



Australian Government

ICTTEN7193B Plan a transmission network

Release 1

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Modification History

Release	Comments
Release 2	This version first released with <i>ICT10 Integrated Telecommunications Training Package Version 3.0</i>. References to other units updated. Outcomes deemed equivalent.
Release 1	This version first released with <i>ICT10 Integrated Telecommunications Training Package Version 1.0</i>.

Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to analyse requirements and plan a telecommunication transmission network for a service provider.

The plan may be for a project associated with a new installation or an upgrade of capacity or technology in an existing network or for convergence to Next Generation Networks (NGN).

Application of the Unit

Technical officers, supervisors and engineers who plan transmission networks apply the skills and knowledge in this unit.

Transmission networks for service providers include optical Ethernet, dense wavelength division multiplexing (DWDM) and fibre to the x (FTTx) optical networks and wireless networks, such as microwave, satellite and worldwide interoperability for microwave access (WiMAX).

Licensing/Regulatory Information

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.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Element	Performance Criteria
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>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.</i>

Elements and Performance Criteria

1. Scope the project	1.1 Obtain relevant legislation, codes, regulations and standards and follow occupational health and safety (OHS) and environmental requirements for the given work 1.2 Obtain project brief from appropriate person 1.3 Evaluate potential transmission options and select the most suitable type of transmission network that meets the criteria outlined in the project brief 1.4 Analyse the limitations of the transmission path characteristics and develop solutions for transmission impairments 1.5 Produce a report outlining the reasons for the selection of a transmission network together with a shortlist of suitable equipment vendors and products 1.6 Obtain the traffic load from network information sources or forecasts and dimension the proposed network service 1.7 Produce a brief on the relationship between transmission network architecture components and the overall network and their impact on the work 1.8 Evaluate the equipment type and technologies to determine availability, cost and compatibility with existing network equipment 1.9 Determine resources and equipment needed for the work according to enterprise procedures and check for correct operation and safety 1.10 Assess the capacity limitation of various platforms in the context of the work to optimise maximum network performance 1.11 Determine product capability and calculate allowable capacity of transmission network to allow for network growth
2. Produce a link budget	2.1 Analyse the transmission system using equipment and vendor's specifications to produce a link budget and assess the resulting margin 2.2 Document the results of the link budget analysis
3. Produce deployment plan for transmission network	3.1 Conduct planning work using current equipment components and complying with transmission network deployment rules and exemption process criteria 3.2 Produce a preliminary plan on the deployment of the network that maintains integrity of the transmission network 3.3 Establish a solution to unexpected situations through

	discussion with appropriate personnel, with consideration to job specifications, safety and enterprise procedures 3.4 Review plan to ensure that it complies with all standards and codes required when working on network access and make adjustments where appropriate
4. Complete work	4.1 Produce final deployment plan including recommendations agreed with the customer 4.2 Provide a report on network management and performance monitoring system to be incorporated in the transmission network to ensure the network is performing at optimum level

Required Skills and Knowledge

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

Required skills

- analytical skills to:
 - analyse transmission situations
 - review and evaluate different options for transmission networks
 - select and compare benefits and limitations of one transmission method over another
- communication skills to:
 - interact with design team personnel and equipment vendors
 - maintain a customer focus and consider customer needs
- literacy skills to:
 - read and interpret technical and non-technical documentation
 - write summary reports in required formats
- numeracy skills to undertake link budget calculations, interpret results and evaluate different types of technical data
- PC skills to search databases of suitable equipment and vendors
- planning and organisational skills to plan and monitor own work and that of others
- problem solving skills to manage unexpected situations
- research skills to gather data on networks
- task management skills to work logically and systematically with required attention to detail
- technical skills to identify the technologies that constitute a transmission network.
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Required knowledge

- alternating current and transmission line theory
- awareness of emerging telecommunications switching and transmission technologies including microwave radio, optical fibre and satellite
- capacity and capability management
- capacity limitation of various platforms
- commercial considerations of Access Network deployment
- common switching and transmission support services
- compatibility issues of technology and equipment
- currency of technology and equipment use
- data transmission
- digital multiplexing techniques and hierarchies
- enterprise deployment rules
- exemption process criteria
- network topologies
- product capability and availability that are allowable within a transmission network
- telecommunications:
 - alarm management
 - bearers

- performance monitoring systems
- transmission:
 - architectures and geographical categorisation
 - information sources
 - technology and equipment.

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 potential transmission options and select the most suitable type of transmission network • analyse the effect of transmission path characteristics on transmission systems and develop solutions for transmission impairments • select appropriate testing regimes for transmission technologies • determine key multiplexing features of transmission technologies • develop a transmission network work plan.
Context of and specific resources for assessment	Assessment must ensure: • site where transmission network may be planned • equipment and system manuals and specifications • legislation and documentation to plan a transmission network.
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 the deployment of a transmission network • review of reports completed by the candidate for differing transmission network examples • review of final deployment plan prepared by the candidate outlining recommendations for the customer • oral or written questioning to assess knowledge of equipment and technologies as used within the transmission network.
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:

	• ICTRFN7182B Produce a radio link budget. 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.
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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.

<i>Relevant legislation, codes, regulations and standards</i> include:	• Australian Communications Industry Forum (ACIF) standards and codes • Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) Radiation Protection Standard – Maximum Exposure Levels to Radio Frequency Fields – 3 kHz to 300 GHz • AS Communications Cabling Manual (CCM) Volume 1 • Australian building codes and regulations • Environmental Protection Acts • fire regulations • OHS • relevant international standards • technical standards AS/ACIF S008:2006 and AS/ACIF S009:2006.
<i>Project brief</i> may include:	• access to existing services • details of budgeted costs • details of the grade of service required • location of intermediate add-drop points • location of transmission terminals • network topology • presence of existing services • protection methods • traffic bit rate • traffic protocols.
<i>Appropriate person</i> may include:	• network engineer • project engineer • project manager.
<i>Transmission network</i> may include:	• Core Network • geostationary • long haul network • mesh network • metropolitan area network • optical fibre: • passive optical network (PON)

	• submarine cable • terrestrial cable • point-to-point link • satellite • ring network • hybrid fibre coaxial (HFC) network • terrestrial microwave: • licensed • unlicensed • WiMAX.
Limitations may include:	• optical: • chromatic dispersion • four-wave mixing • polarisation mode dispersion (PMD) • satellite: • loss of orbital position • rain attenuation • terrestrial interference • wireless and terrestrial microwave: • atmospheric absorption • fading • terrestrial interference.
Network information sources may include:	• network management databases for: • capacity assessment data • network performance data • traffic dimensioning data • network management tools.
Dimension may include:	• allowance for future growth • capacity of the channels • number of channels required.
Transmission network architecture components may include:	• earth command and control station • earth station • horn antenna • low noise amplifier (LNA) • low noise block (LNB) • multiplexing equipment: • network management system • STM-1 multiplexer • STM-16 multiplexer • STM-192 multiplexer

	• STM-4 multiplexer • STM-64 multiplexer • synchronous digital hierarchy (SDH) • optical fibre network: • optical add-drop multiplexer (OADM) sites • reconfigurable optical add-drop multiplexer (ROADM) • terminal sites and optical add-drop multiplexer sites: • battery backup • dispersion compensation devices (DCD) • dense wavelength division multiplexing (DWDM) system • equipment racks • erbium doped fibre amplifier (EDFA) • optical amplifier • patch panel • power supplies • Raman amplifier • rectifier • regenerator • parabolic reflector • patch antenna • satellite antenna: • fixed • rotatable • satellite network • satellite receiver • satellite transmitter • satellite transponder • terrestrial microwave network: • circulators and isolators • coaxial cable • indoor unit • microwave transmitter and receiver • outdoor unit • parabolic reflector antennas • radio tower, mast, rooftop • waveguide.
Equipment type may include:	• asymmetrical • circuit switched • coarse wavelength division multiplexing (CWDM)

	• DWDM • digital • duplex • IP based • packet switched • simplex • symmetrical • time division multiplexing (TDM) • wavelength division multiplexing (WDM).
Technologies may include:	• compression types: • H.264 • MPEG-2 • MPEG-4 • protocols and transport methods: • asynchronous serial interface (ASI) • DVB-ASI • HD-SDI • SD SDI • optical transport network (OTN): • IP/MPLS over OTN/DWDM • optical Ethernet: • fast Ethernet • gigabit Ethernet • 10 Gbps • synchronous digital hierarchy (SDH) • synchronous optical network (SONET).
Resources may include:	• equipment • hardware • installation platforms • ladders • manpower • materials • safety equipment • software • tools.
Enterprise procedures may include:	• asset registration • compliance • preferred suppliers • preferred vendors • procurement agreements

	• purchase requisition • service level agreements.
Link budget may include:	• actual received power level • allowance for splices due to fibre cuts • contingencies • fade margin • margin • path loss • required receive level • transmitted signal power level • transmitter hardware losses.
Network management may include:	• administration • alarms • event history • maintenance • operation • provisioning.
Performance monitoring may include:	• alerting users that network degradation is underway • gauging the quality of payload signals • power level lower limit • power level upper limit • threshold crossing levels.

Unit Sector(s)

Telecommunications - Telecommunications networks engineering