SISTEMAS E REDES MULTISERVIÇO – 2019/20

Practical Evaluation # 1 – Trends

EXPLANATION OF THE WORK

In this practical work it is intended that students develop by themselves a topic related to the new trends in networks and communications systems. The result will be a presentation that will be made in class.

Students are encouraged to perform self-learning of a selected topic, always counting on the availability of the teacher for guidance. The starting point is this document where the topics that can be chosen by the students are listed. For each one, the teacher indicates some bibliography that serves as the first framework and starting point for its development.

The work will be evaluated in two strands:

1. **Document** – Presentation, in Powerpoint or other to the choice of students, which should not have more than 8 slides. It is not intended for exhaustive work, but should present the main aspects of each theme:
    1. Introduction to the topic
    2. Objectives that the technology intends to achieve
    3. Main technology Features
    4. What is still to develop/resolve
    5. If any, concrete examples of use

2. **Presentation** – The above document will be presented by the group to the class in the last weekend of the discipline. The presentation time should not exceed 15 minutes, complemented by a period of questions posed by the teacher or colleagues who will have a maximum of 10 minutes. The knowledge of the theme and the ability to answer questions posed by the faculty or colleagues will be evaluated.

The presentation will be made in the last two classes of the discipline – 17 and 18 January. You will have to submit to the Moodle presentation until the day before.

LIST OF TOPICS TO CHOOSE

1. MPLS
2. Metro Ethernet
3. Storage in Data Center
4. Future of GPON
5. Future of Ethernet
6. Passive Optical LAN
7. Fibre Channel
8. iSCSI
9. Impact of Virtual reality on networks
10. WebRTC
11. Protocols for security in multimedia
12. Mobile 5G for IoT
13. WPA-3
14. Wi-Fi 6

DESCRIPTION AND SUGGESTED BIBLIOGRAPHY

1. MPLS

1. Multi Protocol Label Switching is used in operators networks to provide QoS. All packages are complemented with an additional field (Label) that is queried by Routers to make forwarding decisions. Labels can be manipulated by the network manager to allow traffic engineering.
   a. Suggested Bibliography:
      i. "TCP/IP Teoria e Prática" (Capítulo 8.5.2), Fernando Boavida e Mário Bernardes, FCA – The teacher can borrow
      ii. "Projetos Avançados de Redes IP" (Capítulo 2.6), Dhiman Chowdhury, Ed. Campus – The teacher can borrow
      iii. "Engenharia de Redes Informáticas" (Capítulo 5.5), Fernando Boavida, Edmundo Monteiro, FCA – The teacher can borrow
      iv. "Triple Play" (Capítulo 10.4); Hens e Caballero, ed. Wiley – The teacher can borrow "Computer and Communications Networks" (Capítulo 14.3); Nader Mir; Prentice Hall - The teacher can borrow

2. Metro Ethernet

1. Metro Ethernet is the extension of Ethernet technology to operator Networks (WAN) to enable pure Ethernet connectivity between different locations in an organization. This allows, for example, to work with the same VLAN´s on different networks

without the need to resort to Layer3 connections. Given the differences between LANs and WANs, the Ethernet settings must be changed and adjusted.

a. Suggested Bibliography:
   i. "Triple Play" (Capítulo 10.1); Hens e Caballero, ed. Wiley – The teacher can borrow
   ii. Site do Metro Ethernet Forum: https://www.mef.net/

3. Storage in Data Center

1. The information stored in DataCenters has been growing in volume, but also in the diversity and need for fast access. To respond to these requirements, technologies such as Hyperconvergence or Flash memories have been developed.
2. Suggested Bibliography:
   i. E-book "Hyperconverged-Infrastructure-For-Dummies-eBook" da John Wiley & Sons, Inc.
   ii. Outro material a ser fornecido pelo docente

4. Future of GPON

1. To implement FTTH networks, operators have generically GPON and NG-GPON1 technology, as will be studied in our curricular unit. The GPON is evolving in terms of capacity and throughput. You must present what is foreseen for the future of these networks, namely the NG-GPON2 with TWDM.
2. Suggested Bibliography:
   i. "New FTTH-based Technologies and Applications - A White Paper by the Deployment &Operations Committee", José Salgado (PT Inovação), Rong Zhao (Detecon International), and Nuno Monteiro (PT Inovação), www.ftthcouncil.eu

5. Future of Ethernet

1. Ethernet networks must improve in throughput needs and quality of service that users increasingly require. Currently, Ethernet networks are already installed on Gigabit Ethernet and 10-Gigabit Ethernet technology, but there are punctual needs of higher throughput. It is intended to present the general lines of future Ethernet networks at 100 and 400Gbps.
2. Suggested Bibliography:
   i. Site web https://kb.wisc.edu/ns/page.php?id=7829 with the technologies 100Gb and 400Gb, want can be starting point for research

6. Passive Optical LAN

1. The advantages of fiber optics can be taken to the LAN ´ s through the construction of local networks 100% in fiber. One of the available technologies is the Passive

Optical LAN that is based on GPON networks but with adaptations to LAN environment.

2. Suggested Bibliography:
   i. Apresentação "Passive Optical LAN Design, de Matt Miller - Principal Systems Engineer, Leidos" – The teacher can borrow
   ii. Site web: "https://apolanglobal.org/white-papers/"

7. Fibre Channel

1. Fibre Channel Technology is one of the key uses in SAN networks, that is, Storage Area Networks, to enable rapid access of processing systems to storage systems.
2. Suggested Bibliography:
   i. "Data Center Storage Evolution: Executive Summary" - www.siemon.com – ask the teacher;
   ii. E-book: "Storage-area-networks-for-dummies" – ask the teacher;

8. iSCSI

1. ISCSI Technology is an alternative to Fibre Channel on SAN networks, that is, Storage Area Networks, to enable rapid access of processing systems to storage systems. It is based on changes to Ethernet protocols and equipment.
2. Suggested Bibliography:
   i. "Data Center Storage Evolution: Executive Summary" - www.siemon.com – ask the teacher;
   ii. E-book: "Storage-area-networks-for-dummies" – ask the teacher;

9. Impact of Virtual Reality in networks

1. Virtual Reality is one of the most demanding applications in a communications network due to the high debits and low delays required. It is intended to present the implications the placement of virtual reality in IP networks have, whether they are private LAN ´ s or on the Internet
2. Suggested bibliography
   i. Artigo "Toward Low-Latency and Ultra-Reliable Virtual Reality", de Mohammed S. Elbamby ; Cristina Perfecto ; Mehdi Bennis ; Klaus Doppler disponível em: https://www.researchgate.net/publication/322675070_Toward_Low-Latency_and_Ultra-Reliable_Virtual_Reality/link/5a69e8f1aca2728d0f5f29ec/download
   ii. Artigo "Challenges in Networking to Support Augmented Reality and Virtual Reality" de Cedric Westphaldf, disponível em: "https://pdfs.semanticscholar.org/725e/69bd0093e76505161b8dc6d68ad0a50c47da.pdf

10. WebRTC

1. The purpose of this technology is to enable direct and real-time communication between browsers, without the need to transmit the data through an intermediate server or the installation of extensions. Thus, any device equipped with a browser is able to communicate directly with another for data transmission, whether transmitting audio, video or simple files.
2. Suggested Bibliography:
    i. Site: "https://searchunifiedcommunications.techtarget.com/definition/WebRTC-Web-Real-Time-Communications"
    ii. Dissertação de Mestrado "*WebRTC - Evolução na Web*" de Roberto Rocha; - ask the teacher

11. Security protocols in Multimédia

1. Multimedia communications such as VoIP or video have an obvious need for privacy, confidentiality and integrity. It is intended to present the most important solutions for this topic, for example TLS and SRTP.
2. Suggested Bibliography:
    i. "Segurança em Redes Informáticas" (Capítulos 8.7 e 9.9), André Zúquete, FCA - The teacher can borrow
    ii. "Triple Play" (Capítulo 4.3.5); Hens e Caballero, ed. Wiley – The teacher can borrow
    iii. Datasheet da Skype: https://download.skype.com/share/business/guides/skype-connect-technical-datasheet.pdf
    iv. Artigo: "Key Management Protocols for Secure Wireless Multimedia Services: A Review" de Mamoona Asghar, Mohammed Ghanbari and Martin Fleury disponível em: https://www.researchgate.net/publication/236884841_Key_Management_Protocols_for_Secure_Wireless_Multimedia_Services_A_Review/link/0deec51f7ef811e10e000000/download

12. Mobile 5G for IoT

1. The emerging 5G mobile network technology will give special focus to the communication needs of IoT devices. These are equipment that typically require low bandwidth and low power. How do 5G networks respond to these requirements and maintain the operation required by other users?
2. Suggested Bibliography:
    i. Site https://www.iotworldtoday.com/2019/04/04/why-5g-network-slicing-matters-for-iot-applications/4/

ii. Artigo: "https://www.ecitele.com/wp-content/uploads/2019/01/Network-Slicing-BR_new.pdf"
iii. Site web: "https://searchnetworking.techtarget.com/essentialguide/Introduction-to-5G-Your-guide-to-fifth-generation-wireless

13. WPA-3

a. Security in Wifi networks is critical to ensuring the privacy, confidentiality and integrity of communications. The WPA3 is the latest standard for security in Wifi networks that promises greater resistance to attacks. What are the innovations and advantages brought? How will the implementation process be?
b. Suggested Bibliography:
   i. Site da Wi-Fi Alliance: "https://www.wi-fi.org/discover-wi-fi/security"

14. Wi-Fi 6

1. WiFi 6 (802.11 ax) is the latest standard of WiFi networks to be normalized by the Wifi Alliance. Promises superior debts, lower battery consumptions, among others. It is intended to describe the innovations of this standard and what is already being done by manufacturers.
2. Suggested Bibliography:
   i. Site da Wi-Fi Alliance https://www.wi-fi.org/discover-wi-fi/wi-fi-certified-6