Australian Government

Department of Education, Employment and Workplace Relations

ICTTEN5217A Plan a wireless mesh network

Release: 1

ICTTEN5217A Plan a wireless mesh network

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit describes the performance outcomes, skills and knowledge required to plan a wireless mesh network comprised of radio nodes organised in a mesh topology. Wireless mesh networks provide users with secure wireless roaming beyond traditional wireless local area network (LAN) boundaries and are readily deployed in areas that lack wired backhaul. The mesh topology and ad-hoc routing give mesh networks stability, offer redundancy and have the ability to self-form and self-heal. Mesh networks enable local communities and those in remote areas to participate in a distributed shared network without the need for centralised management. No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement but users should confirm requirements with the relevant federal, state or territory authority.

Application of the Unit

Application of the unit	Technical staff who work with wireless networking equipment or radio communications equipment apply the skills and knowledge in this unit to design a scalable wireless access network using mesh technology for growing communities. This may include planning officers and field officers from private and public organisations.

Licensing/Regulatory Information

Refer to Unit Descriptor

Pre-Requisites

Prerequisite units		

Employability Skills Information

Employability skills	This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Research wireless mesh networks and formulate the system architecture	1.1. Confirm with regulatory spectrum management authority the ***specific regulations*** regarding radio characteristics 1.2. Contact customer to determine ***wireless mesh network*** design specifications 1.3. Evaluate the use of ***frequency bands*** for the operation of the WMN 1.4. Evaluate and select the ***wireless technology***, ***internet protocol*** (***IP***) version and ***mesh routing protocol*** to satisfy design criteria 1.5. Specify and source the ***hardware and software requirements***
2. Prepare a detailed plan for the mesh network	2.1. Evaluate the maximum line of sight distances achievable between backbone nodes and between mesh nodes 2.2. Plan the sites where mesh nodes will be located and plot to scale on a map 2.3. Estimate the quantity and length of the links required between mesh nodes to ensure design is within specifications 2.4. Design backbone links in the mesh topology for scalability of future deployments 2.5. Select the location of the internet ***gateway*** for the network 2.6. Allocate operating frequencies at mesh nodes, backbone nodes and wireless access points for optimum network performance with minimal interference from adjacent network routers
3. Plan the IP addresses and subnet mask	3.1. Produce an addressing scheme and allocate IP addresses and subnet mask to mesh nodes, backbone nodes and access points 3.2. Produce a configuration scheme to secure the network
4. Document the mesh network	4.1. Document the plans and drawings for the mesh network 4.2. Produce an ***installation plan*** for the building of the mesh network 4.3. Following installation, configuration and testing of the mesh network, incorporate 'as built' amendments if appropriate

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

Required skills

- analysis skills to evaluate information and make recommendations
- communication skills to liaise with vendors and installation personnel on technical and operational matters
- literacy skills to interpret technical documentation and write reports in required formats
- numeracy skills to perform calculations, interpret results and evaluate different types of technical data
- planning and organisational skills to plan, prioritise and monitor own work and that of others
- problem solving and contingency management skills to adapt testing procedures to requirements of particular situations and modify activities depending on operational contingencies, risk situations and environments
- technical skills to:
  - configure and set up IP addresses and subnet masks
  - install software
  - select and specify appropriate performance tests and test equipment

Required knowledge

- antenna gain, polarisation
- cable loss
- calculation of effective isotropic radiated power (EIRP)
- calculation of line of site radio range
- decibels and related units
- IP addressing and subnet masks
- network security and firewalls
- network topologies
- radio frequency (RF) frequency bands
- routing protocols
- transmission control protocol (TCP)-IP protocols
- wireless networking hardware, access points, wireless routers and gateway
- wireless protocols

Evidence Guide

EVIDENCE GUIDE	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Evidence of the ability to: • evaluate and select wireless technology and mesh routing protocol • plan a wireless mesh network from a project brief • produce an IP addressing scheme • prepare an installation plan.
Context of and specific resources for assessment	Assessment must ensure: • sites where planning a wireless mesh network may be conducted • design criteria and other site related documentation • equipment specifications and technical documentation.
Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: • direct observation of the candidate planning a wireless mesh network • review of plan prepared by the candidate outlining recommendations for the customer • review of IP addressing scheme prepared by the candidate • oral or written questioning to assess knowledge of equipment and technologies as used within the mesh network.
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example: • ICTTEN4050A Install and configure a wireless mesh network • ICTRFN3055A Install a radio communications antenna and feedline.

EVIDENCE GUIDE	
	Aboriginal people and other people from a non-English speaking background may have second language issues. Access must be provided to appropriate learning and assessment support when required. Assessment processes and techniques must be culturally appropriate, and appropriate to the oral communication skill level, and language and literacy capacity of the candidate and the work being performed. In all cases where practical assessment is used it will be combined with targeted questioning to assess required knowledge. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. Where applicable, physical resources should include equipment modified for people with special needs.

Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Specific regulations may include:	• maximum allowable antenna gain • maximum allowable EIRP • maximum allowable power output for transmitter • use of the 2.4 GHz band • use of the 5.8 GHz band.
Wireless mesh network may	• client wireless mesh network - client nodes perform routing

RANGE STATEMENT	
include:	• hybrid wireless mesh network - perform mesh and access functions • infrastructure wireless mesh network - mesh routers for the clients.
Frequency bands may include:	• multiple frequencies for access and transmission • same frequency for access and transmission • separate frequencies for access and transmission.
Wireless technology may include:	• 802.11a • 802.11b • 802.11g • 802.11n • 802.11s draft IEEE 802.11 amendment • 802.16.
Internet protocol (***IP***) may include:	• IPv4 • IPv6.
Mesh routing protocol may include:	• ad-hoc on-demand distance vector (AODV) • better approach to mobile ad-hoc networking (BATMAN) • dynamic source routing (DSR) • hybrid wireless mesh protocol (HWMP) • infrastructure wireless mesh protocol (IWMP) • optimised link state routing protocol (OLSR).

Hardware and software requirements may include:	• hardware:
	  • access points
	  • antenna polarisation
	  • directional microwave antennas
	  • omnidirectional microwave antennas
	  • wireless routers
	• software:
	  • open source software:
	  • FreeBSD
	  • Freifunk
	  • proprietary.

Gateway may include:	• asymmetric digital subscriber line (ADSL) • very small aperture terminal (VSAT).
Installation plan may include:	• addressing scheme • configuration instructions and commands

RANGE STATEMENT	

	• frequency allocation plan
	• network element details:
	  • MAC address
	  • model, type and serial number
	• security implementation
	• siting of mesh routers and gateways
	• software version.

Unit Sector(s)

Unit sector	Telecommunications

Co-requisite units

Co-requisite units		

Competency field

Competency field	Telecommunications networks engineering