Title	**Demonstrate and apply intermediate knowledge of computer network engineering principles**		
Level	**5**	**Credits**	**15**

Purpose	This unit standard covers the operation of routers and the principles of routing within a computer network. People credited with this unit standard are able to: – demonstrate and apply knowledge of routers and WANs in computer networks; – demonstrate and apply knowledge of simple network routing protocols; – demonstrate and apply knowledge of network interface protocols; and – apply basic router troubleshooting techniques.

Classification	Electronic Engineering > Computer Engineering

Available grade	Achieved

Prerequisites	Unit 22712, *Demonstrate and apply introductory knowledge of computer network engineering principles,* or demonstrate equivalent knowledge and skills.

Guidance Information

1 This unit standard is intended for use in engineering courses at diploma level.

2 This unit standard is one of four designed to cover knowledge of computer network engineering principles, the others being Unit 22712, *Demonstrate and apply introductory knowledge of computer network engineering principles*; Unit 11583, *Demonstrate and apply advanced knowledge of local computer network engineering principles*; and Unit 16989, *Describe and apply advanced knowledge of computer network engineering techniques to set up a WAN*.

3 References
CCNA 1 and 2 Companion Guide, Revised (Cisco Networking Academy Program) 3rd Edition; ISBN: 1587131501;
Routers and Routing Basics CCNA 2 Companion Guide, Wendell Odom, Rick McDonald, ISBN: 1587131668;
and all subsequent amendments and replacements.

4 Definitions
ACL – access control lists.

CDP – Cisco Discovery protocol.
CLI – command line interface.
FR – frame relay.
HDLC – high-level data link control.
ICMP – internet control message protocol.
IGRP – interior gateway routing protocol.
Industry practice – practice used and recommended by organisations involved in the electrotechnology industry.
Intermediate knowledge – means employing a broad knowledge base, with substantial depth in some areas of the subject matter, to analyse and interpret a wide range of information.
IOS – internet operating system.
RIP – routing information protocol.
TCP/IP – transmission control protocol/internet protocol.
TFTP – trivial file transfer protocol.
WAN – wide area network.

5 All measurements are to be expressed in Système International (SI) units, and, where required, converted from Imperial units into SI units.

6 All activities must comply with: any policies, procedures, and requirements of the organisations involved; the standards of relevant professional bodies; and any relevant legislative and/or regulatory requirements.

7 Range
- a performance in relation to the outcomes of this unit standard must comply with the Health and Safety at Work Act 2015;
- b laboratory and workshop safety practices are to be observed at all times.

Outcomes and performance criteria

Outcome 1

Demonstrate and apply knowledge of routers and WANs in computer networks.

Performance criteria

1.1 The role of routers in WANs is described in terms of design, function and location in accordance with industry practice.

Range routers in WAN, internal components, external connections, management of port connections.

1.2 Basic configuration techniques are applied to a router and the configuration file and interface states are examined in accordance with industry practice.

Range may include but is not limited to – CLI configuration, router name, passwords serial and Ethernet interfaces, banners, show commands.

1.3 Tools are used to obtain details about neighbouring routes and devices in accordance with industry practice.

Range may include but is not limited to – CDP, telnet, ping, traceroute.

1.4 Tools are used to manage the IOS software in accordance with industry practice.

Range may include but is not limited to – configuration register settings, use of TFTP, copy and paste, Xmodem, password recovery.

Outcome 2

Demonstrate and apply knowledge of simple network routing protocols.

Range may include but is not limited to – static routes, RIP, IGRP; evidence of two is required.

Performance criteria

2.1 Characteristics of static routes and simple routing protocols are explained in accordance with industry practice.

2.2 Simple routing protocols and static routes are configured for a network in accordance with industry practice.

Outcome 3

Demonstrate and apply knowledge of network interface protocols.

Performance criteria

3.1 Protocols associated with various interfaces on a router are described in accordance with industry practice.

Range includes but is not limited to – Ethernet, HDLC, FR.

3.2 TCP/IP suite error and control messages are explained in accordance with industry practice.

Range may include but is not limited to – ICMP, error reporting, unreachable networks, ping, echo messages, ICMP redirect.

3.3 TCP/IP protocol design, structure, and transport layer ports are explained in accordance with industry practice.

Range may include but is not limited to – TCP operation, synchronisation, denial of service attacks, windowing, sequence numbers, port numbering and well known ports.

3.4 ACLs are used to control and filter network traffic in accordance with industry practice.

Range includes but is not limited to – standard, extended, and named ACLs applied to TCP/IP protocols.

Outcome 4

Apply basic router troubleshooting techniques.

Performance criteria

4.1 Fault symptoms are identified using logical techniques and recorded in accordance with industry practice.

Range to include physical cabling, and router configuration errors in a small network of two routers;
evidence of two physical and three network faults is required.

4.2 Fault causes are identified using efficient diagnostic techniques, tools, tests, and servicing data, and the fault is corrected in accordance with industry practice.

Range may include but is not limited to – the use of show commands to examine routing tables and interface status, ping, traceroute, telnet and debug commands.

4.3 Diagnostic procedures are used to ensure that the fault correction steps have not introduced new network faults.

Range may include but is not limited to – ping, traceroute, telnet.

This unit standard is expiring. Assessment against this standard must take place by the last date for assessment set out below.

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	18 December 2006	31 December 2021
Rollover and Revision	2	28 June 2018	31 December 2021
Review	3	28 January 2021	31 December 2021

Consent and Moderation Requirements (CMR) reference	0003

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.