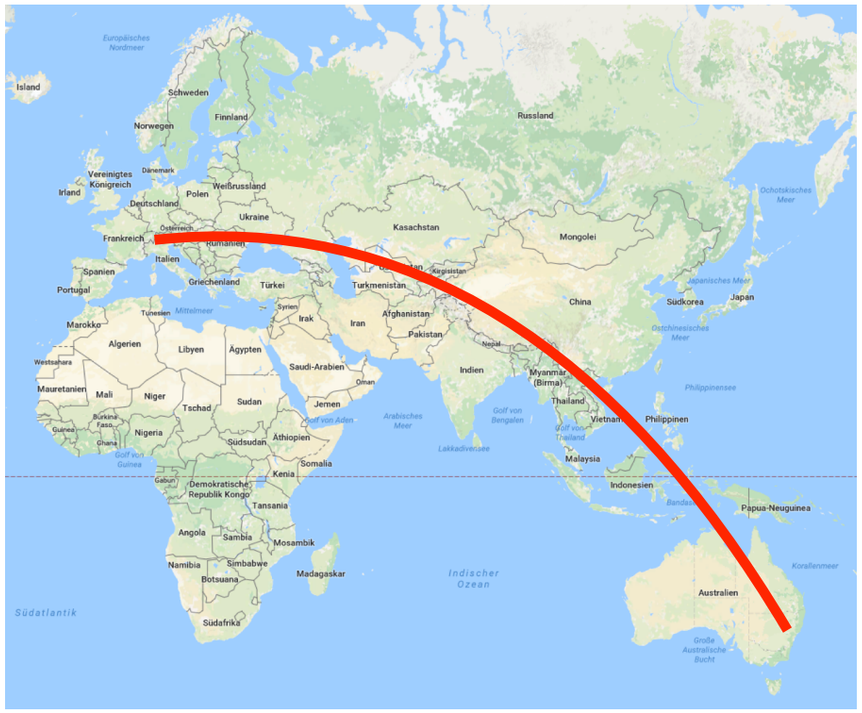
To access a website,

your data has to go from you

to the server and back.

request and response

Task 5a: Speed of Light



How long does it take to access sydney.edu.au?

Distance: 16’600km

Speed: 3 x 10^8m/s

Task 5a: Speed of Light

$$t = \frac{\text{distance}}{\text{speed}} = \frac{2 \times 1.66 \times 10^{7}\text{m}}{3 \times 10^{8}\text{m/s}} \approx 110.7\text{ms}$$

Task 5b: Speed of the “Internet”

To test a connection, we can use `ping`

- `-c` count, number of queries
- `-i` wait, time in seconds between each packet
- `-s` packetsize, number of data bytes to send
- `-S` src_addr, source address to use if multiple IPs available

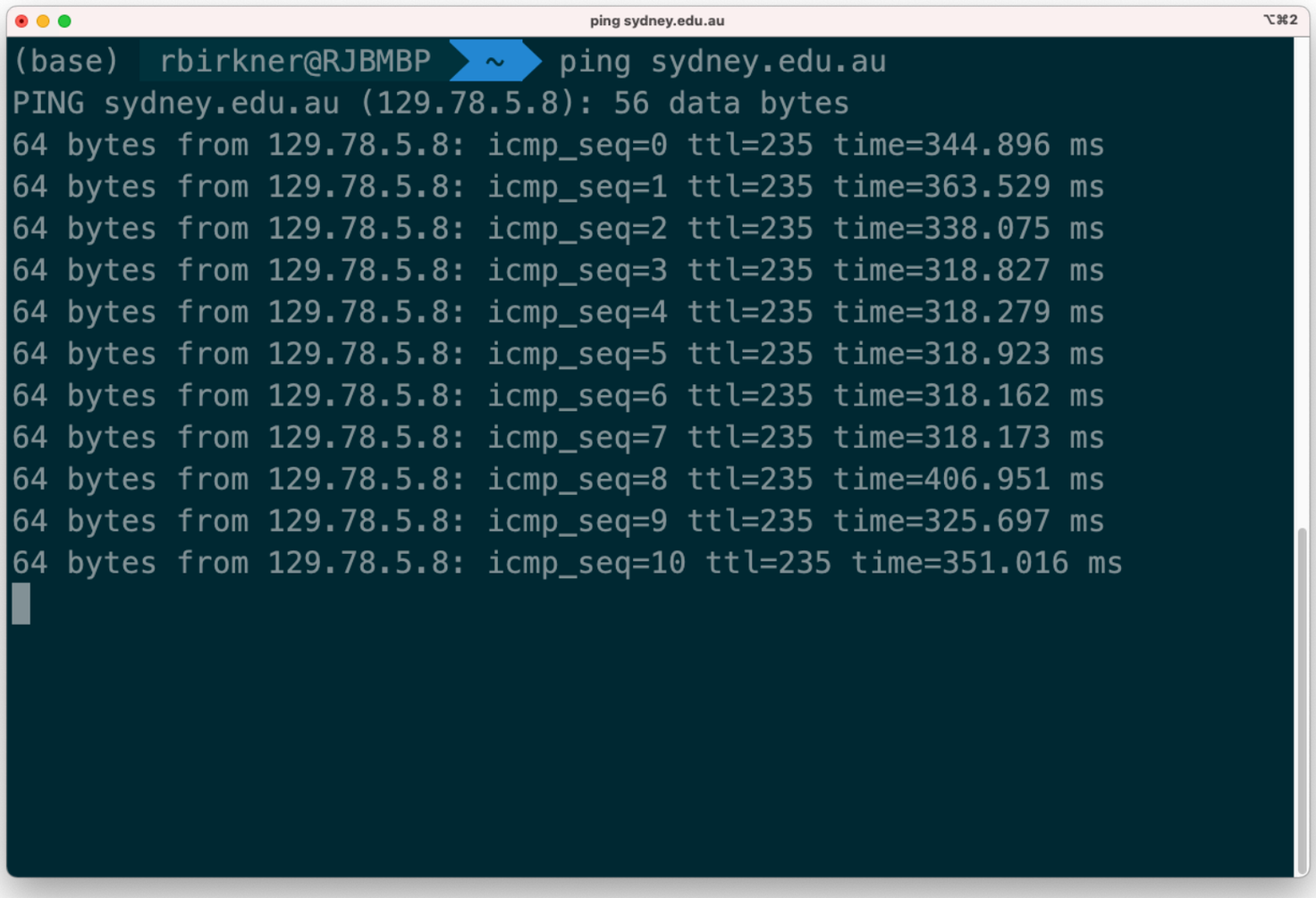
...

Task 5b: Speed of the “Internet”

test #1

…

test #11

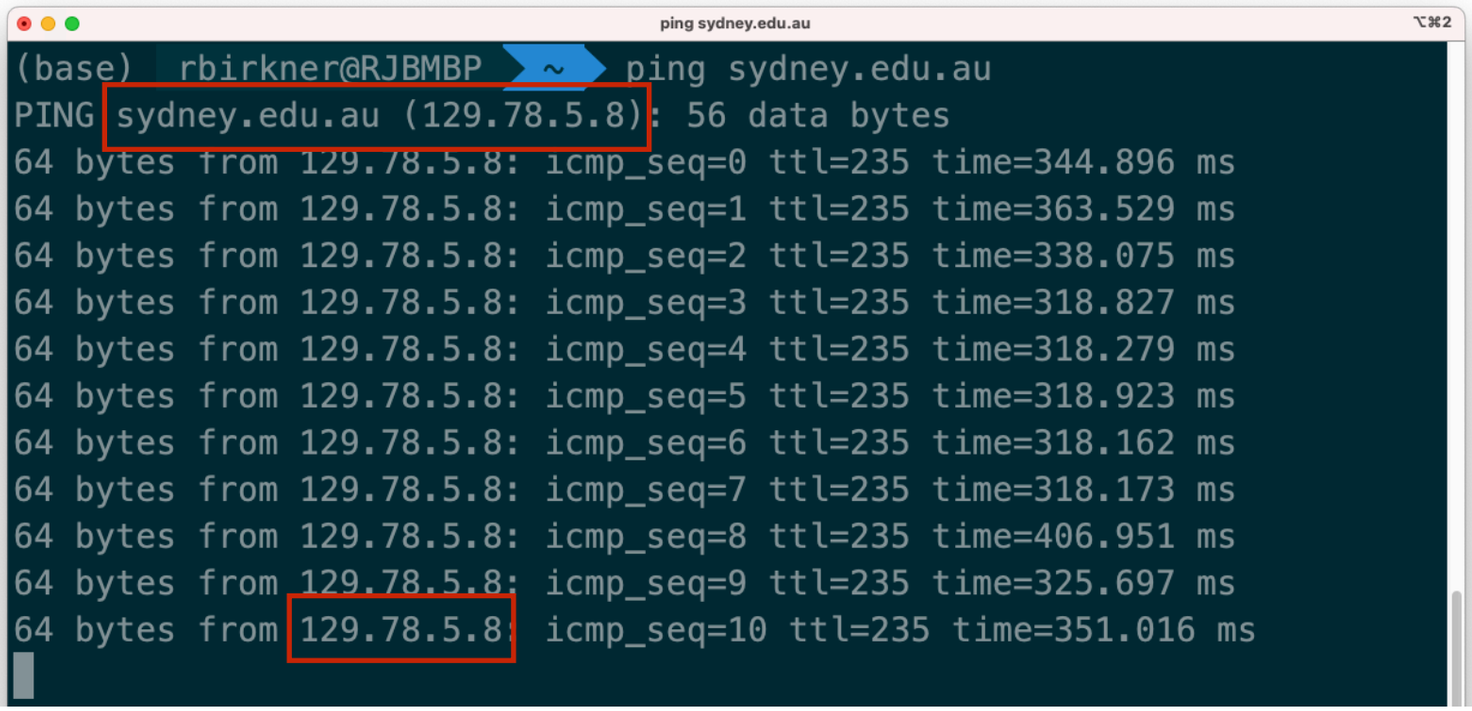


Task 5b: Speed of the “Internet”

test #1

…

test #11



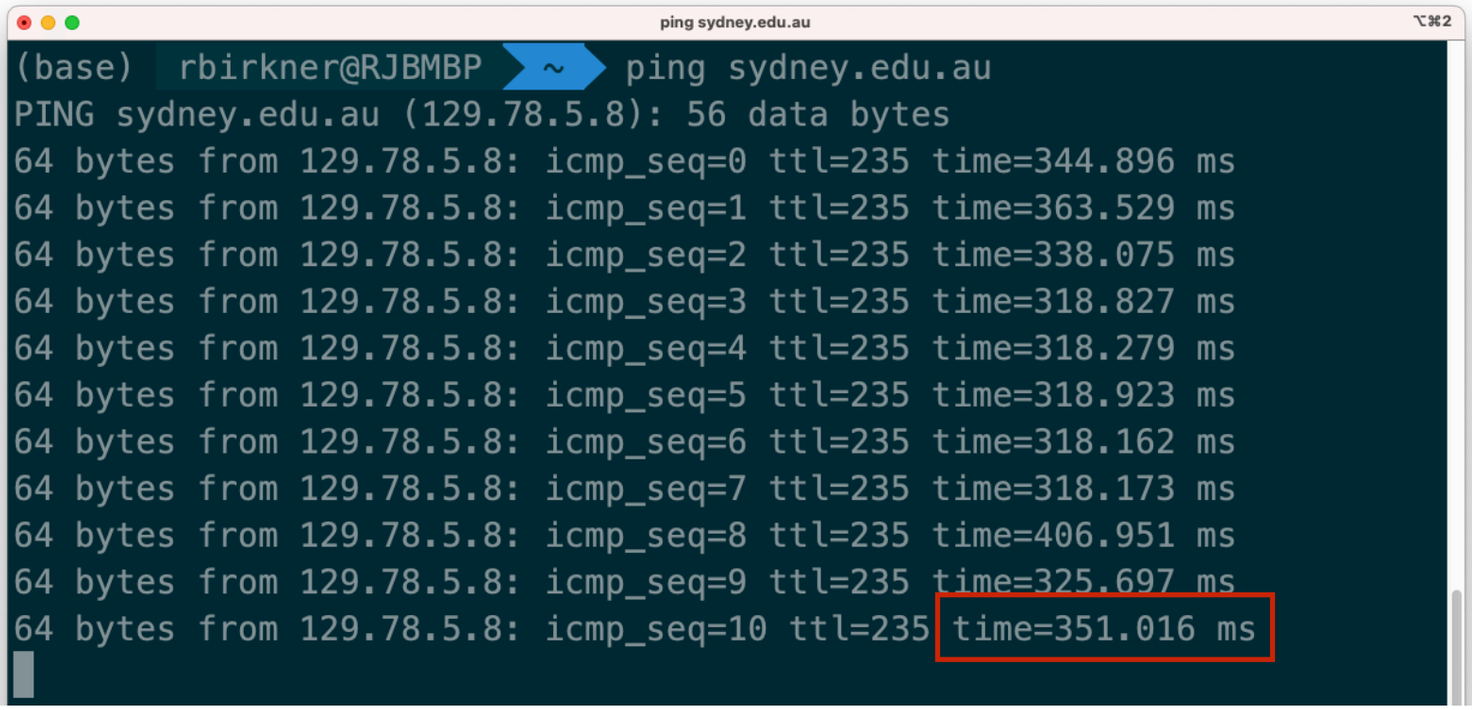
Destination address

Task 5b: Speed of the “Internet”

test #1

…

test #11



RTT measurements

Round Trip Time

Both directions!

Task 5b: Speed of the “Internet”

`ping sydney.edu.au`

“expected”	≈110ms
“observed”	≈320ms

What’s the reason for the difference?

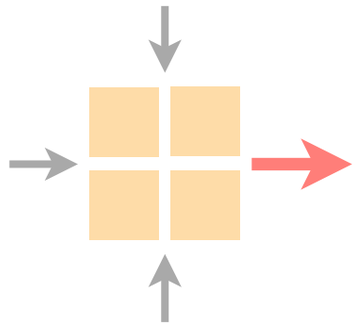
transmission, processing, queuing delay

cables don’t follow the shortest path

speed of light is reduced in fibre cables

Communication Networks

Exercise 1



Overview current assignment

Discussion of Task 5

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