Unit 43: Routers and Routing Basics (Cisco CCNA2)

NQF Level 3: BTEC National

Guided learning hours: 60

Unit abstract

This unit is a comprehensive introduction to the principles of router configuration and management, as well as the operational functionality of routing protocols.

The unit covers the skills and knowledge typical of the networking sector that an ICT network communications expert would need to understand to successfully complete their work. In particular, learners will be taught how to configure and connect a Wide Area Network (WAN), integrate various routing protocols and configure routers to perform routing and security decisions. In addition, learners will understand and apply commonly used networking technologies in a variety of contexts.

In most organisations, it is accepted that network management is essential in order to run support systems efficiently and effectively. Learners will appreciate what takes place in the daily operation of a network infrastructure and how differing systems interact with each other.

This course involves hands-on, lab-oriented activities that stress laboratory safety and working effectively in a group environment. Theory aspects are studied and tested online using Cisco's own electronic curriculum which learners may also access from home. The course is delivered through a blended learning approach where tutor-led teaching is combined with electronic materials and testing.

This unit will prepare learners to sit the Cisco Network Fundamentals (CCNA2) certification and, in addition, (when completing Networking Fundamentals (CCNA1), Intermediate Switching and Routing (CCNA3) and WAN Technologies (CCNA4) it will help you prepare for globally recognised CCNA professional certification.

This unit is assessed via the Cisco Routers and Routing Basics (CCNA2) online examination. There are further criteria for merit and distinction grades.

To view general information about the Cisco Routers and Routing Basics (CCNA2) objectives please visit www.cisco.com/web/learning/netacad/course_catalog/CCNA.html, the detailed scope and sequence documents are available to academies on the Cisco internal site.

Learning outcomes

On completion of this unit a learner should:

1 Be able to identify and understand different routing protocols

2 Configure a router to communicate with a WAN infrastructure

3 Design and implement network security and network traffic control

4 Test and troubleshoot a network system to identify faults and quality of communication.

Unit content relating to the merit and distinction criteria

Routing techniques: eg link state routing protocols, distance vector routing protocols, hybrid routing protocols, static routes

WAN network infrastructure: eg more than one router interconnected, another router preconfigured for connection and communication

Routing protocol: eg RIP, RIP version 2, IGRP, EIGRP

Selected network traffic: eg ICMP, HTTP, FTP, Telnet

Commands: enable mode; privilege mode; configuration mode; memory write commands; show commands; console password configuration; interface; IP addressing; routing; telnet configuration; router status and troubleshooting

Grading grid

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all of the learning outcomes for the unit. The criteria for a pass grade describe the level of achievement required to pass this unit.

Grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
The pass criteria are evidenced by the Cisco Routers and Routing Basics (CCNA2) examination. The centre will evidence this with a copy of the learner's class grade book from the assessment system upon completion of the course (this must be listed by student name). A pass grade is a score of 70% or more in the final examination.	M1 plan the implementation of a router on a WAN network infrastructure, based on a pre-determined design M2 evaluate and apply the required commands to configure a router to communicate using a common routing protocol M3 test the communication between routed networks.	D1 troubleshoot a routing device and justify the solution implemented to restore operation D2 justify, develop, implement and test an ACL to control selected network traffic D3 evaluate and recommend different routing techniques and provide a comparison of their operational benefits.

Essential guidance for tutors

Delivery

Cisco Routers and Routing Basics (CCNA2) is a proprietary course within the Cisco Networking Academy program, the curriculum, assessment and support materials are available only to institutions participating in the program. Cisco makes these available at no cost for any non-profit institution, there are some costs for instructor training and support. For detailed information please consult this web link: www.cisco.com/web/learning/netacad/get_involved/BecomeAnAcademy.html.

If learners are following the Cisco course in parallel with a BTEC course then it is recommended that the two aspects of the assessment are integrated so that tasks being completed as part of the practical preparation for Cisco are used as the basis of the additional assessment for the merit and distinction criteria.

Assessment

To achieve a pass grade, learners must pass the Routers and Routing Basics (CCNA2) module examination.

To achieve a merit grade, learners must in addition to passing the Routers and Routing Basics (CCNA2) module examination, achieve the three merit criteria. For M1, the tutor can devise a scenario, or use the Cisco CCNA2 final practical assessment, where learners will need to select, and plan what tasks they are to complete in the connection of their router to another.

M2 links to M1, learners must decide on the commands they are going to use before they apply them to a router. This artefact may be handwritten, typed, or orally dictated notes during the practical exercise.

M3 links to M1 and M2 and requires learners to prove the 'basic' communication and configuration is operational, the routing protocol and communication lines must be 'up' for learners to be successful.

To achieve a distinction grade, learners must achieve all of the pass and merit criteria and the three distinction grade criteria. For D1, they must prove they have solved a technical problem; the tutor can 'create' a fault on a configured router, and ask learners to identify and document the resolution process.

D2 links to M1, M2 and M3 in the form of a practical assessment, learners must provide evidence of planning the ACL, which must an extended ACL to prevent a host from being able to communicate using selected network traffic (ICMP or HTTP or FTP or Telnet).

For D3, the unit covers different routing protocols. Learners can produce a document, hold a discussion, or give a presentation which evaluates each protocol and promotes their differing benefits.

NB: For academies, the practical work can be delivered using packet tracer, this enables learners to save 'evidence' of the work they have completed on the routed network.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

The learning outcomes in this unit are closely linked with *Unit 2*: *Computer Systems*, *Unit 22*: *Network Management*, *Unit 27*: *Principles of Computer Networks*, *Unit 42*: *Networking Basics (Cisco CCNA1)*, *Unit 44*: *Switching Basics and Intermediate Routing (Cisco CCNA3)*, *Unit 45*: *WAN Technologies (Cisco CCNA4)*, *Unit 50*: *Networking Security (CompTIA Security +)* and *Unit 51*: *Configuring and Troubleshooting Networks (CompTIA Networks +)*.

This unit has links to the Level 3 National Occupational Standards for IT Practitioners, particularly the area of competence 'System Operation'.

Essential resources

This course must be taught in a computer laboratory with internet access in order to assess learners via the Cisco online assessment system. The web is a useful source of technical information.

If another room for lab work is available, the cabling and network configuration part of the class can be taught in this classroom. One lab computer for every two learners is an ideal situation but many classes have up to three to four learners per laboratory computer. Lab computers do not need to be the latest or newest systems, but it helps if they are all identical. It is recommended that computers used by other classes should not be used as learners may dismantle the machines. There should be a supply of redundant computers for this task.

Tutor resources

- One LCD projector (or TV with hookup to computer).
- A workstation hooked up to network (both LAN and Net) with CD ROM and CD burner for making copies of CDs, for collecting/showing learners' work and for using tutor CDs that come with texts.

Laboratory resources

- Computers on LAN with internet access — suggested ratio of one for every learner (for theory work).
- One server saving class work (learner presentations etc).
- One web server to host the Cisco electronic content.
- One lab area with tables, electrical outlets, extra network jacks and, if possible, elevated storage shelves for routers, switches and monitors.
- One or two storage cabinets for tools and consumables.
- Storage area for lab computers and spare parts (shelving, cabinet etc).
- Laboratory (tear-down) computers — suggested ratio of one for every two learners, or VM-Ware, virtual PC emulators.

Cisco Routers and Routing Basics (CCNA2) requirements

CISCO specify a wide range of lab resources for the delivery of the CCNA programme, which can be accessed at: www.cisco.com/web/learning/netacad/downloads/779/edu/media/pdf/how_to_become_academy.pdf.

Indicative reading for learners

For a list of Cisco resources to assist with this unit, including exam preparation materials see: www.cisco.com/web/learning/netacad/course_catalog/CCNA.html.

Key skills

Achievement of key skills is not a requirement of this qualification but it is encouraged. Suggestions of opportunities for the generation of Level 3 key skill evidence are given here. Tutors should check that learners have produced all the evidence required by part B of the key skills specifications when assessing this evidence. Learners may need to develop additional evidence elsewhere to fully meet the requirements of the key skills specifications.

Application of number Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• planning the implementation of a router on a WAN network infrastructure, based on a pre-determined design.	N3.1 Plan an activity and get relevant information from relevant sources. N3.2 Use this information to carry out multi-stage calculations to do with: a amounts or sizes b scales or proportion c handling statistics d using formulae. N3.3 Interpret the results of your calculations, present your findings and justify your methods.

Communication Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• evaluating and recommending different routing techniques and providing a comparison of their operational benefits.	C3.1a Take part in a group discussion. C3.1b Make a formal presentation of at least eight minutes using an image or other support material. C3.2 Read and synthesise information from at least **two** documents about the same subject. Each document must be a minimum of 1000 words long. C3.3 Write **two** different types of documents each one giving different information about complex subjects. One document must be at least 1000 words long.
Information and communication technology Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• evaluating and recommending different routing techniques and providing a comparison of their operational benefits.	ICT3.1 Search for information, using different sources, and multiple search criteria in at least one case. ICT3.2 Enter and develop the information and derive new information. ICT3.3 Present combined information such as text with image, text with number, image with number.

Improving own learning and performance Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• planning the implementation of a router on a WAN network infrastructure, based on a pre-determined design • testing the communication between routed networks.	LP3.1 Set targets using information from appropriate people and plan how these will be met. LP3.2 Take responsibility for your learning, using your plan to help meet targets and improve your performance. LP3.3 Review progress and establish evidence of your achievements.
Problem solving Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• troubleshooting a routing device and justifying the solution implemented to restore operation.	PS3.1 Explore a problem and identify different ways of tackling it. PS3.2 Plan and implement at least one way of solving the problem. PS3.3 Check if the problem has been solved and review your approach to problem solving.
Working with others Level 3	
When learners are:	**They should be able to develop the following key skills evidence:**
• planning the implementation of a router on a WAN network infrastructure, based on a pre-determined design.	WO3.1 Plan work with others. WO3.2 Seek to develop co-operation and check progress towards your agreed objectives. WO3.3 Review work with others and agree ways of improving collaborative work in the future.