DUBLIN CITY UNIVERSITY

ELECTRONIC AND COMPUTER ENGINEERING

EE562 Network Stack Implementation

Tutorials

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1 Question 1

1.1

1.1.1

Q. Explain the term "re-entrancy" in the context of operating systems. Describe spinlocks and semaphores and why and when either might be used in the code of network device drivers.

A.

1.1.2

Q. Explain what is meant by network byte order and host byte order and comment on the difficulties this cuases fpr the authors of portable networking stacks.

A.

1.2

Q. The source code for the interrupt handler of a Linux device driver (kernel v2.6.x) for a network interface card is shown in Listing Q1. Identify the more obvious errors in this code and describe how to fix them. You may assume that any necessary include files and libraries operate correctly.

A.

2 Question 2

2.1

Q. Describe, with the aid of a diagram, the Netfilter architecture for packet processing in the Linux kernel. List the available hook points and hook function verdicts. Which of these could be used to stop ICMP messages traversing a Linux-based soft router?

A.

2.2

Q. Write a program in C that will implement a fireqall as a dynamically loadable kernel module on a Linux host acting as a web server. The purpose of the module is to prevent web browsers located outside the CIDR block 136.206.0.0/16 from accessing the server, whose IP address is "136.206.1.2". (You may assume that all necessary include files are loaded by including "whatever.h"). What changes to your code would be needed if it were to be installed instead on a gateway router (interconnecting the CIDR block and the wider internet)?

A.

3 Question 3

3.1

Q. Explain, with the aid of a diagram, the three-way handshake used to establish a TCP connection.

A.

3.2

Q. Describe how an incoming UDP message is assigned to a socket by the Linux networking kernel. What happens if no appropriate socket is found?

A.

3.3

3.3.1

Q. You are designing a video streaming application and must choose between the transport layer protocols UDP and DCCP. Present the advantages and disadvantages of the two protocols in this context.

A.

3.3.2

Q. Briefly describe the ICMP protocol, and describe its use in implementing the "traceroute" command.

A.

3.3.3

Q. Briefly describe what is meant by a "network processor", and why network processors might be used in a high-speed router.

A.

4 Question 4

4.1

4.1.1

Q. Describe the concept of a spinlock and explain why spinlocks must be used in the code of network device drivers. Present a scenario in which deadlock can occur through the use of a spinlock.

A.

4.1.2

Q. Explain what is meant by network byte order and host byte order and comment on the difficulties this causes for the authors of portable networking stacks.

A.

4.2

Q. The source code for the interrupt handler of a Linux device driver (kernel v2.8.x) for a network interface card is shown in Listing Q4. Identify the more obvious errors in this code, and describe how to fix them. You may assume that any necessary include files and libraries operate correctly.

A.

5 Question 5

5.1

Q. Describe, with the aid of a diagram, the Netfilter architecture for Packet processing in the Linux Kernel. Present a table listing the hook points available for intercepting IPv4 packets in the Linux kerel, and briefly describe, for each hook point, possible applications of a hook function installed at that point.

A.

5.2

Q. Write a program in C that will implement a firewall as a dynamically loadable kernel module on a Linux host. The purpose of the module is to prevent traffic from IP address "136.206.1.2" reaching any process running on the host, passing all traffic. (You may assume that all necessary include files are loaded by including "whatever.h") Will the firewall still work if the host uses a proxy server for web access?

A.

6 Question 6

6.1

Q. Draw a state diagram of the TCP protocol, explaining the three-way handshake used to establish a TCP connection

A.

6.2

6.2.1

Q. Newer transport layer protocols are frequently designed to be "TCP-friendly". Explain what is meant by this term.

A.

6.2.2

Q. Briefly describe the ICMP protocol, its purpose, and some sample messages. Where does it sit in the TCP/IP stack?

A.

6.2.3

Q. Briefly describe what is meant by a "network processor", and why network processors might be used in a high-speed router.

A.