Sistemas e Redes Multisserviço – 2018/19

Exame Época Normal – 22 de fevereiro de 2019 – Duração: 2h00

Resolution

In your interest, make the letter legible; the inability to read due to poor handwriting and / or presentation may lead to the non-consideration of the response (s).

1. A company has a LAN that is not to connect to the Internet. Do you consider it necessary and possible to configure Quality of Service? Justify.
   The fact that there is no Internet connection does not prevent or discourage the implementation of QoS on a LAN. If the LAN is multiservice, with applications with different treatment needs, QoS must be implemented to allow different applications to have the best advantage of the network. In a LAN, QoS is implemented at the level of Switches and Routers.
2. Do you agree with the following statement? "A network with a delay of 1 second will always have a high delay variation, compromising the transmission of video on demand". Justify.
   I do not agree. If the network maintains a constant delay of 1 second, there will be no delay variation. In this situation, the transmission of video on demand will not be unviable. The user will experience a delay of 1 second at the beginning of the viewing but will watch the video without interruption from that moment.
3. In an 802.11 network used in a business environment, is there a greater need for security than in an Ethernet network? What safety standard should you use for this purpose?
   802.11 networks are wireless (Wifi) networks. The signals use air as a transmission medium so they are more likely to be captured by third parties than in an Ethernet network that uses cables, where only those who can physically connect to the network will be able to access it. Not to mention that, in a network with switches, the access to third party communications is even more complicated. The security standard to be used is WPA2.
4. A manager of a corporate computer network with e-mail, VoIP and access to a database, was faced with a need: the same network will support a new application that is considered critical for the company's good functioning. For this, it decided to change the QoS settings for the PQ algorithm, placing this new application as the most important. What risks does this option entail?
   The scheduling algorithm PQ establishes an absolute priority which means that, as long as there is traffic to serve in the highest priority queue, the following queues will not be served. Thus, traffic in the remaining queues will be delayed or even lost. If the new application has a high volume of traffic and one of the other applications requires low delays (e.g. VoIP), this will have its performance compromised.
5. Explain the reasons why customers of ADSL services do not all have the same speed or can change channels on the TV's own controls.
   The ADSL service is supported on the copper lines of the telephone network that are greatly affected by attenuation and interference. Thus, two customers, even if connected to the same

exchange, may have different debits as they may be at different distances from the exchange. On the other hand, the maximum download speed is 24Mbps but most customers have less. This does not allow the support of all channels offered by operators to customers. Operators limit this amount to 2 or 3 to make room for the Internet. Boxes are required on each TV to select the channel you want to watch at that moment and only those will be transmitted on access.

6. Describe the architecture of the GPON networks from the operator's exchange to the customers' home, taking care to mention the available rates and the number of customers served.

Components of PON Fiber Optic Networks:

- *The CO (Central Office), is the point where the optical fibers leave the Exchange for the network; multiplexes the TV, voice and Internet data received via the Core network and delivers it to fiber.*
- *The OLT - Optical Light Transmiter is the light emitter for each fiber and is unique for all users in the same cascade.*
- *Between the CO and the user there are only fiber splitters to divide the signal among several fibers. As they are passive, these networks are called PON - Passive Optical Network. At most there are 4 splittings to each customer.*
- *On the client are the ONT - Optical Network Terminal whose function is to act as a gateway between the optical and electrical signals and also to separate the components of voice, data, RF TV and IPTV.*
- *The throughput of each fiber at the output of the OLT is 2.4Gbps (GPON) or 10Gbps (10GPON). Each fiber can feed up to 64 clients (GPON) or 128 (10GPON).*

7. Is it possible to transmit raw video (uncompressed) via the Internet? Justify and describe the main compression operations typically used in IPTV.

It is not viable. The debt generated by raw video reaches more than 1Gbps and there are still no offers from Internet operators with speeds above 1Gbps. Typically, IPTV video compression is done in MPEG which has the following main steps:

- Motion compensation: between consecutive frames only the modified information is transmitted;

- Use of motion vectors to determine the positions of pixel blocks in the following image;

- Elimination of redundant information through mathematical treatment of previous data

- Quantification and coding with smaller codes for the most frequent occurrences.

8. When, in your home, you change channels in the command of your Set Top Box, what is the protocol and what are the operations triggered until you receive the new channel?
The protocol that triggers channel change requests is IGMP. When we select a new channel in the Set Top Box group, it generates an IGMP "Leave" message to signal the network that no longer wants to receive this channel and, also, an IGMP "Join" to join the new channel.

These messages are then handled on multicast networks for the transmission or removal of channels on the various circuits in the network.

9. *(Multiple choice question. Choosing the wrong option implies a negative value of 25% of the quote) Which of the following are the possible monitoring architectures in mixed networks with Linux and Windows equipment?*
   - *TLS*
   - *SNMP (WMI option does not work on Linux systems)*
   - *BCP*
   - *WMI*

10. The management of application servers is no longer done in the model of having a physical server for each application. Describe the current architecture used and its advantages.

Server management is now based on virtualization. The hardware and the computational capacity available are managed by a software layer, the Hypervisor, which creates virtual machines and also manages resources by allocating them to each virtual machine so that each one behaves as an independent server.

The advantages are: Better use of resources; faster creation of computers or servers; possibility of treating a computer or server as a file that can be easily transported; easier to create Disaster Recovery backups and architectures

11. Um Router has the capacity to process 10000 packets per second. At the entrance of the output buffer, the following packages are already classified and placed in three QoS queues:
    - 10,000 VoIP packages
    - 8000 email packages
    - 12000 internet browsing packages

    Calculate how long it would take for all E-mail packages to be processed for each of the following scheduling algorithm:

    a. FQ
       Each row is treated equally. E-mail will be entitled to 1/3 of the router's processing capacity, that is, 3333 packets per second. The 8000 packets would be handled in 8000/3333 = 2.4 seconds
    b. PQ with VoIP->E-mail-> Internet prioritization
       Mail packets will only be processed when the VoIP queue is empty. The 10,000 VoIP packets occupy the first second of processing of the router. The email packages start immediately afterwards and are all handled before browsing the Internet. If the router handles 10,000 packets in one second, the 8000 mail packets will be handled in 8/10 of a second. Thus, all mail packages will be processed after 1 + 0.8 = 1.8 seconds.
    c. WFQ with: E-mail 40%, VoIP 50%, internet 10%
       In this case, E-mail is entitled to 40% of the Router's processing capacity, that is, 4000 packets per second. So the 8000 packages will be treated after 2 seconds.
    d. Using WFQ, what would be the minimum weight assigned to the E-mail queue so that all of its packages could be processed in less than 1 second?

If the router is capable of processing 10000 packets per second, and we need 8000 of these to be for VoIP, we will have 8000/10000 = 0.8, that is, 80%.

12. A company suffered a disaster at 12 noon on January 10, having run out of all its servers. The services were restored at 6:30 pm, thus meeting the maximum deadlines defined in your DR plan. Meanwhile, a user verified that he had to update the information he had created since 8 am. With this data, calculate:

    a) What RTO and RPO were defined in this company's DR plan?
    RTO - Time taken to get systems back up and running. In this case, from 12pm to 6:30 pm, that is, 6h30 minutes.
    RPO - Reflects the period of time that the lost information cannot be recovered. In practice, it is the time that elapses from the last backup. In this case, if it was not possible to recover from 8 am, the backup must have been at that time. So 12h-8h = 4h of information was lost and this will be the minimum RPO of this company.
    b) Knowing that, on January 20, yet another malfunction with the same duration occurred, which is the availability of the network this month?

    D=MTBF/(MTBF+MTTR)

    MTTR – average failure recovery time. If both breakdowns had the same duration (6:30 am) then this will be the average recovery time.
    MTBF – is the average time the network has been available. The total number of hours in the month of January is 31x4 = 744 hours. At this total time we have to remove 2x6h30 = 13h of breakdown and we have a total of 731h of operation during the month. The network has been in operation for three periods (from 1 to 10 January, from 10 to 20 January and from 20 to 31 January). So the average time between failures is 731/3 = 243.67h.

    So, D=243,67/(243,67+6,5)=0,974, i.e. aprox. 97,4%