

Name_____ Student ID_____ Department/Year_____

1st Examination

Introduction to Computer Networks (Hybrid)

Class#: EE 4020, Class-ID: 901E31110

Spring 2021

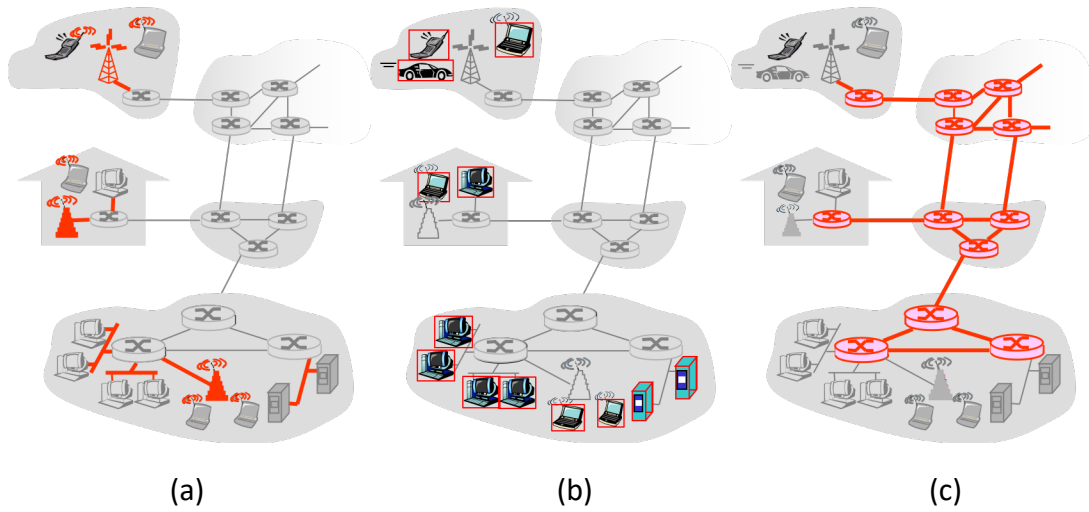
13:20-14:10 Thursday

March 18, 2021

Cautions

1. There are in total 100 points to earn. You have 45 minutes to answer the questions. Skim through all questions and start from the questions you are more confident with.
2. Use only English to answer the questions. Misspelling and grammar errors will be tolerated, but you want to make sure with these errors your answers will still make sense.

1. (ch11, 3pt) Consider the 3 figures below that highlight different parts of the mini-Internet we've seen several times in class. (3pt)



- (1) Which highlights the core part of the mini-Internet (1pt)?
- (2) Which highlights the edge part of the mini-Internet (1pt)?
- (3) Which highlights the access network part of the mini-Internet (1pt)?

Sample Solution:

- (1) (c)
- (2) (b)
- (3) (a)

2. (ch11, 5pt) Consider the following sequences of events. True (T) or false (F), it is a part of a social or communication protocol at work?

(1) When your friend says hi to you, you say hi back (1pt).

(2) When a Web server receives a Web request, it sends a Web response back (1pt).

(3) A stranger informs you that your zip fly is open. You blush and zip up (1pt).

(4) When a laptop connects to a new WiFi subnet, the laptop sends a request to the DHCP server on the subnet to acquire an IP address. The DHCP server sends a “no free IP address” message back to the laptop (1pt).

(5) You ask a question. Polly does not respond. You ask the question again. Polly responds the second time (1pt).

Sample Solution:

All T

3. (ch12, 10pt) Consider the 5 access network technologies we have discussed in class. Which of the following statements are true and which are false?

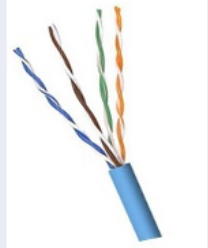


- (1) ADSL provides equal uplink and downlink bandwidth (1pt).
- (2) Cable modem provides equal uplink and downlink bandwidth (1pt).
- (3) FTTH provides equal and unequal uplink and downlink bandwidth (1pt).
- (4) Ethernet provides equal uplink and downlink bandwidth (1pt).
- (5) WiFi provides equal uplink and downlink bandwidth (1pt).
- (6) ADSL provides dedicated access from the household to the ISP (1pt).
- (7) Cable modem provides dedicated access from the household to the ISP (1pt).
- (8) FTTH provides dedicated access from the household to the ISP (1pt).
- (9) Ethernet provides dedicated access from the user to the AP (1pt).
- (10) WiFi provides dedicated access from the user to the AP (1pt).

Sample Solution:

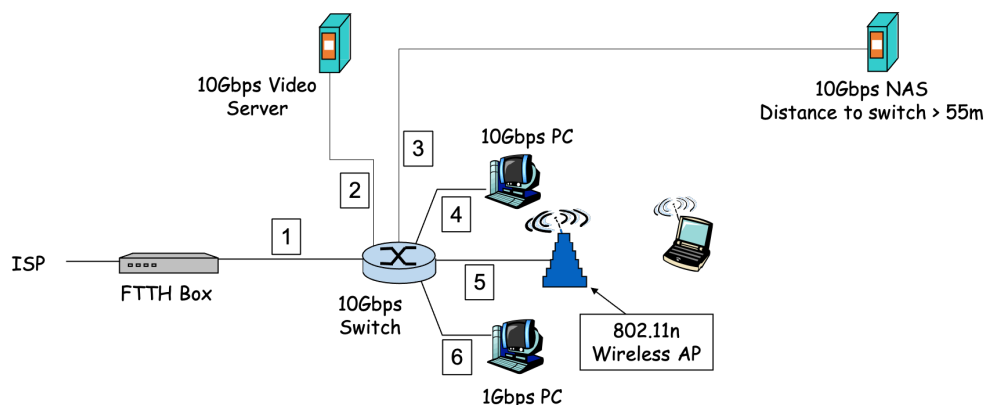
F, F, T, T, T, T, F, T, F, F

4. (ch12, 18pt). 10Gbps Ethernet switches and 10Gbps Ethernet network cards are growingly affordable. As we introduce these 10Gbps Ethernet devices into the network, we might want to be careful about the use of Ethernet cable to take advantage of the 10Gbps capacity.

The Cat5e, Cat6, Cat6a cables are commonly available these days. They differ in (1) the modulation frequency and (2) the shielding granularity. Higher modulation frequency gives more reliable 10Gbps transmission rate. More elaborated shielding gives more reliable 10Gbps rate over a long distance.

	Cat5e	Cat6	Cat6a
Frequency	100MHz	250MHz	500MHz
Shielding			
Capacity	1Gbps	10Gbps	10Gbps
Distance	100m	Up to 55m	100m

The figure below depicts a small enterprise network. Suggest the cable for each of the 6 links connecting the 10Gbps switch to other devices on the subnet. The goal is to make sure the link won't limit the transmission rate between the switch and the other end.



- (1) Which cable for link 1 (1pt)? And why (2pt)?
- (2) Which cable for link 2 (1pt)? And why (2pt)?
- (3) Which cable for link 3 (1pt)? And why (2pt)?
- (4) Which cable for link 4 (1pt)? And why (2pt)?
- (5) Which cable for link 5 (1pt)? And why (2pt)?
- (6) Which cable for link 6 (1pt)? And why (2pt)?

Sample Solution:

- (1) Cat6. To be safe, provided the uplink/downlink lead out of the FTTH box is unknown.
- (2) Cat6. To provide 10Gbps capacity between two 10Gbps devices.
- (3) Cat 6a. To provide reliable 10Gbps capacity over a long distance.
- (4) Cat 6. to provide 10Gbps capacity between two 10Gbps devices.
- (5) Cat5e. The WiFi AP will be the bottleneck anyway (600Mbps max).
- (6) Cat5e. The 1Gbps PC will be the bottleneck anyway.

Or Cat6a throughout. To allow expansion.

5. (ch13, 10pt) Give an example, excluding the water and vehicle transportation example we've went through in the class and quiz#3, transporting substances in circuit switching fashion vs. packet switching fashion.
- (1) Identify the substance being transported (2pt)
 - (2) Identify a circuit switching way to transport the substance (2pt)
 - (3) Identify a packet switching way to transport the substance (2pt).
 - (4) Justify why the former is circuit switching like (2pt).
 - (5) Justify why the latter is packet switching like (2pt).

Sample Solution:

Example:

- (1) Transportation of knowledge
- (2) Circuit switching way: make an appointment for Q&A with the instructor
- (3) Packet switching way: drop by the office hour for Q&A with the instructor

Justification:

- (4) The former **guarantees** that one gets the instructor's time.
- (5) The latter not and one might need to **queue up for his/her turn**.

This is just one example. Other examples that make sense will also be accepted

6. (PA1, 14pt) If you discover that you are under DoS attack, you may also email/call the network admins of the attacker to have the admins blocking the traffic from the origin. To do so, one uses `whois`. Below is an example to find out the administrative information of the PA server.

```
$whois 140.112.42.221
% IANA WHOIS server
% for more information on IANA, visit http://www.iana.org
% This query returned 1 object

refer:      whois.arin.net

inetnum:    140.0.0.0 - 140.255.255.255
organisation: Administered by ARIN
status:     LEGACY

whois:      whois.arin.net

changed:    1993-05
..... <rest of output omitted>
```

- (1) Log in to the PA server with the team's username and password and then create a subdirectory `exam1-<student ID>`. Leave the subdirectory there for us to grade (4pt).
- (2) Go to the `exam1-<student ID>` subdirectory and create a file `whois-output.txt` to contain the output of your `$whois 140.112.42.221`. Leave the file there for us to grade (4pt).
- (3) Download the file containing the output of `$whois 140.112.42.221` to your local disk and upload it to the Exam#1 Google Form right here (4pt).
- (4) Check the output from `whois` and tell the email address to report abuse (2pt).

Sample Solution:

- (1)-(2) check the directory and file on server
- (3) check the file on Google Form DB
- (4) `hostmaster@twnic.net.tw` or `abuse@ntu.edu.tw`

7. (ch14, 22pt) Let's `traceroute` to `eurocom.fr` and investigate the routes a little more.

- (1) Go to your subdirectory `exam1-<student ID>`. `traceroute` to `eurocom.fr` and create a file `traceout-output.txt` to contain the output of your `$traceroute eurocom.fr`. Leave the file there for us to grade (4pt).
- (2) Examine your traceroute output. Do you see the delays being different among the three probes (1pt)? And why (3pt)?
- (3) Examine your tracroute output. Do you see the routers being different among the three probes (1pt)? And why (3pt)?
- (4) Use `whois` to find out the sequence of countries along the route from the PA server to `eurocom.fr` (6pt).
- (5) Google up the company connecting TW to the Internet. Tell the company's motto on its homepage (2pt).
- (6) Explore and see if you can find and download Asia part of the network map. Load the map you find here (2pt).

Sample Solution:

- (1) Check file on PA server
- (2) Yes, 2 possible reasons: varying queuing delay and varying routes between each of the probes
- (3) Yes, to balance traffic load, to react to network failure, or other reasons that make sense.
- (4) TW, SE, FR
- (5) Simplify connectivity
- (6) Check the file on Google Form DB

ps. Regarding (4)-(6) of the problem set, the route on the date/time of the exam turned out very different from the date/time polly was writing the exam. Good that no one attempted to answer (4)-(6).

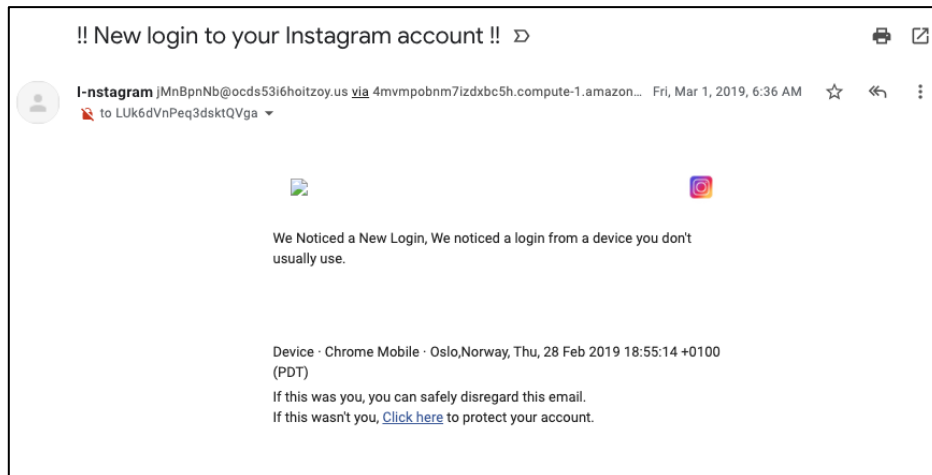
8. (ch15, 4pt) Which of the followings are the reasons for structuring the Internet protocols in layers? State true (T) or false (F).
- (1) To mimic lasagna and lasagna tastes better than spaghetti (1pt)
 - (2) To provide as a reference model to facilitate discussions (1pt)
 - (3) To be similar to the process of taking the flights such that it is easy to learn (1pt)
 - (4) To allow fast changes within a layer without needing to know the details of protocols in other layers (1pt)

Sample Solution:

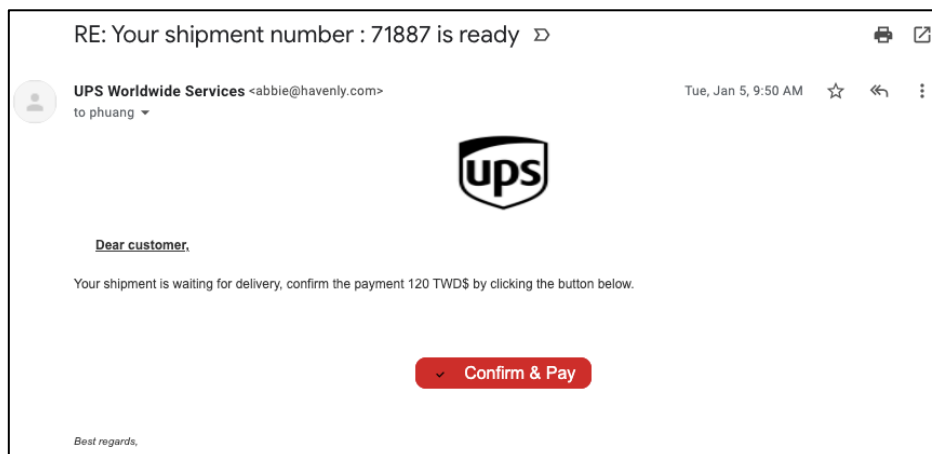
F, T, F, T

9. (ch16, 9pt) Polly has received these emails in recent years. For each of them, advise whether Polly should click the link suggested (3pt). Tell also why you'd advise so (6pt).

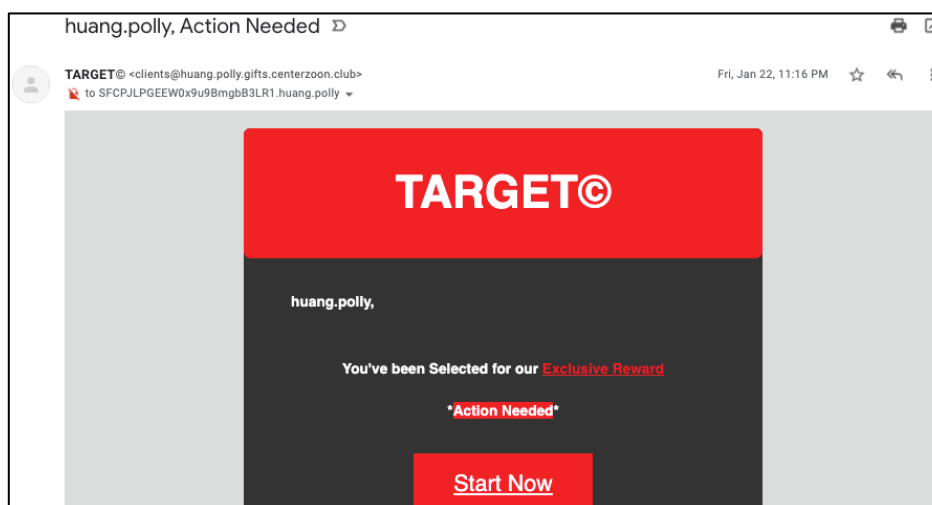
(1) March 1, 2019, from IG



(2) January 5 2021, from UPS



(3) January 5 2021, from UPS



Sample Solution:

- (1) Either way and justify your suggestion
- (2) Either way and justify your suggestion
- (3) Either way and justify your suggestion

10. (PA2, 5pt) Take a look at the program below.

(1) Tell the outcome of the program (2pt).

(2) What do you think the program does (3pt)?

```
package main

import (
    "bufio"
    "fmt"
    "strings"
)

func main() {
    const input = "ScanBytes is a split function for a Scanner that
returns each byte as a token.\n"
    scanner := bufio.NewScanner(strings.NewReader(input))
    scanner.Split(bufio.ScanBytes)
    count := 0
    for scanner.Scan() {
        count++
    }
    fmt.Printf("%d\n", count)
}
```

Sample Solution:

(1) 79

(2) Counting bytes in the "" assigned to input.

11. (Golang) Consider the following Go program: server-midterm-1.go. Execute the server-midterm-1.go first and then client-101.go.

server-midterm-1.go

```
package main

import (
    "bufio"
    "fmt"
    "os"
    "strings"
)

func main() {
    scanner := bufio.NewScanner(strings.NewReader("gopher"))
    for scanner.Scan() {
        fmt.Println(len(scanner.Bytes()) == 6)
    }
    if err := scanner.Err(); err != nil {
        fmt.Fprintln(os.Stderr, "shouldn't see an error scanning a
string")
    }
}
```

client-101.go

```
package main

import "fmt"
import "bufio"
import "net"

func check(e error) {
    if e != nil {
        panic(e)
    }
}
```

```

func main() {
    conn, errc := net.Dial("tcp", "127.0.0.1:<your port#>")
    check(errc)
    defer conn.Close()

    writer := bufio.NewWriter(conn)
    len, errw := writer.WriteString("Hello World!\n")
    check(errw)
    fmt.Printf("Send a string of %d bytes\n", len)
    writer.Flush()

    scanner := bufio.NewScanner(conn)
    if scanner.Scan() {
        fmt.Printf("Server replies: %s\n", scanner.Text())
    }
}

```

- (1) Tell the output on screen of server-midterm-1.go (1%).
- (2) Tell the output on screen of client-101.go (1%).
- (3) Explain why we see the output on screen server-midterm-1.go (3%).
- (4) Explain why we see the output on screen client-101.go (3%).

Sample Solution:

- (1) "Launching server..."
- (2) "Send a string of 13 bytes"
- (3) conn.Close() closes the conn socket before the reader/writer wrap. No messages can be read or written back onto the socket.
- (4) conn is closed from the server side. Therefore, the client is not able to receive a message back, and not able to print the message on the screen.