Module 29 Practical Networking

Module title	Practical Networking
Module NFQ level (only if an NFQ level can be demonstrated)	8
Module number/reference	BSCH-PN
Parent programme(s)	Bachelor of Science (Honours) in Computing Science
Stage of parent programme	Award stage
Semester (semester1/semester2 if applicable)	Semester 2
Module credit units (FET/HET/ECTS)	ECTS
Module credit number of units	5
List the teaching and learning modes	Direct, Blended
Entry requirements (statement of knowledge, skill and competence)	Learners must have achieved programme entry requirements.
Pre-requisite module titles	BSCH-CH, BSCH-DNA
Co-requisite module titles	None
Is this a capstone module? (Yes or No)	No
Specification of the qualifications (academic, pedagogical and professional/occupational) and experience required of staff (staff includes workplace personnel who are responsible for learners such as apprentices, trainees and learners in clinical placements)	Qualified to as least a Bachelor of Science (Honours) level in Computer Science or equivalent and with a Certificate in Training and Education (30 ECTS at level 9 on the NFQ) or equivalent.
Maximum number of learners per centre (or instance of the module)	60
Duration of the module	One Academic Semester, 12 weeks teaching
Average (over the duration of the module) of the contact hours per week	3
Module-specific physical resources and support required per centre (or instance of the module)	One class room with capacity for 60 learners along with one computer lab with capacity for 25 learners for each group of 25 learners

Analysis of required learning effort		
	Minimum ratio teacher / learner	**Hours**
Effort while in contact with staff		
Classroom and demonstrations	1:60	12
Monitoring and small-group teaching	1:25	24
Other (specify)		
Independent Learning		
Directed e-learning		
Independent Learning		50
Other hours (worksheets and assignments)		39
Work-based learning – learning effort		
Total Effort		125

Allocation of marks (within the module)					
	Continuous assessment	**Supervised project**	**Proctored practical examination**	**Proctored written examination**	**Total**
Percentage contribution	50%			50%	100%

Module aims and objectives

This module seeks to give the learner an understanding and knowledge of networking fundamentals including the Open Systems Interconnect (OSI) seven-layer model concepts, terminology and technologies using industry standard hardware and software.

Minimum intended module learning outcomes

On successful completion of this module, the learner will be able to:

1. Construct a peer to peer Ethernet LAN
2. Solve Ethernet networking issues using switched LAN technology
3. Configure a Cisco router for basic network connectivity
4. Configure a Cisco switch
5. Construct and implement a network addressing scheme
6. Configure simple networks
7. Discuss basic security and wireless concepts

Rationale for inclusion of the module in the programme and its contribution to the overall MIPLOs

Networking is fundamental to all modern communication in computing science. Without it there is no internet, no Web, and no ability to develop systems that communicate with each other. Knowledge of these areas is essential to anyone who wants to work in the IT industry.

Appendix 1 of the programme document maps MIPLOs to the modules through which they are delivered.

Information provided to learners about the module

Learners receive a programme handbook to include module descriptor, module learning outcomes (MIMLO), class plan, assignment briefs, assessment strategy, and reading materials.

Module content, organisation and structure

Review of Network Fundamentals

- TCP/IP and OSI networking models,
- Data link layer fundamentals,
- Ethernet LANs,
- WAN fundamentals,
- Fundamentals of IP, TCP and UDP

Cisco Devices

- Operating & basic configuration of Cisco Routers and switches

LAN Switching

- Understanding routing and switching
- LAN switch basics
- VLANs and Trunking
- LAN cabling & topologies

TCP/IP

- IP addressing and subnetting

Routing

- Dynamic Routing Protocols
- Configuring RIPv2
- Static and default routing
- Implementing NAT and DHCP

WAN

- Remote Access technologies: PSTN, modems, ISDN, DSL, cable modems

Module teaching and learning (including formative assessment) strategy

Assessment has two components. Fifty percent of the assessment is based on continuous assessment during module delivery. The other 50% is based on learners taking the 640-822 Interconnecting Cisco Networking Devices Part 1 (ICND1) examination which is held in a test centre recognised by Cisco. This exam is associated with the Cisco Certified Entry Network Technician certification and a tangible first step in achieving the Cisco Certified Network Associate certification.

Timetabling, learner effort and credit

The module is timetabled as one 1.5-hour lecture per week and one 1.5-hour practical session per week.

The number of 5 ECTS credits assigned to this module is our assessment of the amount of learner effort required. Continuous assessment spreads the learner effort to focus on small steps and helps to ensure learner engagement over the course of the module.

There are 36 contact hours made up of 12 lectures and 12 practical sessions delivered over 12 weeks with both taking place in a classroom. The learner will need 50 hours of independent effort to further develop the skills and knowledge gained through the contact hours. An additional 39 hours are set aside for learners to work on class tests that must be completed for the module.

The team believes that 125 hours of learner effort are required by learners to achieve the MIMLOs and justify the award of 5 ECTS credits at this stage of the programme.

Work-based learning and practice-placement

There is no work based learning or practice placement involved in the module.

E-learning

The college VLE is used to disseminate notes, advice, and online resources to support the learners. The learners are also given access to Lynda.com as a resource for reference.

Module physical resource requirements

Requirements are for a classroom for 60 learners equipped with a projector. A computer lab with Boson lab simulator installed.

Reading lists and other information resources

Reading lists and other information resources

Recommended Text

Odom, W. (2016) *Cisco CCENT/CCNA ICND1 100-105 official Cert guide*. Indianapolis: Cisco Press.

Secondary Reading

Sequeira, A. (2013) *Cisco ICND1 Foundation Learning Guide: LANs and Ethernet*. Indianapolis: Cisco Press

Specifications for module staffing requirements

For each instance of the module, one lecturer qualified to at least Bachelor of Science (Honours) in Computer Science or equivalent, and with a Certificate in Training and Education (30 ECTS at level 9 on the NFQ) or equivalent.. Industry experience would be a benefit but is not a requirement.

Learners also benefit from the support of the programme director, programme administrator, learner representative and the Student Union and Counselling Service.

Module Assessment Strategy

The assignments constitute the overall grade achieved, and are based on each individual learner's work. The continuous assessments provide for ongoing feedback to the learner and relates to the module curriculum.

No.	Description	MIMLOs	Weighting
1	2 Tutorials on the smaller elements of the modules content	1-4	25%
2	1 In-class Test: A series of test-like questions in preparation for final exam	5-7	25%
3	Final Exam: ICND 1 Exam	1-7	50%

All repeat work is capped at 40%.

Sample assessment materials

Note: All assignment briefs are subject to change in order to maintain current content.

Tutorial 1	
Course	BSCH
Module	Practical Networking
Notes	- This tutorial relates to Chapters 1 - 5 of CCENT/CCNA ICND1 100-101. - Do not copy and paste any content from the book. - All submissions will be checked for PLAGIARISM. - If you use any sources of information other than the textbook please cite your sources.
Issue Date	
Due Date	
Word Count	1200 words
Submission	You must submitting the following: - A soft copy via Moodle - A hard copy to your lecturer which *must* include a signed cover sheet

Q1. Differentiate with the aid of examples the difference between adjacent layer interaction and same layer interaction.

Q2. With the aid of an example
- describe the basic process involved in routing a packet across a network
- explain the encapsulation / decapsulation process when a packet encounters a router

Q3. With the aid of an example explain how a Ethernet frame is forwarded within a LAN

Q4. What headers / trailers are added to Application Layer data as it passes down through the TCP/IP (updated) model. State the name of the PDU at each layer of the TCP/IP model.

Q5. Explain the main benefits of having a layered model (like the OSI model).

Q6. For each of the scenarios below identify whether the cable used would be a crossover cable or a straight-through cable giving a reason for your selection.

- Scenario 1: PC to Hub
- Scenario 1: Hub to Switch
- Scenario 1: Switch to Router
- Scenario 1: NIC to Switch
- Scenario 1: Router to Router

Q7. In relation to MAC addresses briefly explain the term Organisationally Unique Identifier (OUI).

Q8. Differentiate between half-duplex and full-duplex transmission modes.

Q9. Identify three fundamental differences between WANs and LANs. Include in your answer a brief explanatory note on each.

Q10. In relation to leased lines identify all the hardware requirements at the customer site necessary to create a point-to-point link.

Q11. Using a diagram explain how the Data Link Layer header and trailer changes as it goes from two geographically distant LANS.

Q12. Write a brief explanatory note on the following Internet Access (WAN) links.

a) Leased Line
b) DSL
c) Cable

Q13. For each IPv4 address below state the class of address, giving a reason for your

answer. a) 8.1.1.1
b) 130.22.10.1
c) 200.16.30.5
d) 127.0.0.1
e) 30.40.50.60

Q14. Explain the term 'subnetting' and include in your answer three reasons why is important in networking.

Q15. Briefly explain five of the primary goals of a routing protocol?

Q16. Explain the function role of the following protocols / utilities on a network.

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a. DNS
b. ARP
c. Ping

Q17. For the port numbers below what is the most likely destination application? You must *state* a reason for your answer.

a. 25
b. 80
c. 8080
d. 23
e. 20/21

Q18. In relation to Multiplexing explain the term 'socket'.

Q19. Identify three major differences between the TCP and UDP transport layer protocols.

Course	BSCH
Module	Practical Networking
Notes	• This tutorial relates to chapters 16 to 21 of CCENT/CCNA ICND1 100-101. • Do not copy and paste from the book • All submissions will be checked for PLAGIARISM • All sources of information should be cited and referenced.
Tutorial	2
Issue Date	
Due Date	Any time before
Word Count	Minimum 1000 words
	You must submit • A softcopy via Moodle •

Question	1	<<Chapter	15>>

a. Prove that the syntax of the following commands is the same on Switches / Routers
   i. Hostname configuration
   ii. Enabling interfaces
   iii. Configuration of Telnet, Console and Enable passwords.

Question	2	<<Chapter	16>>

Briefly discuss in your own words the combination of interface status codes.

Question	3	<<Chapter	17>>

With the aid of a diagram and in your own words explain the five steps of a routers routing logic.

Question	4	<Chapter	17>

Briefly discuss the 3 ways in which a routers routing table can be populated with routes

a. Briefly discuss how packets in two different VLANS can be routed using

a. A router with a VLAN trunk connecting to a LAN switch
b. A layer 3 switch

b. Briefly define what a sub-interface is and how it can be configured on a router.

Question	5	<<Chapter	17>>

i. In your own words describe the general function of a routing protocol.
ii. Differentiate between an Interior and an exterior routing rrotocol.
iii. State for the following routing protocols, OSPG, RIP v1, RIP v2 and EIGRP
   a. the routing metric
   b. the administrative distance
   c. whether the routing protocol is classless / classful

Question	6	<<Chapter	18>>

i. Briefly outline the process of assigning an IP address, subnet mask, default gateway and dns information to a host using DHCP.

ii. Explain what DHCP relay is and with the aid of an example show how a Cisco Router can be configured to support this

Question	7	<<Chapter	18>>

i. For a LAN based host, for the default router/gateway setting to work state the four conditions that must be met in order for the setting to work.

ii. State what the following dos-prompt commands can be used for:
   a. Ping
   b. Traceroute
   c. Telnet
   In your answer include the syntax of each command.

Question	8	<<	Chapter	19>>

A subnet design uses the following class A network 10.0.0.0

An engineer must choose a single mask to use throughout the network that supports 500 subnets with the largest subnet requiring 800 host IP addresses.

If 25% growth must be allowed for on the largest subnet determine the mask that should be used.

Question	9	<<	Chapter	20>>

With the aid of an example discuss the process involved in adding a new subnet to an existing VLSM design.

Question	10	<<	Chapter	21>>

Determine the 'best' summary route for the following:

- **10.1.50.0/23**
- **10.1.48.0/23**
- **10.1.46.0/23**
- **10.1.52.0/23**

The solution *must* be in your own words

BSc Practical Networking

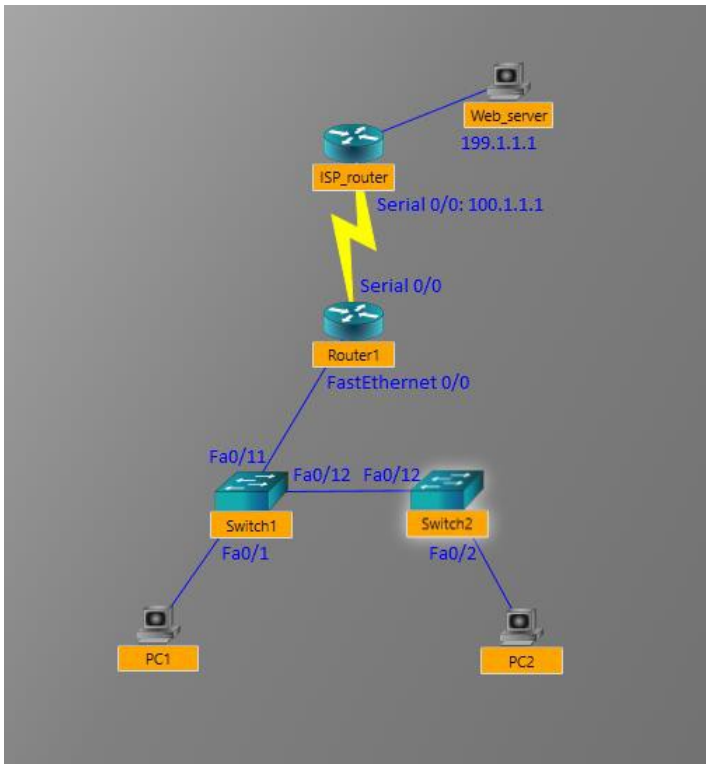
Class test

Please download the Boson lab file from Moodle.

A command reference can be found at the end of this document.

Topology

The topology of the lab is as follows:



Scenario

The ISP_router and Web_server devices are pre-configured. Your task is to configure the Router1, Switch1, Switch2, PC1 and PC2 to achieve the below objectives.

Objectives

Router

1. Configure the Serial0/0 interface of Router1 with the following IP address and subnet mask: a. IP: 100.1.1.10, mask: 255.255.255.0
2. Configure the FastEthernet0/0 interface of Router1 with the following IP address and subnet mask:
   a. IP: 192.168.100.1, mask: 255.255.255.0
3. Enable RIP version 2 on the router and enable it on the 100.1.1.0 network.
4. Set the enable secret on the router to 'cisco'.
5. Set up source static NAT on Router1, with Serial0/0 as the outside interface, FastEthernet0/0 as the inside interface, to translate packets leaving the

router to use the IP address of the outside interface as their source IP.

Switches

1. On Switch1 and Switch2, create vlan 200 with the name 'Office'
2. On both switches configure the ports FastEthernet0/1-11 as access ports in vlan 200.
3. On both switches configure port FastEthernet0/12 as a trunk port.

PCs

1. Configure PC1 with the following IP address, subnet mask and gateway:
   a. IP: 192.168.100.101, mask: 255.255.255.0, gateway 192.168.100.1
2. Configure PC2 with the following IP address, subnet mask and gateway:
   a. IP: 192.168.100.102, mask: 255.255.255.0, gateway 192.168.100.1
3. Verify network connectivity by trying to ping the IP address of the Web_server: 199.1.1.1

Command reference

Command	Description
access-list access-list-number {deny | permit} source-address source-wildcard	creates an ACL that denies or permits IP traffic from the specified address or address range
clock rate clock-rate	sets the clock rate for a Data Communications Equipment (DCE) interface
configure terminal	enters global configuration mode from privileged EXEC mode
enable	enters privileged EXEC mode
end	ends and exits configuration mode
exit	exits one level in the menu structure
hostname host-name	sets the device name
interface type number	changes from global configuration mode to interface configuration mode
ip address ip-address subnet-mask	assigns an IP address to an interface
ip access-group {access-list-number | access-list-name} {in | out}	controls access to an interface
network network-address	activates the specified routing protocol on the specified network
no shutdown	enables an interface
ping ip-address	sends an Internet Control Message Protocol (ICMP) echo request to the specified address
router rip	enables Routing Information Protocol (RIP) routing
show access-lists [access-list-number | access-list-name]	displays the contents of current ACLs
show ip interface	displays IP information for an interface
show running-config	displays the active configuration file
version 2	enables RIP version 2 (RIPv2)
ip nat inside	defines the inside interface for NAT

ip nat inside source static inside-local-address inside-global-address	creates a static NAT translation
ip nat outside	sets an interface to be an outside interface
ip nat inside source list accesslist-number interface type number overload	translates anything matching the access list to the IP address of the interface specified; overload indicates that Port Address Translation (PAT) will be used
show ip nat translations	displays the NAT translation table
show ip route	displays the IP routing table
interface range fastethernet slot/starting-port - ending-port	configures a range of interfaces
show vlan	displays VLAN information
show vtp status	displays VTP con? guration
switchport access vlan vlan-id	assigns the default VLAN for a port
switchport mode {access | dynamic {auto | desirable} | trunk}	configures the VLAN membership mode of a port
switchport trunk encapsulation dot1q	configures trunk for 802.1Q encapsulation
vlan vlan-id	creates a VLAN
vtp domain domain-name	assigns the domain name for VTP
vtp mode [client | server | transparent]	configures the VTP mode
vtp password password	assigns the VTP password; switches must be configured with the same VTP domain and VTP password in order for VTP to propagate VLAN information between the switches
enable password password	sets the enable password
enable secret password	sets the enable secret password
line console 0	accesses console line configuration mode
login	enables password checking at login
logout	exits from the user EXEC mode command-line interface (CLI) and ends the current session
password password	specifies the password that is required for a user to log in
ipconfig /all	is used in NetSim to display the IP addresses and Media Access Control (MAC) address on a workstation
ipconfig /dg ip-address	is used in NetSim to assign a default gateway IP address to a workstation interface
ipconfig /ip ip-address subnet-mask	is used in NetSim to assign an IP address and subnet mask to a workstation interface