



Autumn Examinations 2019

Exam Code(s) 3BCT
Exam(s) Third Year Computer Science & Information Technology

Module Code(s) CT3531
Module(s) Networks and Data Communications 2

Paper No. 1

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Instructions: Answer any 4 questions.
All questions carry equal marks.

Duration 2 hrs
No. of Pages 6
Discipline(s) Information Technology
Course Co-Ordinator Dr. D. Chambers

Requirements None

Question 1

- a) What are the main phases of network design as per the top-down network design approach? 5 MARKS
- b) What are some typical technical goals for organizations today when undertaking network design? 5 MARKS
- c) How is Availability typically measured or expressed? How might it be possible to achieve “Five Nines” in this context? 5 MARKS
- d) When considering protocol behavior, what is the difference between relative network utilization and absolute network utilization? 5 MARKS
- e) What architectural and environmental factors should you consider for a new wireless installation? 5 MARKS

Question 2

Assume that you are working for a large corporation that wants to use the private IP address range starting at 10.0.0.0/8 for its internal network. The company management wants to be able to have up to 256 separate sites globally with a routed subnet for each site. You are requested to design the network layout. Answer the following questions and fully explain the logic behind each answer:

- a) What subnet mask will need to be used for the individual routed subnets? 6 MARKS
- b) How many host IP addresses are available in each routed subnet? 4 MARKS
- c) What are the valid host addresses and the broadcast addresses for the first and last subnets? 5 MARKS
- d) What other private IP ranges could the company use if needed? 4 MARKS
- e) What is the purpose of using a Network Address Translation (NAT) router? Does using a NAT router enhance or decrease security for an internal network? Explain the logic behind your answer. 6 MARKS

Question 3

- a) Explain the purpose of the *mtr* utility and what it typically shows.
4 MARKS
- b) Who is responsible for allocating public IP addresses in Europe? Explain briefly the purpose and implementation of the so-called “Last /8 Policy”.
3 MARKS
- c) Describe briefly each of the following: Private Network Interconnect, IP Transit Provider, Default Free Zone
6 MARKS
- d) What are the key parameters required for a Border Gateway Protocol (BGP) session? Give an example of how a BGP session might be configured on a Mikrotik Router.
6 MARKS
- e) The result of a running 'show bgp ipv4 unicast 140.203.0.0/16' on an internet facing BGP router of a University in the USA is shown below. What is the best path from that University to the NUI Galway network (140.203.0.0/16)? Explain in your answer how the best path is chosen in this case. What Autonomous System number announces the prefix 140.203.0.0/16?
6 MARKS

BGP routing table entry for 140.203.0.0/16

Paths: (3 available, best #x)

3128 11537 20965 1213
143.235.40.4 from 143.235.40.4 (143.235.32.1)
Origin IGP, localpref 976, valid, external

11537 20965 1213
144.92.254.229 from 146.151.156.145 (146.151.156.145)
Origin IGP, localpref 975, valid, internal

174 1213
33.145.32.1 from 33.145.32.1 (33.145.32.1)
Origin IGP, localpref 975, valid, external

Question 4

- a) Describe the 12-Step Programme for Network Security Design. What additional steps can be taken to maintain good security over time?
6 MARKS
- b) What is the best practice for securing Public Servers accessible over the Internet? What is the purpose of running Virtual Private Network (VPN) software on client devices?
7 MARKS
- c) Outline briefly the three main functions provided by a Packet Filter in Linux. Which firewall chain is used in IPTABLES for packets that are destined for a local process running on the device itself? Explain in detail the purpose of the following two firewall rules that are defined using IPTABLES format:

```
iptables -I FORWARD -p tcp -d 140.203.0.0/8 --syn -j DROP
```

```
iptables -t nat -A POSTROUTING -s 192.168.0.0/16 -j SNAT --to-source  
91.203.182.14
```

12 MARKS

Question 5 Consider the example network shown in Figure 1 below:

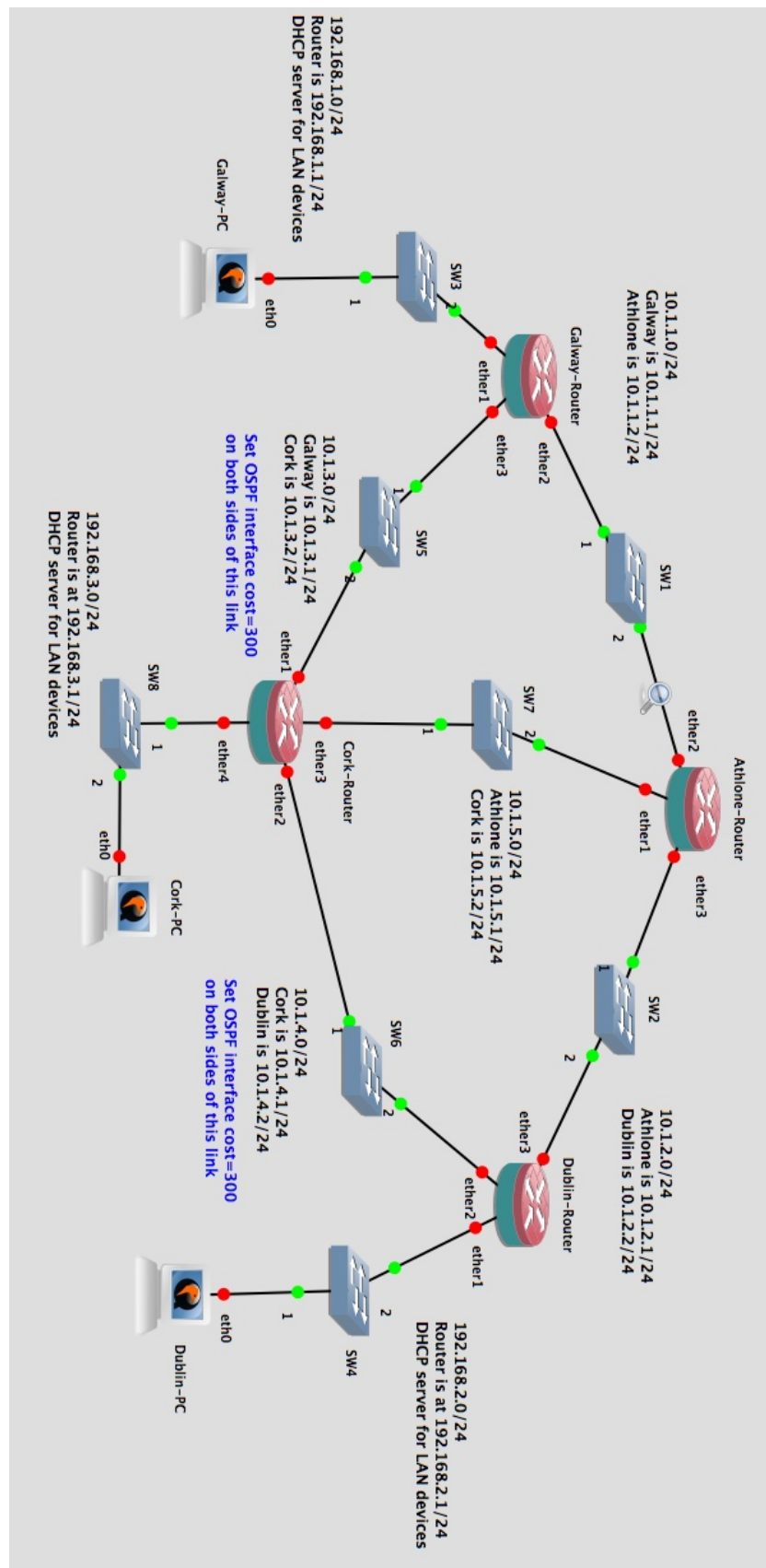


Figure 1 - Example Network

Answer the following questions in relation to this network:

- a) Describe the operation and purpose of the OSPF protocol in the network shown. What is the Link State Database and how is Dijkstra's Algorithm used by OSPF in this context? 5 MARKS
- b) Describe the format of an OSPF Link State Announcement. Explain how a Link State Announcement from the Galway router would be disseminated throughout the network? 6 MARKS
- c) What route will a PC attached to the Dublin router normally take to get to the Galway router? What would happen with OSPF if the link between the Galway and Athlone became unavailable for some reason? 5 MARKS
- d) Suppose a company was using the RIP dynamic routing protocol on its routers, what reasons would you give to persuade them to change to OSPF instead? In this context explain the difference between Distance Vector and Link State routing. 5 MARKS
- e) Assume that the routers are running Mikrotik RouterOS. The Galway, Cork and Dublin routers need to be setup as DHCP Servers for the local network with the host device. What configuration commands are required to enable this feature on a Mikrotik router? 4 MARKS