Egzamin 2018, pytania

Computer Networks (Politechnika Warszawska)

Questions for ECONE students

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In the document I have collected some questions to help you preparing to the ECONE tests and exam. The questions show what is important to remember from the lectures. In my opinion, it would be useful to read a part of them (related to a given subject) before the lecture on the subject. What is an expected answer for the question you can check with me during a lecture and my consultations; during a test or exam it would be to late.

There are also some WEB links related to every subject. Please remember that in wikipedia you can find errors and non-complete information!

I will be happy if you help me to make this document better, thus any comments, corrections and new WEB links you will find, will be appreciated. You can send me them by email.

Lecture 1 & 2: History of computer networks and protocol stack models

Questions

1. When did the first computer network appeared and how they were organized?
2. What were the dominant network technologies in 80s, 90s, and what technologies dominate today?
3. What were the most important reasons for Internet grow and be world widely used?
4. What are the important facts for Internet evolution?
5. What standardization institutes are important for network engineering?
6. What are the principal functions of every OSI ISO layer.
7. What for a reference model of an information/telecommunication system is defined?
8. Why TCP/IP reference model is different than OSI ISO? Compare them.
9. Describe different switching techniques.
10. Characterize different network topologies.

Related WEB readings:

http://www.pcvr.nl/tcpip/ TCP/IP Illustrated, Volume 1, The Protocols, W. Richard Stevens

http://www.isoc.org/internet/history/brief.shtml

http://www.thenetworkencyclopedia.com The Network Encyclopedia, there are among others:
http://www.thenetworkencyclopedia.com/entry/networking-history-1980/
http://www.thenetworkencyclopedia.com/entry/networking-history-1990/

From http://en.wikipedia.org/
Communications_protocol, OSI_model, History_of_the_Internet, Network_topology, Circuit_switching, Packet_switching, Category:Internet_governance, LAN_switching, Flow_control_(data)

Lecture 3: Addressing in IP Networks

Questions

1. Describe addresses that are used on different layers of the TCP/IP network model.
2. Describe addresses defined by IEEE 802 (their types and structures).
3. What are the IEEE 802 address representations for broadcast and multicast?
4. Describe addresses used in IPv4 networks.
5. Describe the fields of IPv4 header.
6. How does ARP (Address Resolution Protocol) work?
7. What information do ARP and RARP servers return?
8. What are the main functionalities of ICMP and DHCP?
9. What are the essential differences between BOOTP and DHCP?
10. How IP fragmentation and *maximum transfer unit* size discovery are processed in IPv4 networks?

Related WEB readings:

From http://en.wikipedia.org/
MAC_address, IP_address, Subnetwork, Classful_network, Classless_inter-domain_routing, Link-local_address, Address_Resolution_Protocol, IPv4, IPv6, ICMP, DHCP, Dynamic_dns

Lecture 4 & 5: Routing on the Internet

Questions

1. Explain meaning of the following terms related to routing: static / dynamic, distance-vector / link-state, classfull / classless, reactive / proactive, interior / exterior, single-path / multipath, flat / hierarchic.
2. Compare distance-vector with link-state routing.
3. Describe taxonomy of routing mechanisms.
4. What for the concept of autonomous systems was introduced?
5. What are the principal differences between EGP and IGP protocols?
6. How do Distance-Vector protocols work?
7. How do Link-State protocols work?
8. Give the names of at least 2 EGP and 3 IGP protocols.
9. What are the important features of OSPF protocol?

Related WEB readings:

From http://en.wikipedia.org/
Autonomous_system_(Internet), Internet_backbone, Interior_Gateway_Protocol, Border_Gateway_Protocol, Routing_Information_Protocol, Open_Shortest_Path_First, Bellman-Ford_algorithm, Dijkstra%27s_algorithm, Router_(computing), Core_router

http://www.tcpipguide.com/free/t_TCPIPGatewaytoGatewayProtocolGGP.htm

Lecture 6: Serial links. Protocols SLIP and PPP. Modems. UUCP

Questions

1. What kinds of serial links dominated in the past what kinds dominate nowadays?
2. Describe functionalities of SLIP and PPP?
3. What is the aim of UUCP programs suit?
4. What communication links can be used for UUCP?

Related WEB readings:

From http://en.wikipedia.org/
USB, FireWire, RS232, Asynchronous_start-stop, Manchester_code, Bisync, HDLC, Point-to-Point_Protocol, UUCP

Lecture 7: Ethernet technology

Questions

1. Briefly describe the IEEE 802.1 LAN/MAN Reference Model.
2. Discuss Ethernet features from the user's perspective.
3. Describe Ethernet scope of usage and its features.
4. Describe switching in the 2nd, 3rd and 4th OSI layers.
5. Discus pros and cons for Industrial Ethernet deployment.
6. Describe the principles of the EPON technology.
7. What are the advantages and disadvantages of EPON?
8. Describe virtualization of LANS.
9. Discus redundancy aspects in LAN's topology.

Related WEB readings:

http://www.protocols.com/pbook/lan.htm

http://www.cisco.com/en/US/docs/internetworking/technology/handbook/Ethernet.html

From http://en.wikipedia.org/

Carrier_sense_multiple_access_with_collision_detection, Ethernet, EPON, Spanning_tree_protocol, VLAN_Trunking_Protocol

Lecture 8: Transport Layer Protocols

Questions

1. Present the applications that use TCP and those that use UDP.
2. Describe functionalities of TCP and UDP.
3. Discus internals of TCP.
4. What functionalities provide transport protocols other than TCP and UDP?

Related WEB readings:

http://cities.lk.net/tcp.html

http://www.sctp.org/

http://tools.ietf.org/html/rfc3481 TCP over Second (2.5G) and Third (3G) Generation Wireless Networks

http://simula.stanford.edu/~alizade/Site/DCTCP.html Data Center TCP

http://research.csc.ncsu.edu/netsrv/?q=content/bic-and-cubic

http://vincent.bernat.im/en/blog/2014-tcp-time-wait-state-linux.html

I might suggest RFC 793, Section 3.7 for a good description of the sliding windows protocol as used in TCP, with a good discussion of window management.
http://www.rfc-editor.org/rfc/rfc793.txt
Then RFC 7567 goes into the latest IETF thinking on queue management techniques, which are the elaborations of sliding window protocols:
http://www.rfc-editor.org/rfc/rfc7567.txt

From http://en.wikipedia.org/
Transport_layer, Transmission_Control_Protocol, TCP_tuning, Slow-start#Fast_Recovery, TCP_congestion-avoidance_algorithm, DCCP, SCTP, Real-time_Transport_Protocol

Lecture 9: Transport Layer Programming Interfaces

Questions

1. Explain the basic communication paradigms.
2. Characterize BSD sockets functions.
3. How can a process deal with simultaneous operations over several opened sockets??
4. How does *inetd* process work?

Related WEB readings:

There is a huge number of WEB publication related to BSD sockets, eg.:

http://en.wikipedia.org/wiki/Berkeley_sockets

http://www.freebsd.org/doc/en_US.ISO8859-1/books/developers-handbook/index.html

http://www.ecst.csuchico.edu/~chafey/prog/sockets/sinfo1.html (there are some programming examples)

If you wish to start programming, I advice you to read this book:

R.Stevens, UNIX Network Programming, Prentice Hall PTR (1998), ISBN 0-13-490012-X

Lecture 10 & 11: Internet Application Layer Protocols (DNS, SNMP, FTP, HTTP, SMTP)

Questions

1. Describe Domain Name System.
2. Characterize Simple Network Management Protocol.
3. Give the principles of File Transfer Protocol.
4. Characterize HyperText Transfer Protocol.
5. Characterize protocols used for electronic mail.

Related WEB readings:

http://www.ncftp.com/ncftpd/doc/misc/ftp_and_firewalls.html

From http://en.wikipedia.org/

Domain_Name_System, Domain_name, Simple_Network_Management_Protocol, File_Transfer_Protocol HyperText_Transfer_Protocol, HTTP_proxy, SMTP, Email_agent_(infrastructure), Email_authentication

Lecture 12: Network Security Issues

Questions

1. Describe security services important for network users.
2. Describe security tools that are deployed in computer networks.
3. Characterize stream and block cipher approaches?
4. Discus symmetric and asymmetric ciphering?
5. How authentication is performed using asymmetric ciphers?
6. Compare Challenge Handshake Authentication Protocol with Diffie-Hellman key exchange method?
7. How does a certification institution work providing security services?
8. Describe Public Key Infrastructure.

Related WEB readings:

From http://en.wikipedia.org/

Stream_ciphers, Block_ciphers, Diffie-Hellman_key_exchange, RSA, Public_key_infrastructure, Certificate_revocation_list, Steganography

Lecture 13: Internet Protocol version 6

Questions

1. Describe history of IPv6 evolution.
2. What are the advantages of IPv6?
3. Characterize internals of IPv6.
4. Mention principal transition mechanism to use IPv6 in IPv4 world.
5. Compare IPv6 with respect to IPv4.

Related WEB readings:

http://www.sixxs.net/main/

http://www.6deploy.eu/index.php?page=tutorials2

http://www.potaroo.net/tools/ipv4/ IPv4 Address Pool Exhaustion

From http://en.wikipedia.org/
IPv6, Multihoming, Teredo_tunneling

Lecture 13: MPLS technology

Questions

1. Describe the MPLS principles.
2. What are the advantages of MPLS?
3. What is the idea of Generalized MPLS?

Related WEB readings:

From http://en.wikipedia.org/
MPLS, Optical_burst_switching

Lecture 14: IP Multicast

Questions

1. Describe the IP multicast principles.
2. What are the protocols that support IP multicast?
3. How IP multicast is processed inside a LAN?
4. How do work multicast routing algorithms?
5. What are the main difficulties in reliable multicast projects?
6. How a reliable multicast transmission can be achieved?
7. What are the main difficulties in reliable multicast projects?

Related WEB readings:

http://www.tldp.org/HOWTO/Multicast-HOWTO.html

http://www.savetz.com/mbone/

From http://en.wikipedia.org/
Multicast

Lecture 15: Virtual Private Networks

Questions

1. Describe Virtual Private Network types.
2. Which techniques / protocols are used to build VPNs on different ISO OSI levels?
3. Describe motivation for VPN usage and examples of the usage.

Related WEB readings:

https://www.sans.org/reading-room/whitepapers/vpns/network-based-vpns-1047

From http://en.wikipedia.org/
VPN, Generic_Routing_Encapsulation, PPTP, L2TP, IPSec, VPLS