NIA CA1 solution

Redes y aplicaciones Internet (Universitat Oberta de Catalunya)

Computer Science, Multimedia and Telecommunications Studies

Networks and Internet Applications
Activity: PEC 1 – First Continuous Evaluation Test

- The solution must be delivered in a PDF file in the subject classroom.
- You must include references to the resources you consulted to answer the questions.
- The delivery deadline is **April 7, 2024**

Answers

1. In the following Kurose video he talks about who controls the Internet:https://www.youtube.com/watch?v=xrd4hD_9fS8. Watch the video and answer the following questions:
   a) According to what is discussed in the video, what are the three layers or dimensions that allow the different standardization organizations on the Internet to be identified? Describe each of them.

The content layer, the names and numbers layer, and the infrastructure layer.

   b) Discuss the advantages and disadvantages of having a single global standardization body for Internet protocols compared to having multiple regional standardization bodies.

Advantages of a single global organization:

Interoperability- Facilitates communication and data exchange between different networks and devices.
Efficiency- Reduces duplication of effort in standards development.
Innovation- Promotes collaboration and exchange of ideas between experts around the world.

Disadvantages of a single global body:

Lack of flexibility: makes it difficult to adapt standards to the specific needs of each region.
Less regional control: Countries or regions may have less control over decisions that affect their own Internet use.
Possible monopoly: A single global body could have too much power and influence over the development of the Internet.

Advantages of multiple regional organizations:

Flexibility: allows standards to be adapted to the specific needs of each region.
Mayor control regional: Countries or regions have more control over decisions that affect their own Internet use.
Diversity: facilitates the diversity of approaches and solutions in Internet development.

Disadvantages of multiple regional organizations:

Lack of interoperability- can make communication and data sharing between different networks and devices difficult.
Inefficiency: May increase duplication of effort in standards development.
Fragmentation: can fragment the internet market and hinder innovation.

c) The video describes the Internet Corporation for Assigned Names and Numbers (ICANN) as an organization multistakeholder. What does it mean?

It means that it is made up of a variety of interest groups with different perspectives and roles in internet management. The goal of ICANN's multistakeholder structure is to ensure that all interested parties have a voice in decision-making about the Internet. This is based on the idea that the Internet is a global resource that must be governed cooperatively and with the participation of all relevant actors.

d) What are the advantages of ICANN being organized this way?

On the one hand, it allows different **perspectives** and needs of the actors are taken into account. Furthermore, it increases the legitimacy of the decisions made by ICANN. Likewise, it promotes the consent and collaboration between different interest groups.

2. Answer the following questions about IP addressing:

a) For the address 84.213.20.224 / 23, calculate the network identifier, the broadcast address and the host range.

Network: 84.213.20.0 / 23
Host range: 84.213.20.1 - 84.213.21.254
Broadcast: 84.213.21.255

b) On a network with 14,043 hosts. What is the minimum network mask that would support that number of hosts?

The minimum network mask required is 18 bits (255.255.192.0), since it can support up to 16,382 hosts.

32766 = 2^[32 - 17] - 2
16382 = 2^[32 - 18] - 2
8190 = 2^[32 - 19] - 2

c) The network to which the address 251.17.125.251/23 belongs needs to be segmented into at least 84 subnets. Calculate the necessary subnet mask, and the first resulting subnets.

The minimum subnet mask required is 30 bits (255.255.255.252).

64 = 2^[29 - 23]
128 = 2^[30 - 23]
256 = 2^[31 - 23]

The first resulting subnets are:

251.17.124.0/30
251.17.124.4/30
251.17.124.8/30

251.17.124.12/30
251.17.124.16/30

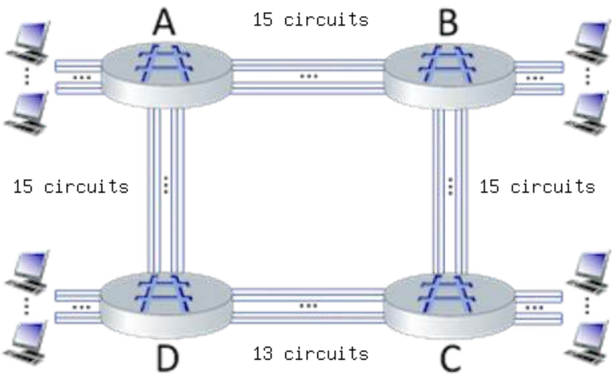
3. Look for some graphic material (video, infographic, etc.) that briefly explains the history of the Internet. View it and share it through the classroom forum, briefly explaining why you have chosen it.

Free answer.

4. Make a graphic diagram of the Internet access you have in your home, identifying the main elements (*hosts*, *routers*, *switches*...). Answer the following questions about your connection:
   a) What type of access is it? Describe its differential technical characteristics.
   b) Identify any security device or mechanism on your network (*firewall*, antivirus, etc.) and briefly describe how it works.
   c) Explain how you would change your router password.

Free response, where the elements at the end of the network (equipment (*hosts*), routers (*routers*), switches (*switches*), ...) and the type of access (DSL, cable, FTTH, ...), security elements and basic steps to access the router configuration.

5. The following figure represents a circuit switching network with four switches, A, B, C and D. Between A and B there are 15 circuits, 15 circuits between B and C, 13 circuits between C and D and 15 circuits between D and A .



   a) What is the maximum number of connections that can be active on the network at the same time?

The maximum number of connections that can be in progress at any time is the sum of all circuits, which occurs when 15 connections go from A to B, 15 connections go from B to C, 13 connections go from C to D, and 15 connections go from D to A. This sum is **58 circuits**.

   b) Let's assume that all possible connections are in progress. Explain what happens when another network connection request arrives.

It will be blocked because there are no free circuits left.

   c) Suppose that each connection requires two consecutive hops and that the connections occur in a clockwise direction, that is, the possible connections are from A to C, from B to D, from C to A and from D to B. With these restrictions, what is the maximum number of connections that can be active on the network at the same time at any given time? Explain your answer.

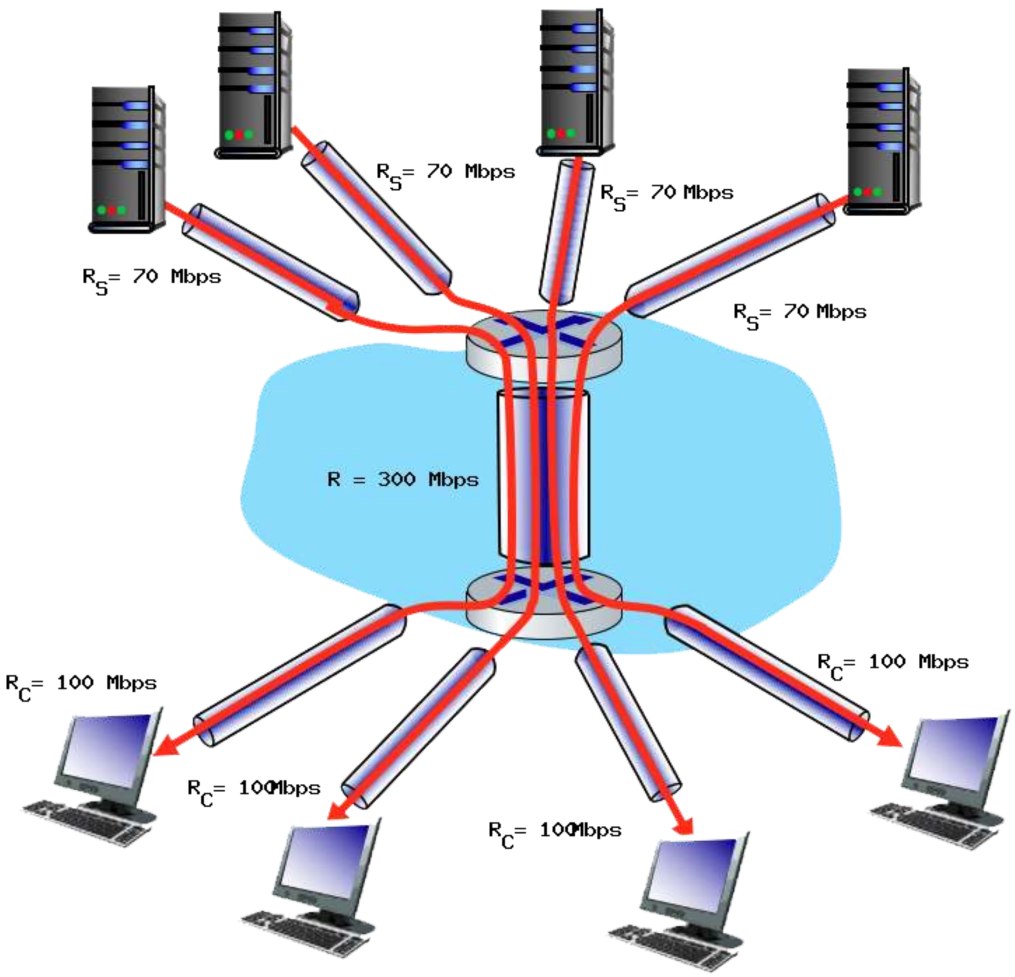
There can be a maximum of 28 connections.

For routes A->C and C->A, we could have 15+13 = 28 simultaneous connections.
For routes B->D and D->B the same thing happens: 15+13 = 28 simultaneous connections

d) Suppose 12 connections are needed from A to C and 12 connections from B to D. Can we route these calls across the four links for 24 connections? Explain your answer.

If the connections were from A to C and from C to A; or from B to D and from D to B it would be possible but from A to C and from B to D it would be 15 the maximum and since we need 12 + 12 it is NOT possible.

6. In the following figure there are four different servers connected to four different clients using four three-hop routes. They all share a common link with a transmission capacity of R=300 Mbps. The four links from the servers to the shared link have a transmission capacity of Rs=70 Mbps. Each of the four links from the shared intermediate link to a client It has a transmission capacity of Rc=100 Mbps.



a) What is the maximum end-to-end throughput, in Mbps (*end to end throughput*), for each of the four client-to-server pairs, assuming that the intermediate link is equally shared (divides its transmission rate equally)?

The maximum throughput is that of the link with the lowest capacity, which is 70 Mbps.

b) Which link out of all of them, Rc, Rs, or R, is the bottleneck?

The bottleneck is the link with the lowest capacity between Rs, Rc and R/4, therefore, it is Rs.

c) Assuming that the servers transmit at the maximum possible speed, what is the utilization rate of the Rs links?

The utilization percentage of Rs will be:

Rbottleneck / Rs = 70/70 = 1, i.e. 100%

d) Assuming that the servers transmit at the maximum possible speed, what is the utilization rate of the Rc links?

Similarly, the percentage of Rc utilization will be:

Rbottleneck / Rc = 70/100 = 0.7, that is, 70%

e) Assuming that the servers transmit at the maximum possible speed, what is the utilization rate of link R?

The utilization of the shared link will be = Rbottleneck / (R / 4) = 70 / (300 / 4) = 0.93, that is, 93%

7. The ping command is a network diagnostic tool used to verify connectivity between two hosts. FromThe following screenshot corresponding to the execution of the ping command answers the following questions:

```
└─$ ping www.uoc.edu
PING d3h7m5mv8dd7fj.cloudfront.net (52.84.66.98) 56(84) bytes of data.
64 bytes from server-52-84-66-98.mad51.r.cloudfront.net (52.84.66.98): icmp_seq=1 ttl=63 time=72.7 ms
64 bytes from server-52-84-66-98.mad51.r.cloudfront.net (52.84.66.98): icmp_seq=2 ttl=63 time=80.4 ms
64 bytes from server-52-84-66-98.mad51.r.cloudfront.net (52.84.66.98): icmp_seq=3 ttl=63 time=77.5 ms
64 bytes from server-52-84-66-98.mad51.r.cloudfront.net (52.84.66.98): icmp_seq=4 ttl=63 time=95.7 ms
64 bytes from server-52-84-66-98.mad51.r.cloudfront.net (52.84.66.98): icmp_seq=5 ttl=63 time=90.0 ms
^C
── d3h7m5mv8dd7fj.cloudfront.net ping statistics ──
5 packets transmitted, 5 received, 0% packet loss, time 4044ms
rtt min/avg/max/mdev = 72.705/83.263/95.699/8.400 ms
```

a) ¿What is the destination IP address?

The destination IP address for this "ping" command is 52.84.66.98, which is an address associated with a CloudFront server.

b) What is the *icmp_seq*?

"icmp_seq" is the sequence number of the sent ping packet. In this case, five ping packets (1 through 5) were sent.

c) What is the*TTL*?

"ttl" represents the "time-to-live" in hops that each sent packet has, that is, the maximum number of hops that a packet can make before being discarded. In this case, the TTL is 63.

d) What does the field *time* indicate?

"time" is the time it took for an ICMP packet to travel to and from the destination server, measured in milliseconds (ms).

e) What does the final line of the capture show?

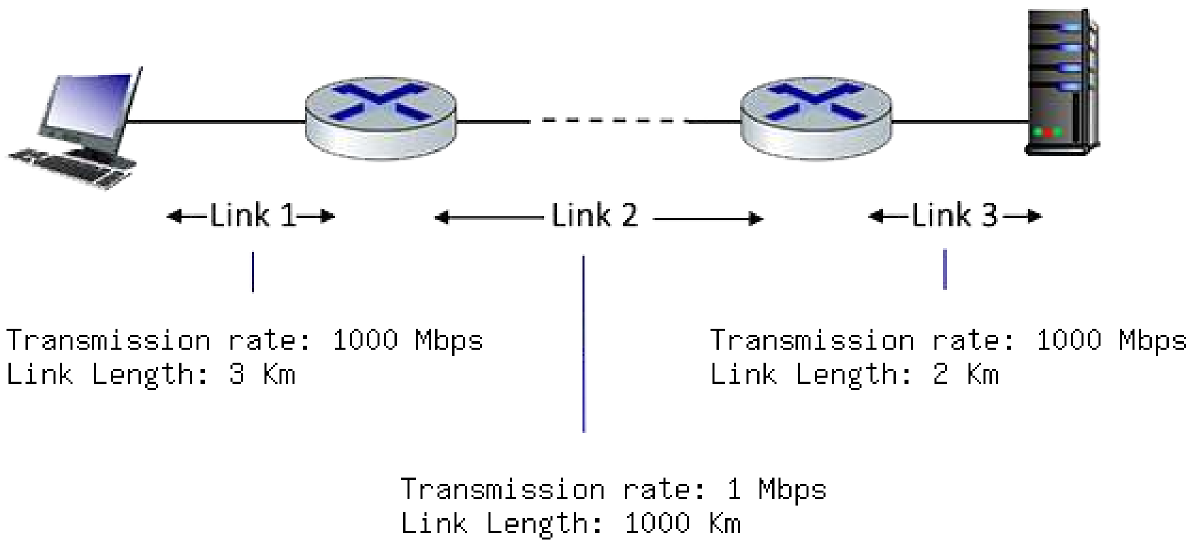
The final line shows summary statistics including the number of packets transmitted and received, the packet loss rate (0% in this case), and the minimum, maximum, average, and standard deviation latency ("rtt") values. the received packages.

f) What was the average propagation delay and in what unit of time is it measured? Depending on what factors can it vary?

The round trip time is called propagation delay and is measured in milliseconds. This value will vary depending on factors such as the distance between devices and network congestion.

In this case, the results indicate that the connection to the server was successful, as all five packets were sent and received with a packet loss rate of 0%. The average latency time ("avg") was 83.263 ms, with a minimum latency range of 72.705 ms and maximum of 95.699 ms.

8. In the following figure we can see three links, each with the specified transmission rate and length. Assuming that the length of a packet is 12000 bits and that the speed of light propagation delay on each link is 3x10^8 m/sec, answer the following questions:



a) What is the transmission delay and propagation delay for each link?

Link 1
Transmission delay = L/R = 12000 bits / 1000 Mbps = 1.20E-5 seconds
Propagation delay = d/s = (3 Km) * 1000 / 3*10^8 m/sec = 1.00E-5 seconds
Total delay = d_t + d_p = 1.20E-5 seconds + 1.33E-6 seconds = 2.20E-5 seconds

Link2
Transmission delay = L/R = 12000 bits / 1 Mbps = 0.012 seconds
Propagation delay = d/s = (1000 Km) * 1000 / 3*10^8 m/sec = 0.0033 seconds
Total delay = d_t + d_p = 0.012 seconds + 0.0033 seconds = 0.015 seconds

Link 3

Transmission delay = L/R = 12000 bits / 1000 Mbps = 1.20E-5 seconds
Propagation delay = d/s = (2 Km) * 1000 / 3*10^8 m/sec = 6.67E-6 seconds
Total delay = d_t + d_p = 1.20E-5 + 6.67E-6 seconds = 1.87E-5 seconds

b) What is the total delay?

The sum of all delays, that is:
Total delay = d_L1 + d_L2 + d_L3 = 2.20E-5 seconds + 0.015 seconds + 1.87E-5 seconds = 0.015 seconds

9. In the following link you can see the transoceanic cables that support Internet communications:https://www.submarinecablemap.com/. Choose one and find out its technical specifications (bandwidth, physical medium, etc.)

   Free response depending on the characteristics of the cable.

10. Search the web for news about cybersecurity. Choose one published in the last month (include the date) and detail which concepts in the section "*Networks under attack*" of the book are discussed in it.

    Free response where fundamentally you will have to talk about confidentiality, availability, integrity, etc.