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CSU33031 – Computer Networks

Assignment 1 - Discussion

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Assignment

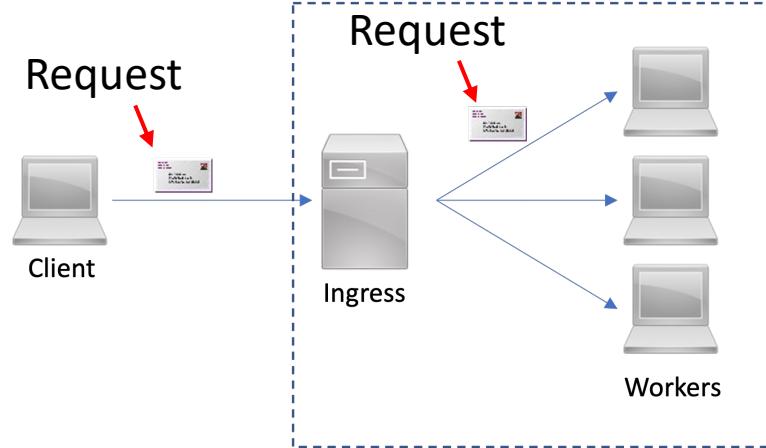
- Develop a protocol that retrieves files from a server
 - The server will distribute requests to a number of workers
 - A worker will retrieve a file and send it to the server
 - The server will forward the file to the client
-
- Has to be based on UDP
 - Header information in binary
 - Programming language of your choice – avoid Python2

Assignment

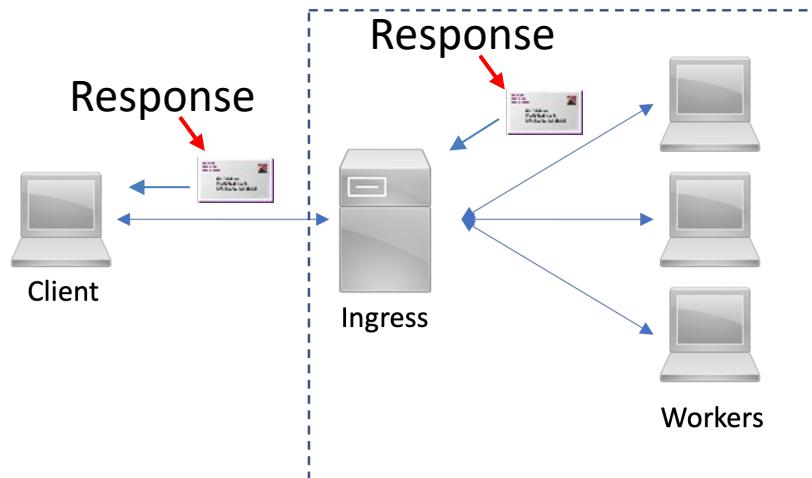
- Develop a protocol that retrieves files from a server
- The server will distribute requests to a number of workers
- A worker will retrieve a file and send it to the server
- The server will forward the file to the client

- Extensions: Security, multiple concurrent requests, etc

Assignment – Use Cases

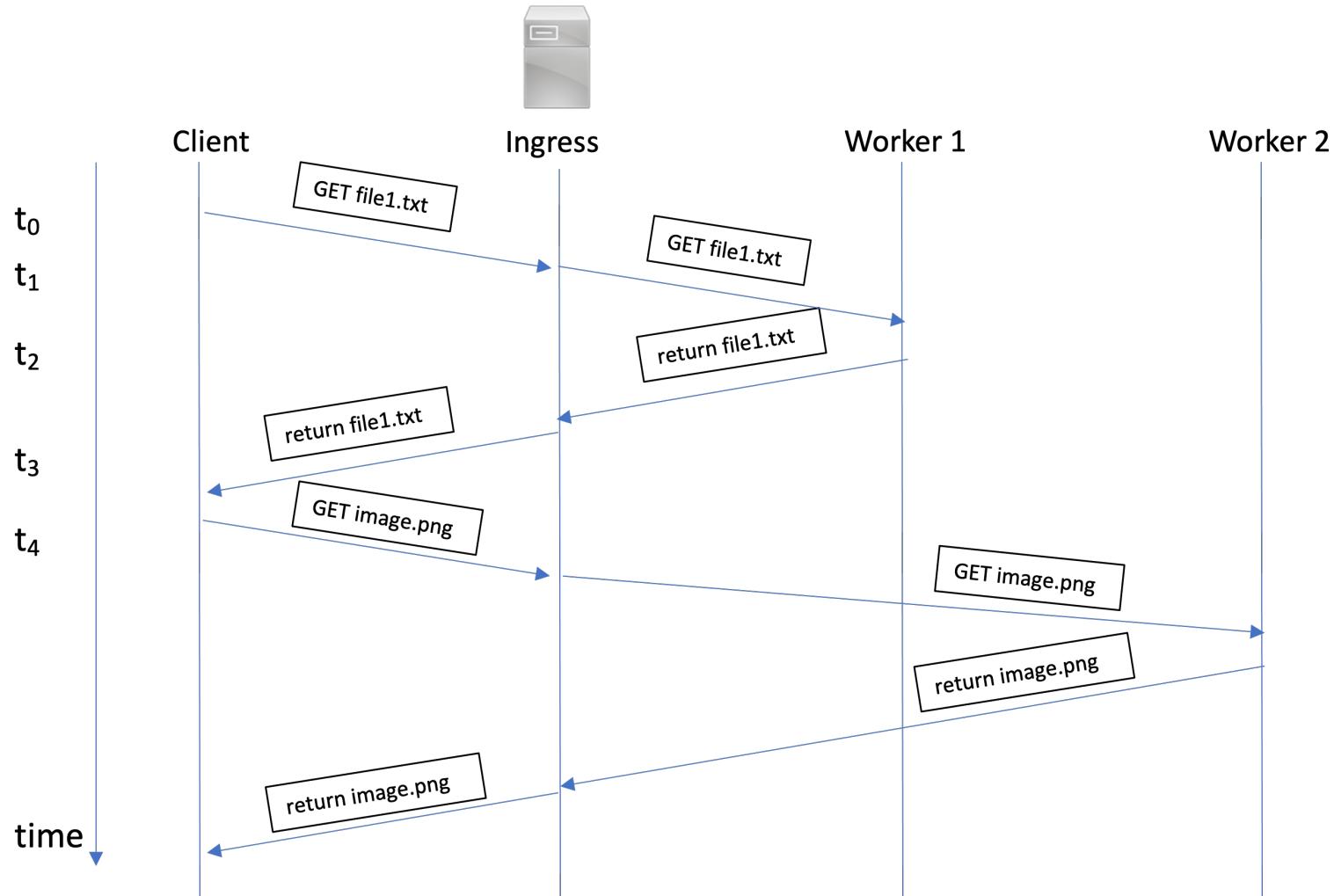


```
Request  
Filename foobar.html  
Options maxsize 1500
```



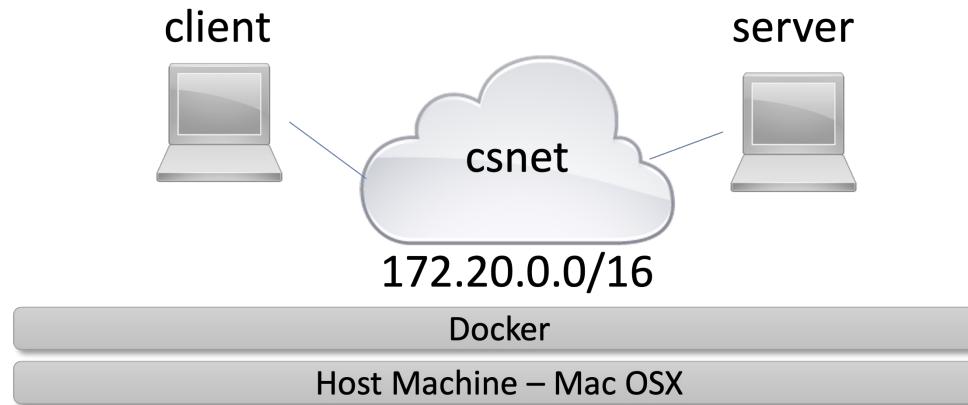
```
Response  
Source  
<Some content here>
```

Assignment – Example Flow

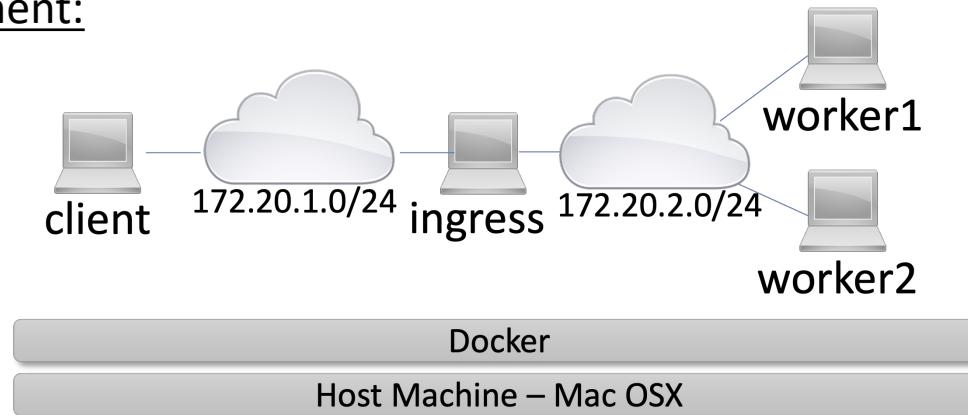


Possible Docker Topologies

Example from the Docker Walkthrough in Resources:



Example for the assignment:



Docker Walkthrough - Based on netcat

Server:

- Start capture in background
- Start netcat listening to port 50000 - UDP

```
sweber — root@6381efe55215: /compnets — com.docker.cli - docker start -i server — 90x15
[1] 2660
root@6381efe55215:/compnets# tcpdump: listening on eth1, link-type EN10MB (Ethernet), snap
shot length 262144 bytes
[nc -l -u server 50000
hello
world
this
is
a
test
for
10 packets captured
10 packets received by filter
0 packets dropped by kernel
]
```

Client:

- Start netcat sending input to server, port 50000

```
sweber — root@c714f2d50089: /compnets — com.docker.cli - docker start -i client — 90x15
[root@c714f2d50089:/compnets# nc -u server 50000
hello
world
this
is
a
test
for
]
```

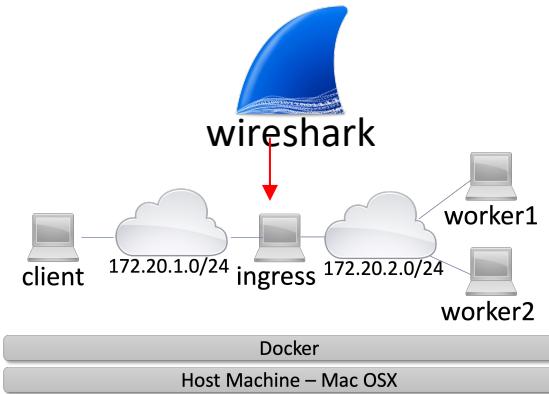
Old Java-based walkthrough at your own peril !!!

Traffic Capture

The screenshot shows the Wireshark interface with a capture file named "selected-capture.pcap". The packet list pane displays seven UDP packets from source 172.20.0.3 to destination 172.20.0.2. The details pane shows the first packet in detail, which is a User Datagram Protocol (UDP) frame. The bytes pane at the bottom shows the raw hex and ASCII data of the selected packet.

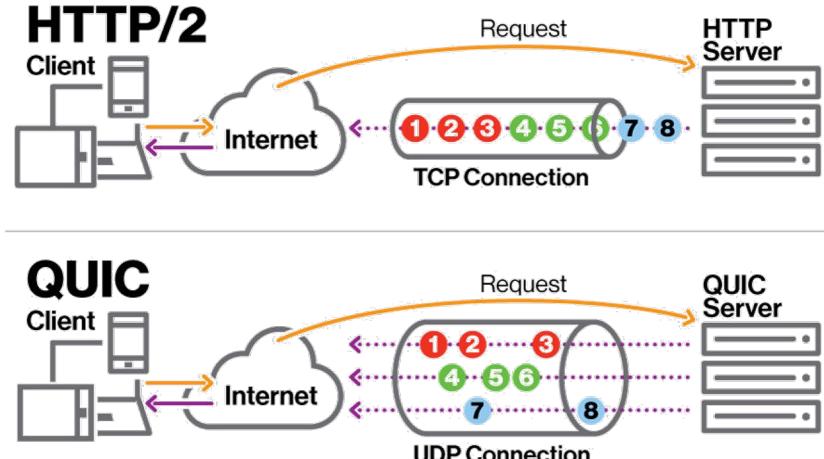
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	172.20.0.3	172.20.0.2	UDP	48	32931 → 50000 Len: 48 (384 bits)
2	2.246045	172.20.0.3	172.20.0.2	UDP	48	32931 → 50000 Len: 48 (384 bits)
3	4.818378	172.20.0.3	172.20.0.2	UDP	47	32931 → 50000 Len: 47 (384 bits)
4	6.174425	172.20.0.3	172.20.0.2	UDP	46	32931 → 50000 Len: 46 (384 bits)
5	7.417462	172.20.0.3	172.20.0.2	UDP	44	32931 → 50000 Len: 44 (384 bits)
6	8.557154	172.20.0.3	172.20.0.2	UDP	47	32931 → 50000 Len: 47 (384 bits)

```
> Frame 1: 48 bytes on wire (384 bits), 48 bytes captured (384 bits)
> Ethernet II, Src: 02:42:ac:14:00:03, Dst: 02:42:ac:14:00:02
└ Internet Protocol Version 4, Src: 172.20.0.3 (172.20.0.3), Dst: 172.20.0.2 (172.20.0.2)
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        Total Length: 34
        Identification: 0x6c4b (27723)
        Flags: 0x40, Don't fragment
        ...0 0000 0000 0000 = Fragment Offset: 0
        Time to Live: 64
        Protocol: UDP (17)
        Header Checksum: 0x7652 [validation disabled]
            [Header checksum status: Unverified]
        Source Address: 172.20.0.3 (172.20.0.3)
        Destination Address: 172.20.0.2 (172.20.0.2)
    User Datagram Protocol, Src Port: 32931, Dst Port: 50000
        Source Port: 32931
        Destination Port: 50000
        Length: 14
        Checksum: 0x584d [unverified]
0000  02 42 ac 14 00 02 02 42 ac 14 00 03 08 00 45 00  ·B.....B.....E··
0010  00 22 6c 4b 40 00 40 11 76 52 ac 14 00 03 ac 14  ·"lK@·@· vR·····
0020  00 02 80 a3 c3 50 00 0e 58 4d 68 65 6c 6c 6f 0a  ···P·· XMhello·
```

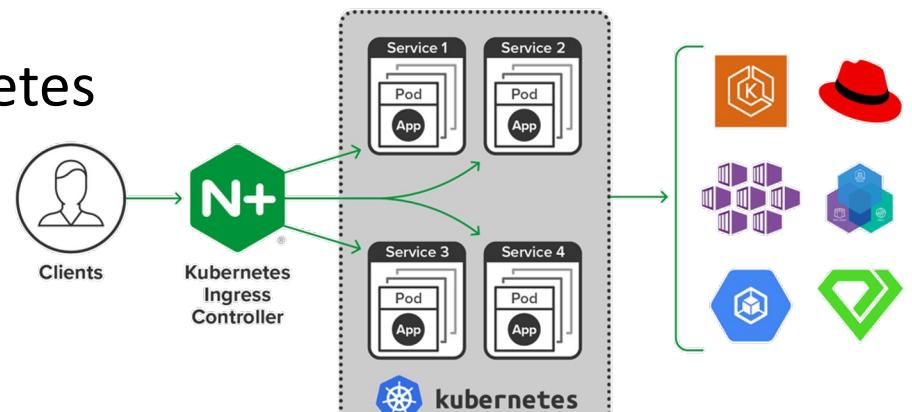


Assignment Relevance

- Designing your own protocol
 - Thinking/Explaining relevance of header information
- Capturing real network traffic
 - Seeing what a packet is
- QUIC protocol
- Ingress Controller in Kubernetes



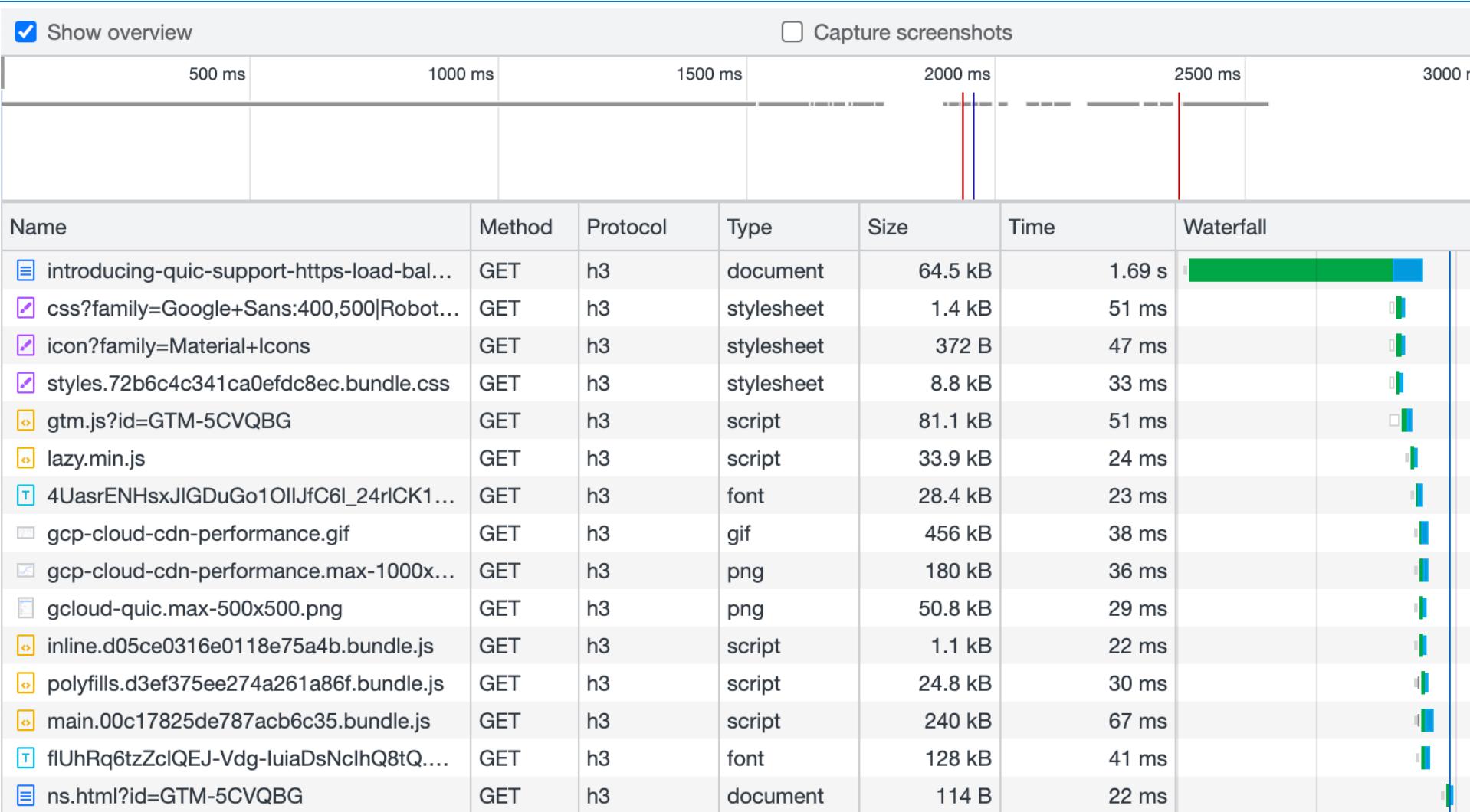
*<https://devopedia.org/quic>



*<https://www.nginx.com/>

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Example Waterfall from Chrome



Learning Outcomes

Hopefully lots

Most

At the
very least

Datacentres Infrastructures

The Rise of HyperGiants

Software-Defined Networking

Protocol Design

NAT &VPN

Docker/Virt.Infra.

Traffic Capture

Sockets

IPv4

Routing

802.3

802.11

Payload

Overhead

Environments:

- Multiple Computers
- Containers / Docker
- Mininet
- Kubernetes

Assignment Timeline

- Preliminary Deadlines for submissions:
 - 28th September: Assignment 1 – Part 1 – Video/PCAP (5%)
 - 12th October: Assignment 1 – Part 2 – Video/PCAP (5%)
 - 28nd October: Assignment 1 – Part 3 – FileReq report (20%)
- **Deadlines on Blackboard count**

mymodule.tcd.ie

Blackboard Setup – Assignment 1 View

CSU33031-202223
(COMPUTER NETWORKS)

Main Page
Assignment 1
Assignment 2
Announcements

Assignment 1

 **Assignment 1** 
Placeholder for description of assignment 1

The assignment is split into 3 parts: 1) an initial video in which you discuss your initial approach towards a solution, 2) a video in which you discuss your progress towards a solution, and 3) a report in which you discuss your solution. Before the submission of a video in part 1 and 2, you will be asked to submit a file with capture of network traffic of your solution in progress; before the submission of a report in part 3, you will be asked to submit a file with capture of network traffic of your solution and the source code etc of your solution.

Part 1

(Step 1 of 2): Submit pcap file
(Step 2 of 2): Submit video file

Part 2

(Step 1 of 2): Submit pcap file
(Step 2 of 2): Submit video file

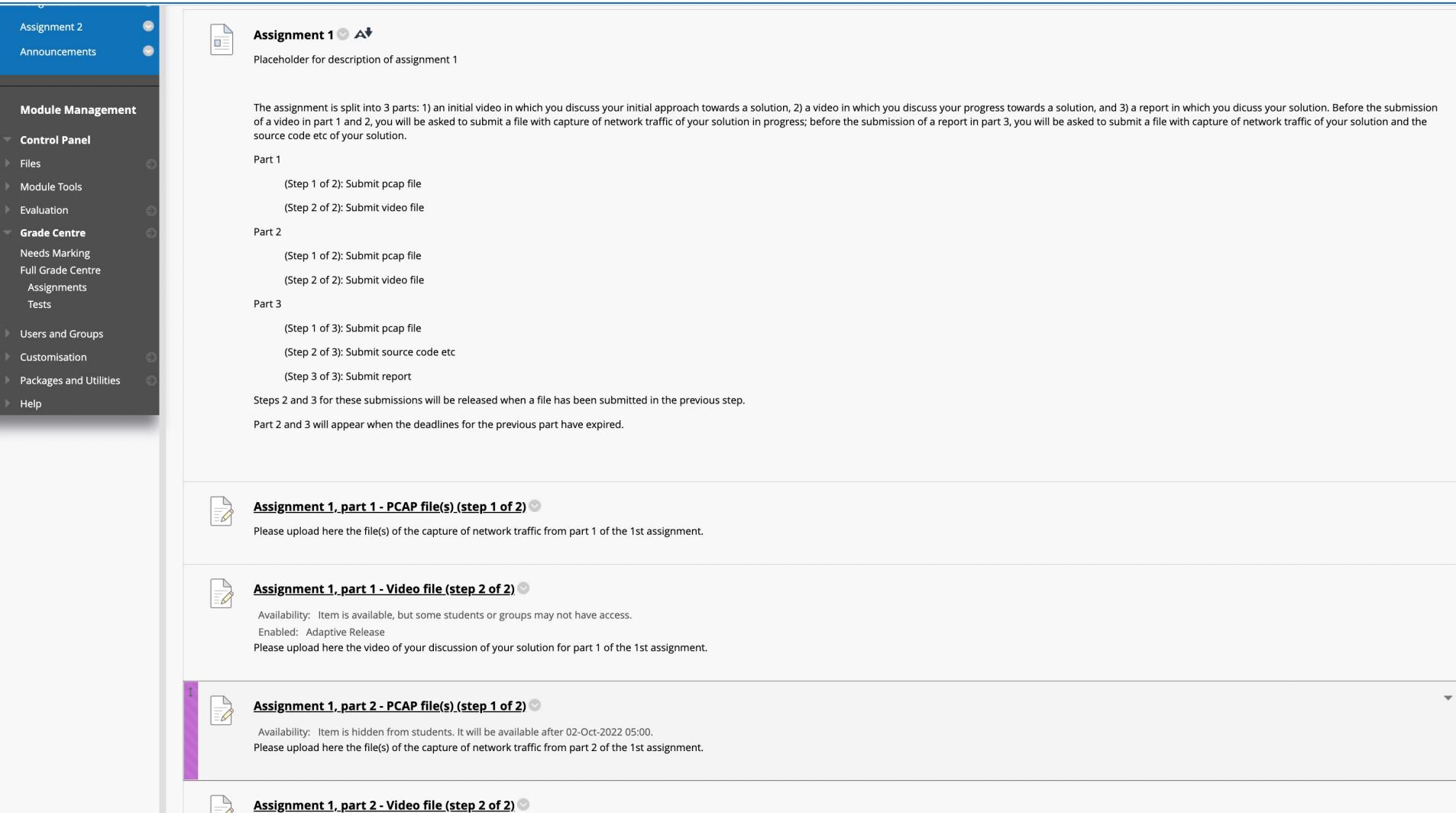
Part 3

(Step 1 of 3): Submit pcap file
(Step 2 of 3): Submit source code etc
(Step 3 of 3): Submit report

Steps 2 and 3 for these submissions will be released when a file has been submitted in the previous step.
Part 2 and 3 will appear when the deadlines for the previous part have expired.

 **Assignment 1, part 1 - PCAP file(s). (step 1 of 2)**
Please upload here the file(s) of the capture of network traffic from part 1 of the 1st assignment.

Blackboard Setup – Add. Assignments



The screenshot shows the Blackboard assignment setup interface. On the left, there's a sidebar with navigation links like Assignment 2, Announcements, Module Management, Control Panel, Files, Module Tools, Evaluation, Grade Centre, Users and Groups, Customisation, Packages and Utilities, and Help. The main area is titled "Assignment 1" and contains a placeholder for the assignment description. It details three parts: Part 1 (submit pcap file, submit video file), Part 2 (submit pcap file, submit video file), and Part 3 (submit pcap file, submit source code etc., submit report). It also notes that steps 2 and 3 are released after step 1. Below this, there are four specific assignment items: "Assignment 1, part 1 - PCAP file(s) (step 1 of 2)", "Assignment 1, part 1 - Video file (step 2 of 2)", "Assignment 1, part 2 - PCAP file(s) (step 1 of 2)", and "Assignment 1, part 2 - Video file (step 2 of 2)". Each item has its availability and enabled status listed.

Assignment 1  Placeholder for description of assignment 1

The assignment is split into 3 parts: 1) an initial video in which you discuss your initial approach towards a solution, 2) a video in which you discuss your progress towards a solution, and 3) a report in which you dicuss your solution. Before the submission of a video in part 1 and 2, you will be asked to submit a file with capture of network traffic of your solution in progress; before the submission of a report in part 3, you will be asked to submit a file with capture of network traffic of your solution and the source code etc of your solution.

Part 1
(Step 1 of 2): Submit pcap file
(Step 2 of 2): Submit video file

Part 2
(Step 1 of 2): Submit pcap file
(Step 2 of 2): Submit video file

Part 3
(Step 1 of 3): Submit pcap file
(Step 2 of 3): Submit source code etc
(Step 3 of 3): Submit report

Steps 2 and 3 for these submissions will be released when a file has been submitted in the previous step.

Part 2 and 3 will appear when the deadlines for the previous part have expired.

Assignment 1, part 1 - PCAP file(s) (step 1 of 2) 

Please upload here the file(s) of the capture of network traffic from part 1 of the 1st assignment.

Assignment 1, part 1 - Video file (step 2 of 2) 

Availability: Item is available, but some students or groups may not have access.
Enabled: Adaptive Release

Please upload here the video of your discussion of your solution for part 1 of the 1st assignment.

Assignment 1, part 2 - PCAP file(s) (step 1 of 2) 

Availability: Item is hidden from students. It will be available after 02-Oct-2022 05:00.
Please upload here the file(s) of the capture of network traffic from part 2 of the 1st assignment.

Assignment 1, part 2 - Video file (step 2 of 2) 

Blackboard Setup – Add. Assignments 2

Part 2 and 3 will appear when the deadlines for the previous part have expired.

 **Assignment 1.part 1 - PCAP file(s) (step 1 of 2)** 

Please upload here the file(s) of the capture of network traffic from part 1 of the 1st assignment.

 **Assignment 1.part 1 - Video file (step 2 of 2)** 

Availability: Item is available, but some students or groups may not have access.
Enabled: Adaptive Release
Please upload here the video of your discussion of your solution for part 1 of the 1st assignment.

 **Assignment 1.part 2 - PCAP file(s) (step 1 of 2)** 

Availability: Item is hidden from students. It will be available after 02-Oct-2022 05:00.
Please upload here the file(s) of the capture of network traffic from part 2 of the 1st assignment.

 **Assignment 1.part 2 - Video file (step 2 of 2)** 

Availability: Item is hidden from students. It will be available after 02-Oct-2022 05:00.
Enabled: Adaptive Release

 **Assignment 1.part 3 - PCAP file(s) (step 1 of 3)** 

Availability: Item is hidden from students. It will be available after 16-Oct-2022 05:00.
Please upload here the file(s) of the capture of network traffic from part 3 of the 1st assignment.

 **Assignment 1.part 3 - source code, etc (step 2 of 3)** 

Availability: Item is hidden from students. It will be available after 16-Oct-2022 05:00.
Enabled: Adaptive Release
Please upload here the source code file(s) etc for your solution of the 1st assignment.

 **Assignment 1.part 3 - PDF of the report (step 3 of 3)** 

Availability: Item is hidden from students. It will be available after 16-Oct-2022 05:00.
Enabled: Adaptive Release
Please upload here a PDF copy of your report that describes your solution of the 1st assignment.

View of Grade Centre

<input type="checkbox"/>	LAST NAME	FIRST NAME	TOTAL	ASSIGNMENT 1, PART 1 - VIDEO FILE (STEP 2 OF 2)	ASSIGNMENT 1, PART 2 - VIDEO FILE (STEP 2 OF 2)	ASSIGNMENT 1, PART 3 - PDF OF THE REPORT (STEP 3 OF 3)	ASSIGNMENT 2, PART 1 - VIDEO FILE (STEP 2 OF 2)	ASSIGNMENT 2, PART 2 - VIDEO FILE (STEP 2 OF 2)	ASSIGNMENT 2, PART 3 - PDF OF THE REPORT (STEP 3 OF 3)
<input type="checkbox"/>			--	--	--	--	--	--	--
<input type="checkbox"/>			--	--	--	--	--	--	--
<input type="checkbox"/>			--	--	--	--	--	--	--
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<input type="checkbox"/>			--	--	--	--	--	--	--

Summary

- Develop your own protocol with your own header information
- Capture traffic
- Create videos & Write report



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