

Vocational Qualifications Pathway (VQP) for Data Science

Job Area Job Level	Data Science
Master Level	<i>The ICT practitioners at this level mainly responsible for decision-making processes. They oversee the entire IT operations and strategic development direction in the organization. Professionals at this level require broad corporate perspective, good communication skills and great technology knowledge.</i>
Job Title	Director of Data Analytics
	Director of Data Science
	Chief Data Scientist
Specialist Level	<i>The ICT practitioners at this level mainly involve in managerial processes. They may associate with individual technical departments and manage those departments by applying their technical and managerial skills. The major tasks performed by the professionals at this level is to manage the individual activities and project segments to lead the project towards completion within the assigned budget and stipulated deadline.</i>
Job Title	Data Architect
	Data Engineer
	Data Scientist
	Data Analyst
Practitioner Level	<i>The ICT practitioners at this level manage certain parts of technical processes depending on their subject matter expertise. Many different profiles are served by professionals at this level who maybe fresh sub-degree graduates or those who possess certain experience in their field.</i>
Job Title	Junior Data Engineer
	Junior Data Analyst
	Junior Data Scientist
Support Level	<i>The ICT practitioners at this level provide basic technical support depending on their subject matter expertise. Many different profiles are served by the practitioners at this level who maybe S6 graduates with relevant ICT skills and knowledge or those who possess little experience in their field.</i>
Job Title	Computer Operator
	User Support Staff
	Technical Support Services Staff
	Help Desk Operator
	Field technician

Proposed Competency Requirements (Data Science - Master Level)

Relevant Job Titles:

- Director of Data Analytics / Director of Data Science / Head of Data Scientist

Area of Work / Cluster Name	Major Task	Competency Requirements	Units of Competency (UoCs) Number	Relevant Qualification for fulfilling Competency Requirements
Strategies and policies for Data Science	1. Lead innovation within the organization and define how additional business value could be created through the utilization of the organization's data assets and analytics	<ul style="list-style-type: none"> ▪ Formulate business strategies and policies ▪ Review, design and re-engineer business processes to form a new business architecture ▪ Establish a business case for an IT investment ▪ Identify and evaluate the data sources to fulfil the data requirements in support of business objectives 	<p>111201L6</p> <p>111125L6</p> <p>ITSWG5617A</p> <p>111136L6</p>	Obtain qualification via training programmes (QF Level 6)
	2. Develop, plan and manage the overall policies and goals of the data science function of the organization	<ul style="list-style-type: none"> ▪ Define data governance policies and architecture principles ▪ Develop application integration architecture ▪ Define data classification policy for enterprise ▪ Define and establish the data architectures 	<p>111123L6</p> <p>111124L6</p> <p>111133L6</p> <p>111138L6</p>	

Area of Work / Cluster Name	Major Task	Competency Requirements	Units of Competency (UoCs) Number	Relevant Qualification for fulfilling Competency Requirements
Strategies and policies for Data Science (continued)	3. Ensure all key data management procedures and processes compile with the relevant regulatory requirements.	<ul style="list-style-type: none"> ▪ Review and comply with organisational policies and procedures, relevant laws and regulatory requirements ▪ Review the ethical and social issues for IT applications ▪ Develop compliance framework for the meeting of ethical and regulatory requirements related to enterprise data 	<p style="text-align: center;">111205L6</p> <p style="text-align: center;">111208L6</p> <p style="text-align: center;">111132L6</p>	
Application development for Data Science	4. Evaluate and select the appropriate tools, techniques, staffing and methodologies to extract and manage data for application development.	<ul style="list-style-type: none"> ▪ Review the emerging technologies and cross-functional strategies ▪ Understand the use of data concepts and topologies ▪ Appraise and select the appropriate data management tools and services to manage the target data based on different requirements ▪ Appraise, select and integrate the appropriate data analytics and/or modelling solutions to perform the data analytics process based on different requirements ▪ Keep awareness towards autonomous 	<p style="text-align: center;">111207L6</p> <p style="text-align: center;">111135L6</p> <p style="text-align: center;">111141L6</p> <p style="text-align: center;">111144L6</p> <p style="text-align: center;">111153L6</p>	(Continued) Obtain qualification via training programmes (QF Level 6)

		<p>decision making process on the impact of business</p> <ul style="list-style-type: none">▪ Plan and develop the customised visualisation tools based on the business requirements	111150L6	
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Proposed Competency Requirements (Data Science - Specialist Level)

Relevant Job Titles:

- Data Architect / Data Engineer / Data Scientist / Data Analyst

Area of Work / Cluster Name	Major Task	Competency Requirements	Units of Competency (UoCs) Number	Relevant Qualification for fulfilling Competency Requirements
Development of data collection, analysis and management tools	1. Develop and implement data analyses, data collection systems and other strategies that optimize statistical efficiency and quality	<ul style="list-style-type: none"> ▪ Plan and develop the analytics and modeling tools ▪ Design and develop data management tools and services to manage the target data based on different requirements ▪ Perform the data management processes using the identified tools ▪ Perform model training, testing and validation in evaluating and optimising the model based on various metrics 	<p>111147L6</p> <p>111142L6</p> <p>111143L6</p> <p>111146L6</p>	Obtain qualification via training programmes (QF Level 6 & 5)
Data Acquisition and database management	2. Acquire data from primary or secondary data sources and maintain databases/data systems	<ul style="list-style-type: none"> ▪ Manage and implement different data acquisition options for the identified internal or external sources ▪ Conduct and review pre-processing and transformation of the data with data quality management 	<p>111137L6</p> <p>111140L6</p>	

Area of Work / Cluster Name	Major Task	Competency Requirements	Units of Competency (UoCs) Number	Relevant Qualification for fulfilling Competency Requirements
Data Acquisition and database management (continued)	3. Examine and identify database structural necessities by evaluating client operations, applications, and programming	<ul style="list-style-type: none"> ▪ Check usability of a target data architecture 	111139L6	(Continued) Obtain qualification via training programmes (QF Level 6 & 5)
		<ul style="list-style-type: none"> ▪ Build the analytics solutions/models to support better business decisions and improve performance 	111145L6	
		<ul style="list-style-type: none"> ▪ Perform and evaluate the autonomous decision making process 	111154L6	
	4. Assess database implementation procedures to ensure they comply with internal and external regulations	<ul style="list-style-type: none"> ▪ Enforce enterprise data standards for business needs 	111134L6	
		<ul style="list-style-type: none"> ▪ Appraise the various data visualisation tools and select the appropriate tools according to user requirements 	111149L6	
	5. Prepare accurate database design and architecture reports for management and executive teams	<ul style="list-style-type: none"> ▪ Develop clear and actionable recommendations based on the analysis results to the stakeholders for decision support 	111152L6	

Proposed Competency Requirements (Data Science - Practitioner Level)

Relevant Job Titles:

- Junior Data Engineer / Junior Data Analyst / Junior Data Scientist

Area of Work / Cluster Name	Major Task	Competency Requirements	Units of Competency (UoCs) Number	Relevant Qualification for fulfilling Competency Requirements
Development and Maintenance of database system	1. Support the database system development with all aspects of software design and coding	<ul style="list-style-type: none"> ▪ Understand and utilize the preset data visualisation dashboard/displays tools ▪ Perform script programming 	111151L4 107936L4	Obtain qualification via training programmes (QF Level 3 & 4)
	2. Monitor the technical performance of database systems	<ul style="list-style-type: none"> ▪ Verify and validate that the deployed / migrated software and the existing software are functioning properly 	111159L4	
	3. Conduct data discovery activities, perform cause analysis, and make recommendations for the remediation of data quality issues	<ul style="list-style-type: none"> ▪ Perform system testing against user, technical and hosting requirements 	111160L4	

Proposed Competency Requirements (Data Science - Support Level)

Relevant Job Titles:

- Computer operator / User support staff / Technical support services staff (TSS) / Help desk operator /Field technician

Area of Work / Cluster Name	Major Task	Competency Requirements	Units of Competency (UoCs) Number	Relevant Qualification for fulfilling Competency Requirements
Network Support	1. Network Support	<ul style="list-style-type: none"> ▪ Install and configure client/server application ▪ Configure WAN connection ▪ Troubleshoot network issues 	<p>107882L3</p> <p>107883L3</p> <p>107884L3</p>	<p>Obtain qualifications via training programmes (QF Level 3)</p> <p>Or</p> <p>RPL Mechanism (QF Level 3 RPL Cluster: TOS010L3)</p>
Network Security Support (Technical Support)	2. Network Security Support	<ul style="list-style-type: none"> ▪ Administer basic network security ▪ Administer basic website security ▪ Administer perimeter firewall ▪ Strengthen workstation protection 	<p>107887L3</p> <p>107889L3</p> <p>107890L3</p> <p>107891L3</p>	<p>Obtain qualifications via training programmes (QF Level 3)</p> <p>Or</p> <p>RPL Mechanism (QF Level 3 RPL Cluster: ITOS011L3)</p>
User Support	3. User Support	<ul style="list-style-type: none"> ▪ Provide support to mobile device users ▪ Troubleshoot client device hardware issues ▪ Perform remote support 	<p>107904L3</p> <p>107905L3</p> <p>107907L3</p>	<p>Obtain qualifications via training programmes (QF Level 3)</p> <p>Or</p> <p>RPL Mechanism (QF Level 3 RPL Cluster: ITOS012L3)</p>
System Security Support	4. System Security Support	<ul style="list-style-type: none"> ▪ Create and maintain user accounts on server ▪ Configure user access control on server ▪ Administer system security 	<p>107885L2</p> <p>107886L3</p> <p>107888L3</p>	<p>Obtain qualifications via training programmes (QF Level 3)</p> <p>Or</p> <p>RPL Mechanism (QF Level 3 RPL Cluster: ITOS009L3)</p>

Area of Work / Cluster Name	Major Task	Competency Requirements	Units of Competency (UoCs) Number	Relevant Qualification for fulfilling Competency Requirements
Web Support	5. Web Support	<ul style="list-style-type: none"> ▪ Troubleshoot web browser and connection issues ▪ Maintain website performance ▪ Build simple web site using content management systems ▪ Maintain website 	<p style="text-align: center;">107909L3</p> <p style="text-align: center;">107910L3</p> <p style="text-align: center;">107911L3</p> <p style="text-align: center;">107912L3</p>	<p style="text-align: center;">Obtain qualifications via training programmes (QF Level 3) Or RPL Mechanism (QF Level 3 RPL Cluster: ITOS013L3)</p>
Network and Security Support	6. Network and Security Support	<ul style="list-style-type: none"> ▪ Build a small wireless LAN ▪ Install and configure network components/devices ▪ Install and configure client/server application ▪ Strengthen workstation protection ▪ Troubleshoot web browser and connection issues 	<p style="text-align: center;">107879L2</p> <p style="text-align: center;">107880L2</p> <p style="text-align: center;">107882L3</p> <p style="text-align: center;">107891L3</p> <p style="text-align: center;">107909L3</p>	<p style="text-align: center;">Obtain qualifications via training programmes (QF Level 3) Or RPL Mechanism (QF Level 3 RPL Cluster: ITOS016L3)</p>

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Network Support

Title	Build a small wireless LAN
Code	107879L2
Range	This unit of competency applies to junior IT personnel who are involved with construction of the organisation's network infrastructure. The main duties include installing, configuring of small wireless local area network (LAN) as well as performing user training on the use of the wireless LAN. However, during the planning and network design and sourcing of equipment for the wireless LAN he/she may be required to provide advice and assistance.
Level	2
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge to build a small wireless LAN: <ul style="list-style-type: none"> • Possess good communication and interpersonal skills • Possess good knowledge of basic training skills • Possess good knowledge of different network and wireless security risks • Possess good knowledge of wireless LAN components and their functions • Possess good knowledge of how to acquire technical manuals on wireless LAN equipment • Understand the network needs of users and the organisation • Possess good knowledge on use of network testing software 2. Building a small wireless LAN <ul style="list-style-type: none"> • Comprehend and assess the wireless LAN design diagram. Confirm and raise any concerns or suggestions with the designer or supervisor before purchase of equipment or install work. Area where he/she may assist include but not limited to the following: <ul style="list-style-type: none"> • Evaluate and/or selection of wireless equipment • Advice on any blind spots that affect the wireless signal • Site survey • Prepare for installation of wireless LAN <ul style="list-style-type: none"> • Identify the location of wireless router/Access Point and can be connected to the wired local network or to Internet service provider • Verify power availability for the wireless router • Verify Access Point (AP) has mounting space and signal are not obstructed that reduced transmission efficiency • Acquired network settings • All required equipment have been checked, verified working, and installation manuals are available • Install and configure the wireless router • Perform a wireless coverage test. Install wireless extension device to increase network coverage and remove blind spots, if needed • Configure security settings that conform to the network design and the organisation security policies • Install and configure wireless LAN cards on personal computers or join mobile client and smartphone to the wireless LAN then perform the following tests: <ul style="list-style-type: none"> • Test connection of the wireless network with user equipment to ensure general compatibility and access • Perform speed tests to ensure client connection is of expected performance • Perform security tests to ensure only authorised clients can connect to the wireless network • Label all wireless LAN equipment in accordance with the designed infrastructure plan/diagram • Provide instructions sessions and/or tutoring to users on use of wireless network, topics include: <ul style="list-style-type: none"> • Pairing with designated Service Set Identifier (SSID)

	<ul style="list-style-type: none"> • Logon arrangements • Use of wireless LAN equipment • Document all installation activities and record configuration and security settings details in accordance with the organisation's guidelines and procedures <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • All installation activities and preparation of documents were performed in accordance with organisation guidelines and standards • Always protect the organisation against unauthorised wireless connection and apply industry network security best practices • Follow the organisation's occupational health and safety guidelines and procedures when installing with network equipment
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Perform the necessary preparations before the installation of wireless LAN • Install, configure and test the wireless LAN and equipment in accordance with the organisation's requirements and standards • Provide sufficient and satisfactory training to users that enable them to access the organisation network resources
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Network Support

Title	Install and configure network components/devices
Code	107880L2
Range	This unit of competency applies to support personnel who install and configure network components or devices in a small internal Local Area Network (LAN) environment. A small network would comprise of Internet connection with wireless and wired Internetworking devices such as switches, routers, wireless LAN Access Points (AP).
Level	2
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for installing and configuring network components/devices: <ul style="list-style-type: none"> • Possess basic network troubleshooting skills • Possess good knowledge of system and network monitoring equipment • Possess good knowledge of internetworking devices • Possess good knowledge of network concepts, such as: <ul style="list-style-type: none"> • Network types • Types of cables and distance limits • Wireless LAN • Possess good knowledge of the TCP/IP protocol • Possess basic knowledge of procedures for handling electrical devices 2. Installing and configuring network components/devices <ul style="list-style-type: none"> • Comprehend the installation requirements including: <ul style="list-style-type: none"> • Types of network component/device • Verify location is suitable for the installation work • Prepare for installation work <ul style="list-style-type: none"> • Assess network component/device power and cabling needs • Verify location is suitable for the installation • Acquire the network component/device • Acquire technical manuals and comprehend the installation and configuration instructions • Acquire network configuration information for the network component/device • Perform the installation of network component/device complying to the organisation and manufacturer's procedures • Configure and test the network component/device to ensure it complies with the organisation's network requirement • Clean installation site and return equipment to appropriate location • Document the installation and configuration according to the organisation guidelines and standards 3. Exhibit professionalism <ul style="list-style-type: none"> • Adhere to the organisation's occupational safety procedure • Well converse with industry's networking best practices
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Be well prepared for the installation work • Follow the work order and install the network component/device according to the manufacturer and the organisation procedures • Perform post installation procedures satisfactorily and well document the configuration details and installation work according to the organisation standard procedures
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Network Support

Title	Install and configure client/server application
Code	107882L3
Range	This unit of competency applies to support personnel who install and configure client/server application at workplace. The installation may be for a fresh deployment of the organisation wide client/server application or re-installation when client/server application is having issues. The type of client/server application this UoC refers to is of "tightly coupled" type like POS (Point Of Sales) systems rather than "loosly coupled" type like web browser to web server (any). Also it is installed in an internal network.
Level	3
Credit	6
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for installing and configuring client/server application <ul style="list-style-type: none"> • Possess basic literacy skills to comprehend work orders and technical documents • Possess basic knowledge of networking concept • Possess good knowledge of client and server concept in particular • Possess good knowledge of common operating systems (server and client) • Possess good knowledge of testing and troubleshooting client/server applications 2. Install and configure client/server application <ul style="list-style-type: none"> • Develop installation plan for the client/server application requirements including but not limited to the following: <ul style="list-style-type: none"> • Identify what installation options are required from work order • Identify hardware requirement (i.e. server and client side) • Identify software requirement (i.e. database, middle ware, etc.) • Identify network requirements • Identify security requirements • Identify what data migration is required, if any • Preparing for installation <ul style="list-style-type: none"> • Upgrade hardware of server and client device, if required • Acquire the client/server application installation media • Familiarised with the client/server application installation instructions from vendor documents • Acquire associated settings for the client/server application, such as: <ul style="list-style-type: none"> • IP address of the server and client • Network settings • Authorised access account settings • Acquire all necessary technical manuals • Backup the server and client systems • Install and configure network protocol, middleware, database, if required • Install and configure the server side of the client/server application as required by the work order <ul style="list-style-type: none"> • Configure security and access settings to allow client to connect • Undertake restore or migration of data, if required • Perform appropriate tests • Install and configure client side of the client/server application as required by the work order <ul style="list-style-type: none"> • Configure security setting to enable access to the server side • Configure appropriate functions of the application • Perform tests to ensure client side is forming as required • Perform post installation procedures <ul style="list-style-type: none"> • Clean up work area and remove temporary work files and objects from the server and client device

	<ul style="list-style-type: none"> • Perform backup image of the server and client for system restore, when and if required • Return and store installation media in secure place as instructed by the organisation's guideline • Document the installation and configuration according to the organisation guidelines and standards <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Adhere to the organisation's occupational safety procedure • Well converse with industry's best work practices for installing client/server applications
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Perform the pre-installation activities and being well prepared to ensure the installation of the client/server application without any delay • Ensure the installation process was carried out efficiently without affecting other applications and/or services on the server and clients side • Perform post installation procedures that complied with the organisation guidelines and procedures
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Network Support

Title	Configure WAN connection
Code	107883L3
Range	This unit of competency applies to IT support personnel who are responsible to configure the organisation's internal network to connect and communicate with the external Wide Area Network (WAN) or be connected to the Internet. The configuration will involve configuring the organisation's routers as well of internal hosts. Hosts in this UoC can be user client devices (PCs, mobile devices, tablets, wireless APs, etc.) or servers.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for configuring WAN connection: <ul style="list-style-type: none"> • Possess good literacy skills to interpret network diagram/plan, technical documents, equipment manuals and specifications • Possess basic network installation and configuration skills • Possess good knowledge of internetworking devices • Possess detailed knowledge of the TCP/IP protocol • Possess good problem solving skill • Possess basic knowledge of organisation guideline and safety procedures for handling electrical devices 2. Configure WAN connection <ul style="list-style-type: none"> • Prepare the readiness of the internal network to connect with the WAN, including the following: <ul style="list-style-type: none"> • Comprehend the organisation network plan and architecture, including: <ul style="list-style-type: none"> • Number of internal subnets • Routing settings of each subnet • De-Militarised Zone (DMZ) information • Load balancing for multi WAN connections • Acquire and install router as per required by manufacturer • Acquire internal network settings from network administrator and configure into the router • Liaise with WAN service provider to confirm switch-over date and WAN connection to be installed • Determine connection type (static IP or DHCP assigned) and configure with reference to the organisation's network plan. For static IP address connection to the WAN, acquire the network setting from service provider • Configure and test router with the given WAN IP address • Test the internal and external connection to ensure traffic can flow on both directions • Configure and test host connections • Document the installation and configuration details according to the organisation guideline and standards 3. Exhibit professionalism <ul style="list-style-type: none"> • Adhere to the organisation's occupational safety procedure • Well converse with industry's networking best practices

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Network Support

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• Liaise with WAN service providers to coordinate the cabling and installation of WAN modems into the premises that conform to the network diagram/plan• Configure and test router connection with the WAN connection• Configure all hosts of the internal network to enable them to communicate via the WAN connection
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Network Support

Title	Troubleshoot network issues
Code	107884L3
Range	This unit of competency applies to junior IT personnel who are involved with troubleshooting network issues while in a network supporting role. These junior IT personnel is expected to troubleshoot operational wireless and wired network problems, such as device connection issues, software configuration issues, and network component failure issues. For this UoC devices could be: personal computers, notebooks, tablets, smartphones, internetworking components such as routers, switches, etc.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <p>1. Knowledge to troubleshoot network issues:</p> <ul style="list-style-type: none">• Possess good communication and interpersonal skills• Possess good network troubleshooting skills• Possess basic knowledge of different network technologies• Have good understanding of network components and their functions• Possess good knowledge of how to acquire technical information from manuals, colleagues and Internet• Possess good knowledge in operating network testing equipment

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Network Support

Competency	<p>2. Troubleshooting network issues</p> <ul style="list-style-type: none">• Acquire details of network issues from problem reports or by communicating with users to understand symptoms of network issues• Attempt to reproduce the network issues on user's client device or network component, if possible• For wired network connection issues<ul style="list-style-type: none">• Inspect for loose cabling on the network devices, network clients, and network components. Reconnect and secure cables• Use cable testing equipment to test cable to ensure it is still functioning• For wireless connection issues<ul style="list-style-type: none">• Determine where the issues lie, at wireless client or Access Point side<ul style="list-style-type: none">• Verify the wireless access point is functioning using other devices or clients• Verify the wireless connection setting and the correct password is used at the client side• For software configuration issues<ul style="list-style-type: none">• Acquire network settings from network administrator• Verify the software configuration setting matched the network settings. Reconfigure if necessary• For network component issues<ul style="list-style-type: none">• Verify the device is receiving power<ul style="list-style-type: none">• Perform visual check if power cable is connected• Verify power adapter of the device is working and securely connected• Verify the device's power is on• Verify the device configuration setting is correct• Verify the device is transmitting and receiving signals• Document all troubleshooting activities and record all findings. Also complete problem report in accordance with the organisation's guidelines and procedures <p>3. Exhibit professionalism</p> <ul style="list-style-type: none">• All troubleshooting activities and preparation of documents were performed in accordance with organisation guidelines and standards• Follow the organisation's occupational health and safety guidelines and procedures when working with network equipment
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none">• Prepare sufficiently for the troubleshooting job• Systematically perform troubleshoot tasks and find the network issues• Follow procedures and be able to prepare documents and complete problem reporting in accordance with organisation standard
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Title	Create and maintain user accounts on server
Code	107885L2
Range	This unit of competency applies to support personnel who administer the organisation's servers. A very important task for the administrator or the support personnel of servers is to create accounts of users that are allowed to access the system's resource. This UoC assumes servers are standalone and not in directory service environment
Level	2
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none">1. Knowledge for creating and maintaining user accounts on server<ul style="list-style-type: none">• Possess system troubleshooting skills• Possess good knowledge of system logs• Possess good knowledge of common server operating systems• Possess good knowledge of operating system's access control• Possess basic knowledge of information security• Possess knowledge of the organisation's user security procedures and guidelines

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Competency	<p>2. Create and maintain user accounts on server</p> <ul style="list-style-type: none"> • Determine the needs of the accounts on server, such as: <ul style="list-style-type: none"> • The role of the user (user, administrator, operator, etc.) • Which server, if there are more than one • Personal folder for the user • Access to server resources • Application settings • Access rights • Login to server with administrative account to create the new account and follow the organisation guidelines to setup security settings for the account based on the role of the user. Settings include but not limited to the following: <ul style="list-style-type: none"> • Security role of the account • Directory and file permissions • Password length • Change password requirements and duration • Set temporary password and set user must-change-password on first login • Inform the user of new account details • Regularly use system tools or third party tools to determine security and usage of accounts, such as but not limited to the following: <ul style="list-style-type: none"> • Accounts involved with unusual activities • Attempt to access unauthorised resources • Accounts locked out • Unused accounts • Handle unusual account activities in accordance to the organisation guideline, such as escalating to supervisor • Verify unused accounts and follow the organisation procedures to perform clean-up activities, such as remove account, revoke permission, etc. • Document and record all actions performed on user account in accordance with the organisation guidelines <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Apply system administrator ethics and exercise due diligence when administering user accounts on servers • Exhibit security attitude but balance the needs of users with the organisation security needs when administering system user accounts, as well as securing the server
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Understand the needs for creating new accounts • Use appropriate system tools to create accounts, perform correct configurations, setup correct access rights to server resources and provide sufficient details and guidance to user that enabling him/her to access the server • Monitor account usage and account irregular activities and take corrective actions to maintain accounts current and secured on the server
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Title	Configure user access control on server
Code	107886L3
Range	This unit of competency applies to support personnel who administer the organisation's servers. To access resources on a server the user will need appropriate access rights which administrator will need to configure. Access control in modern servers has pre-configured access control in form of different roles or via traditional access rights.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for configuring user access control on server <ul style="list-style-type: none"> • Possess system troubleshooting skills • Possess good knowledge of system logs • Possess good knowledge of common server operating systems • Possess good knowledge of operating system's access control • Possess basic knowledge of information security • Possess knowledge of the organisation's user security procedures and guidelines 2. Configure user access control on server <ul style="list-style-type: none"> • Determine what role the user is allocated by the organisation, for example: <ul style="list-style-type: none"> • Administrator • Backup operator • Application administrator • Read only analyst • Use server management tools to assign the role to the user's account • Determine resource access permitted for the user, such as but not limited to the following: <ul style="list-style-type: none"> • Local logon • Internet access • Remote logon • Use server tool to configure user accounts with allowed access • Create a check list of access control setting for each shared resources and/or object, such as but not limited to the following: <ul style="list-style-type: none"> • Printers • Folders • Files • Applications • Configure the allowed access and level of access (Read, Write, Execute, etc.) to each object and shared resource • Document and record all user access setting and configuration for reference 3. Exhibit professionalism <ul style="list-style-type: none"> • Comply system administrator ethics and exercise due diligence when administering user accounts and access control on servers • Exhibit security attitude but balance the needs of users with the organisation security needs when setting user access control as well as protecting the server

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• Determine and setup the role of the user that matches his/her access on the server• Identify all the individual objects, shared resources on the server which the user requires access to• Setup and configure correctly the user's access control on the server
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Title	Administer basic network security
Code	107887L3
Range	This unit of competency applies to support personnel who administer the organisation's network security on their regular day to day duties. The duties include supporting users request for network access and ensuring the network is protected in accordance with the organisation's requirements. The organisation network infrastructure, in this context, is a small or simple type which may consists of one perimeter firewall, WAN Internet router, wireless LAN Access Point (AP) for mobile clients, one central switch and a number of group switches with hosts (workstations or servers) connected. Network services may include: file service, network printing, Virtual Private Network (VPN) or remote access, etc.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <p>1. Knowledge for administering basic network security:</p> <ul style="list-style-type: none">• Possess good communication and interpersonal skills• Possess network troubleshooting skills• Understand system and network monitoring equipment logs• Able to operate the organisation network devices• Possess broad knowledge network function and features of network devices• Possess knowledge of threats and the importance of network security• Possess knowledge of the organisation's network security procedures and guidelines

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Competency	<p>2. Administer basic network security</p> <ul style="list-style-type: none"> • Comprehend the organisation's network infrastructure, daily activities list and security policies • Determine the network security status including but not limited to the following: <ul style="list-style-type: none"> • Network devices are operating normally via visual check, including: power lights are on, cables are not loose • Review monitoring and system logs and audit reports to ensure no unauthorised access or irregularities • Ensure Internet security (antivirus, anti-spyware) filtering/detection systems are still effective and up to date • When irregularities are detected, analyse, evaluate and handle irregularities in accordance with the organisation's procedures, seek assistance if necessary. Actions may include: <ul style="list-style-type: none"> • Adjust firewall rules, • Change wireless AP security passwords. • Segregate guest mobile users, if necessary • Train users on network security functions • Adjust access control on network resources • Report irregularities to supervisor • Facilitate user's request to define and configure suitable level of network access on network controlling devices but ensure it conformed to the organisation security specifications • Regularly perform security patches and updates of network devices when required • Regularly review and evaluate the network security to ensure it is well protected and conforms to the organisation needs and complied with regulatory requirement, if any • Document actions/changes to the network in accordance with the organisation's procedures. Consult with colleagues and supervisors when required <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Ensure network security complied with the organisation and regulatory requirements • Exhibit security attitude but balancing the need of users with the security need when administering the network security • Well converse with industry network security best practices and keep updated with trends of network security
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Analyse security logs and reports to determine security irregularities • Handle and rectify network security irregularities in accordance with the organisation procedures • Set the correct level of network access for users in accordance with the organisation procedure
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Title	Administer system security
Code	107888L3
Range	This unit of competency applies to support personnel who administer the organisation's system security on client devices. The duties of support personnel includes installing various security applications, performing various system configuration and setting to protect the system from loss of information (user and organisation) and different network security risks. Client devices mainly refer to personal computers, notebooks and business tablets
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for administering system security <ul style="list-style-type: none"> • Possess good communication and interpersonal skills • Possess system troubleshooting skills • Possess good knowledge of system and network logs • Possess good knowledge of common operating systems • Possess broad knowledge on functions and features of network devices • Understand network security and system security risks • Possess knowledge of the organisation's security procedures and guidelines 2. Administer system security <ul style="list-style-type: none"> • Comprehend the organisation's system security requirements and system security plan, including but not limited to the following: <ul style="list-style-type: none"> • List of authorised personnel/users that can access the system • Level of access/tiered access, or what each user is allowed and not allowed to do on the system • Access control methods, or how users will access the system (user ID/password, digital card, biometrics) • System setting and application needed to strengthen the system and how weaknesses are handled • Which system required system backup and what type of backup procedure to apply • Network security settings and configurations • Install the required security application, such as: <ul style="list-style-type: none"> • Antivirus and spyware protection applications • Personal firewall • Malware protect application • Configure and set remote access and support function according to the organisation guideline and procedure • Configure network and firewal • according to the organisation's guideline • Create and setup user accounts in accordance with organisation security requirements • Review files security settings and modify access and read/write permissions to match user's role. • Regularly perform backups, system security checks, system updates • Monitor and record security checks • Document and record details of installed applications, configurations, settings, risks for system audit, maintenance and support purpose 3. Exhibit professionalism <ul style="list-style-type: none"> • Exhibit security attitude but balance the need of users with the organisation security need when administering system security

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• Comprehend the system security plan• Install the required security applications, correctly configure and perform appropriate setting that complied with the security plan• Perform scheduled system security checks, system update and document system changes in accordance with the organisation's guidelines and procedures
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Title	Administer basic website security
Code	107889L3
Range	This unit of competency applies to support personnel who are responsible to administer security of the organisation's website under the direction of supervisor. The server on which the website resides on, either locally or remote hosted should be protected from hackers, virus, unauthorised access, hijacked. Monitor and validate the web page, scripts, SQL commands used does not have vulnerabilities for malicious attacks which can affect the organisation's network or systems or theft of the organisation's business data.
Level	3
Credit	6
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for administer basic website security <ul style="list-style-type: none"> • Knowledge of different website security risks and the importance of website security protection • Understand the use of website security audit tools • Possess a broad knowledge of server and network security • Possess good knowledge of the organisation's security requirements and policies • Possess good knowledge of website protection technologies and trends • Possess good knowledge of installing and configuring hardware and software 2. Administer basic website security <ul style="list-style-type: none"> • Work with the supervisor to identify the security needs of the organisation's website, including but not limited to the following: <ul style="list-style-type: none"> • Website functionality • Access requirement of transactions, visitors and users • Operating Systems weaknesses • Secure the server of the website with installation of site certificate, regular system patches and updates, antivirus, anti-spyware protection and updates • Configure web server securely with required functionality and features only • Secure website transactions with encryptions • Set access control of server and database to those needed access only • Work with website content development team to ensure scripts and web applications are vulnerabilities free • Regularly use monitoring and audit tools to test and monitor vulnerabilities of the website • Perform regular offline backup of the website • Continue to develop or help to secure procedure to secure the organisation's website that comply with the organisation security requirements 3. Exhibit professionalism <ul style="list-style-type: none"> • Committed to protect the organisation's assets • Exhibit security attitude but balance the business needs against the security need when administering the website security • Well versed with industry network security best practices
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Secure the organisation's website that complied with the organisation's requirement • Use audit and monitoring tools to reduce the website vulnerabilities • Set the correct level of network access for users in accordance with the organisation procedure
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Title	Administer perimeter firewall
Code	107890L3
Range	This unit of competency applies to IT personnel who administer the organisation's network security; particularly the perimeter firewall which protects the organisation internal network from the external network. The administering tasks of these IT personnel include but not limited to: maintain firewall filtering rules, monitor security logs, perform maintenance of the firewall, ensure the firewall is always on, etc.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for administering perimeter firewall: <ul style="list-style-type: none"> • Possess good communication and interpersonal skills • Possess detailed knowledge of network security and different risks • Possess detailed knowledge of firewall concept • Possess good knowledge of operating firewall and monitoring equipment • Understand the organisation's network security requirements and policies • Well updated with network security threats, technologies and trends 2. Administer perimeter firewall <ul style="list-style-type: none"> • Perform regular monitoring of perimeter firewall to ensure it is fully functioning. • Perform reconfiguration of settings when required. Configuration settings that affect security of the network must follow the organisation guideline and procedures before action • Manage firewall filtering rules to match the organisation's and process users needs, including: <ul style="list-style-type: none"> • Create new rules • Amend existing rules • Remove redundant and conflicted rules • Regularly review the list of filtration rules to verify rules still effective and are being used. Cleanup unused rules to maintain efficiency and performance of the firewall • Regularly monitor and review access logs to ensure no security breach or any irregularities. When irregularities found, escalate to supervisor and investigate • Assist supervisor to review operation procedures, such as "filtration rule change" requests • Perform backup of firewall database after any change of settings or filtering rules • Document all changes (configuration, rules) and actions performed on the firewall in accordance to the organisation standards 3. Exhibit professionalism <ul style="list-style-type: none"> • Ensure perimeter protection complied with the organisation guideline • Exhibit security attitude but balancing the need of users with the security need when administering the perimeter security • Well converse with industry network security best practices
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Set up the firewall that matches the organisation business requirements and securely protect the internal network from external environment • Use the firewall monitoring facilities or security log to monitor irregular activities • Follow the organisation's procedures to document all changes and actions made on the firewall
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Title	Strengthen workstation protection
Code	107891L3
Range	This unit of competency applies to support personnel who are responsible for securing client workstation. Workstations are vulnerable to local and external threats, they need to be protected from as much as these threats as possible. Most organisation will have different protection procedures which support personnel need to setup before allowing user to access the workstation. This UoC illustrates some of the protection tasks and it is by no means exhaustive.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <p>1. Knowledge for strengthening workstation protection</p> <ul style="list-style-type: none">• Possess system troubleshooting skills• Possess detailed knowledge of security features and functions of the organisation's operating systems• Possess good knowledge of system security concepts• Possess good knowledge of computer hardware and system software• Possess knowledge of the organisation's security procedures and guidelines

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Security Support

Competency	<p>2. Strengthen workstation protection</p> <ul style="list-style-type: none"> • Comprehend the organisation’s guideline for workstations protection to configure the user’s workstation. Systematically setup and configure protection features on the workstation • Setup physical security protection, including but not limited to the following: <ul style="list-style-type: none"> • Lock the CPU unit to prevent opening of the case • Affix a chain lock (Kensington lock) to secure position for notebooks • Setup password protection (hardware-level) for access to machine’s BIOS • Eliminate or disable unnecessary services. For example: remote access, Internet sharing, etc. • Remove unnecessary executables and registry entries to prevent attacker invoking disabled programs • Set user account to <ul style="list-style-type: none"> • “non-administrator” account, to prevent uncontrolled change of system settings • Avoid multi-user sharing same machine, if possible • Set system account policies <ul style="list-style-type: none"> • Minimum length of account password • Force change password • Set re-used policy • Setup screen save to turn off screen and power off system after a predefined period of no user activities • For systems holding confidential information, setup file encryption and access permission • Install and setup anti-virus, anti-spyware and anti-malware scanning and handling, such as: <ul style="list-style-type: none"> • Auto and scheduled update of virus definitions • Scheduled daily scan • Real time protection • Anti-virus application which starts on system boot • When virus or malware found, clean first (high risk) and quarantine second • Setup firewall protections • Setup auto and scheduled system updates • Create a backup image of the workstation before allowing user to use the machine • Document the system settings and configurations for internal record <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Exhibit security ethics and balance the need of users with the organisation security needs when setting and configuring security protection of user’s workstations
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Comprehend the organisation’s workstation protection guidelines and able to configure and setup required security protections • Complete documents of the security settings and configuration in accordance with the organisation’s procedures
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: System and Hardware Support

Title	Provide support to mobile device users
Code	107904L3
Range	This unit of competency applies to IT support personnel who are responsible for mobile device support to users. As organisations are joining the Bring Your Own Device (BYOD) bandwagon, users will need supporting in the work environment; IT support staff will need to have the necessary skills to support and educate users using mobile devices to access the organisation resources. This UoC concerned on area of general support including but not limited to: setup brand new devices to access organisation resources, assist logon and use of Mobile Device Management (MDM) system, protection of corporate information in event of loss of mobile devices, remote support access and support, change configuration and settings, etc.
Level	3
Credit	6
Competency	<p>Performance Requirements</p> <p>1. Knowledge to perform remote support:</p> <ul style="list-style-type: none">• Possess good communication, listening and interpersonal skills• Possess remote support skills capable to perform troubleshooting, provide instructions systematically and remote problem solving• Possess good knowledge of functions and features of the organisation's MDM system• Possess good knowledge of mobile device supported applications• Possess good knowledge of common mobile device platforms such as IOS, Android, Blackberry, Windows Phone, etc.• Well conversed with the organisation's BYOD guidelines and procedures• Possess good knowledge of virtual desktop technology and Virtual Desktop Infrastructure (VDI) for mobile device

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: System and Hardware Support

Competency	<p>2. Perform remote support</p> <ul style="list-style-type: none"> • Listen attentively and patiently to understand the user's reported issues • Refer to the Trouble Ticket System (TTS)/problem reporting system to determine if similar issues and/or solutions exist • For brand new BYOD mobile devices, follow the organisation guidelines to perform some but not limited to the following tasks: <ul style="list-style-type: none"> • Ensure user understand, agree and accept the organisation policies, particularly when device is misplaced/lost • Install organisation MDM apps and organisation's standard apps • Install mobile support apps, such as: Teamviewer for mobile, Remoty, GotoAssist, etc. • Configure network access setting such as VPN • Backup device • Turn on remote wipe function of the device • Install anti-virus/malware/spyware app • Create new access accounts on MDM server and test connectivity and accessibility to ensure device is function as expected • For troubleshooting or remote support, mobile support application or MDM apps should be used to remote access to the mobile device, to view and change setting, screen capture, direct communicating with user to provide instructions to resolve the issue • For misplaced/lost device, evaluate the risk of data loss and assist the user to use "find my phone/device/mobile" function or use MDM apps to trace, lock or wipe the device • Provide instructions and/or training to users on mobile devices usage and mobile security to protect organisation data • Create a new or update Trouble Ticket (TT)/problem report to record the activities transacted during the support session <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Possess customer service oriented attitude • Apply industry best practices for mobile support and being up-to-date with mobile technology trends
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Set up the users' mobile devices to conform with the organisation's mobile device policies • Use appropriate tools to troubleshoot mobile devices, resolve users experience issues and assist or advice users with correct solutions to resolve issues for providing effective support to users and protect the organisation data in the event of user loss • Take correct actions to protect the organisation's data in the event where users have lost mobile devices • Provide sufficient instruction or training to users on use of mobile devices that conform with the organisation policy
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: System and Hardware Support

Title	Troubleshoot client device hardware issues
Code	107905L3
Range	This unit of competency applies to IT support personnel who are responsible for providing support for client devices. Client devices ranging from personal computer to smart mobile device could experience hardware issues during its operation and support personnel are requested to fix the issues. This UoC concerns the identification of hardware issues before it can be fixed.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for troubleshooting client device hardware issues <ul style="list-style-type: none"> • Possess good troubleshooting and problem analysis skills • Possess good knowledge of operating client devices • Possess good literacy skills for reading technical manuals of client devices • Possess good knowledge of the organisation's procedures for troubleshooting client devices • Possess basic knowledge of hardware protection procedures, such as use anti-static straps, etc. • Possess basic knowledge of the organisation health and safety guideline 2. Troubleshoot client device hardware issues <ul style="list-style-type: none"> • Comprehend symptoms, if any, prior issues appeared from problem report and/or discussion with user. For example: <ul style="list-style-type: none"> • Nothing came on when power button pressed • Blank screen but CPU unit appears to be running • System running very slow and continuously rebooting or hanged • System not responding to mouse and keyboard • Review maintenance records of the device, to determine if maintenance work has contributed or caused the issues • Prepare for troubleshooting: <ul style="list-style-type: none"> • Acquire all necessary technical and user manuals • Acquire tools to open the client device and tools for troubleshooting • Acquire device components or spare parts • Analyse and formulate a troubleshooting plan • Without opening to inspect the inside of the client device, perform checks for loose connections, power sockets, battery, display device, etc. • View the BIOS error message display code or listen for the number beeps sounded and verify the given code with technical manuals to identify BIOS detected error. For example: <ul style="list-style-type: none"> • 1 = Loose memory module • 2 = CPU error repair/replace mother board • 3 = display memory error repair/replace display card • Next stage of checking is to verify connected components have not affected the functioning of client device, such as: <ul style="list-style-type: none"> • Keyboards/mouse (swap with a known working component) • Battery low power on mobile device (swap with a fully charged battery) • Hard disk failure (listen for unusual noise) • Power supply unit failure (verify cooling fan is functioning and/or system light is on) • For intermittent issues, such as "system hang" or "randomly rebooting" under heavy system work load, identify cause of issue using combination of techniques, including but not limited to the following: <ul style="list-style-type: none"> • System log messages • Reproduce the issues with monitoring tools • Incorrect BIOS settings

	<ul style="list-style-type: none"> • Overheating components • Purpose-built hardware analysis device • For mobile device, once verified it is not battery problem and still cannot be started, return the devices to vendor who will use manufacture's hardware problem analysis devices to identify the issues • Once the cause of issues have been identified, formulate a rectification action plan and clean the work area • Document and record the findings in accordance with the organisation procedures and standards <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Follow organisation safety guidelines and procedures when performing troubleshooting of client devices
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Prepare well with troubleshooting work, having all the required tools and manuals for use during the troubleshooting process • Plan the troubleshoot work and systematically perform the troubleshooting to identify the issues or cause of issues • Follow the organisation safety procedures during the troubleshooting process
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: System and Hardware Support

Title	Perform remote support
Code	107907L3
Range	This unit of competency applies to support personnel who are responsible for providing remote support. In a structure support team this would be a Level 2 support personnel where Level 2 is normally the first point of escalation, provides guidance and instructions to Level 1. Level2 is where the support personnel take ownership of incidents where subject matter expertise and experience is required for diagnosis. However, this UoC concerned only remote support competencies and does not distinguish the organization level.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <p>1. Knowledge to perform remote support:</p> <ul style="list-style-type: none">• Possess good communication and interpersonal skills• Possess remote support skills capable of performing troubleshooting and providing systematic instructions for remote problem solving• Possess good knowledge and operating remote support applications• Understand committed Service Level Agreement (SLA) and standards• Possess good knowledge of problem escalation procedures and guidelines• Possess basic knowledge of the organisation computer hardware, Operating System (OS), applications and network equipment

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: System and Hardware Support

Competency	<p>2. Performing remote support</p> <ul style="list-style-type: none">• Comprehend reported problem from Trouble Ticket system (TTS)/problem report system to understand symptoms and diagnostics from support desk colleague (level 1 support)• Search TTS/problem report system to determine if similar issues and/or solutions exist• Communicate with the customers/users to explain actions that will be performed to resolve the issue, such as:<ul style="list-style-type: none">• Need to collect more information related to the reported issue• Need to remote access to user's system• Will instruct the user to self-rectify the issue upon determination that the user is capable of self-rectification• If remote access/control is necessary, determine customer/user's comfort level to have remote access feature of the system turn on and installation of remote access software. To gain customer/user's support it is necessary to explain:<ul style="list-style-type: none">• How the remote access work compare with on-premise support• There are no security risks• Benefits of remote access/control• Perform troubleshoot and/or apply solution to correct the reported issue. If remote solution cannot fix the issue then offer to customer/user the on-premise support option• Confirm solution is acceptable with customer/user• Uninstall any application and/or reset configurations that were used for the remote support purpose and remind users to set off remote support functions on their system• Document all activities and record changed setting in the TTS/problem report. Where necessary, coordinate with other colleagues, such as requesting on-premise engineers to visit the customers/users <p>3. Exhibit professionalism</p> <ul style="list-style-type: none">• Possess customer service oriented attitude• Always keep customer informed of actions and status of the rectification process• Follow industry best practices to use best remote support application to provide remote support
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none">• Comprehend the reported problem from the internal TTS/problem report system and able to update the appropriate record in accordance with the organisation's procedures after the completion of the remote support session• Persuade customers/users to allow remote access/control to their system for troubleshooting and/or correcting of issues• Perform the remote support to the satisfaction of customers/users
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Web Support

Title	Troubleshoot web browser and connection issues
Code	107909L3
Range	This unit of competency applies to support personnel who are responsible for providing front line support on web browser usage to users on different client platforms, including desktops, notebooks, tablets and even smartphones. The web browser is one of the most used applications. Very often users will encounter many issues which will need assistance. Common issues encountered including but not limited to the following: cannot start browser, wrong security setting, incompatibility, malware, connection problem, unable to initiate download after click of links, etc. To assist users the support personnel will troubleshoot and provide a remedy. Additionally the support personnel should provide some basic tutorial to users to avoid repetition and facilitate self-help.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <p>1. Knowledge for troubleshooting web browser and connection issues:</p> <ul style="list-style-type: none">• Possess good communication and interpersonal skills• Possess good troubleshooting skills and capable of providing systematic instructions for remote problem solving• Possess good knowledge of functions of various web browsers on different platforms• Possess basic knowledge of operating different computing platforms• Possess basic knowledge of web browser development and trends such as: technologies, web browser features, malwares attacks, etc.• Possess basic knowledge of the organisation's network infrastructure

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Web Support

Competency	<p>2. Troubleshoot web browser and connection issues</p> <ul style="list-style-type: none"> • Patiently listen to user describing issues and symptoms. Use appropriate questioning techniques to gather as much information to help troubleshoot the issue: <ul style="list-style-type: none"> • What are the types of issue user is experiencing, • What type of browser • What platform and OS environment the browser is operating on • Refer to history problem log to determine if similar problems and solutions exist • If web browser shows “cannot connect to server” or similar message, then troubleshoot network connection by verifying and correcting below items: <ul style="list-style-type: none"> • Verify the client is actually connected to the network (LAN or mobile) • Verify client has acquired a valid IP and DNS address • Verify correct proxy server setting • etc. • If displayed content is inconsistent with the new contents of the web site, then clear the cache of the browser • If downloads are not permitted or no activities after user clicked a link, then review and adjust the security settings that prevent certain risky functions and scripts from auto activated, such as: ActiveX, cookies and downloads. Any adjustment of security setting must be complied with the organisation security policies • If web browser cannot start then locate related error messages from system or application logs to determine the issue. If application is corrupted, and no alternative method of correcting the problem, then uninstall and reinstall the Web browser • If the browser consistently redirected to unwanted web site, this may be due to the browser being hijacked by malware. Use anti-malware software to detect and remove the malware • Explain the cause of issues and remedies applied to users and provide some basic training and advice to user on “best practices on using web browser and surfing internet” • Create or update problem log in accordance with the organisation’s procedures and issues and remedies performed <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Possess customer service attitude with desire to assist users with problems • Follow organisation safety guidelines and procedures when troubleshooting and/or reification of equipment
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Systematically apply web browser troubleshooting techniques to identify the cause of issues and provide remedies • Use correct level of technical language to gather information related to the Web browser issues and conduct tutorial to users • Complete the “after event” procedures in accordance with the organisation’s standards
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Web Support

Title	Maintain website performance
Code	107910L3
Range	This unit of competency applies to IT support personnel who are responsible to maintain the performance of the organisation's website. One of the tasks of website maintenance is to ensure the site is running at an optimal speed that can provide a good user experience to visitors and a successful website with business.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for Maintain website performance <ul style="list-style-type: none"> • Possess good knowledge of various website performance testing tools, such as : Webpage analyser, Google's site tool and Google Page Speed, Yahoo's YSlow, etc. • Possess good knowledge of creating web contents • Possess basic knowledge of different web browsers • Possess good knowledge of the organisation basic network infrastructure • Possess good knowledge of the organisation website performance requirements 2. Maintain website performance <ul style="list-style-type: none"> • Work with supervisor and/or colleagues to identify the website response time required. Different types of responses for different types of contents • Verify the website performance using suitable performance testing/measuring tools • Study the website network and hosting server performance <ul style="list-style-type: none"> • If loading is high, consider off load some of the tasks from the server • If web server is hosted on a Cloud Server, consider using a different hosting service provider • Work with content developers to review and advice on some but not limited to the following: <ul style="list-style-type: none"> • Minimise size of webpage • Minimise the use of nested table • Avoid using oversized image file straight from camera. Resize image files to a match the purpose • Optimise programs, scripts and databases • Regularly run stress tests to ensure the performance of the website is within the organisation's standard • Document performance test results for reporting purpose 3. Exhibit professionalism <ul style="list-style-type: none"> • Possess quality of service attitude. Website performance affects the organisation image and business
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Work with supervisors or colleagues to identify the and formulate a performance standard for the organisation's website • Use performance measuring tools to determine the performance of the organisation website • Work with website developers to improve performance of the website to meet the organisation's performance requirement
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Web Support

Title	Build simple web site using content management systems
Code	107911L3
Range	This unit of competency applies to IT personnel who are responsible for building a simple web site for the organisation. Most companies will want to have an Internet presence; having at least a simple web site and IT personnel are entrusted with building this web site. As Internet and web content management system (CMS) technologies are maturing, building web sites is almost as simple as creating "Office" documents. However, once the web site is built the IT personnel will need to provide tutorials to webpage designer on use of CMS editor to build webpages. This UoC assumes the web site is hosted by hosting service provider.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <ol style="list-style-type: none"> 1. Knowledge for building simple web site using content management systems <ul style="list-style-type: none"> • Possess good communication and interpersonal skills • Possess good knowledge of web hosting concept and sourcing of hosting facilities • Possess detail knowledge of implementing web CMS systems • Possess detail knowledge of operating and administering the organisation's CMS • Possess basic knowledge of HTML • Possess some basic training skills 2. Build simple web site using content management systems <ul style="list-style-type: none"> • Work with supervisor and other stakeholders to identify the website technical requirements from, such as: <ul style="list-style-type: none"> • Type and usage of web site (dynamic, static, Internet store, etc.) • Performance required (response time) • Size of storage • Network speed • Identify suitable web CMS and web hosting company (unless for the organisation use, taking into various factors, including: <ul style="list-style-type: none"> • Prices • Backup service • Facilities offered (storage, network bandwidth, CPU speed, etc.) • Prepare purchasing document, in accordance with organisation procurement procedures, and recommendation for supervisor approval • Liaise with hosting service provider to setup DNS reference to the organisation's new web site and acquire hosting servers logon details to administer the CMS • Download and perform remote installation web CMS on hosting server • Access administrative functions of web CMS to perform following tasks: <ul style="list-style-type: none"> • Upload and install a template for the website • Upload company logo and other media (pictures and video) contents for the home page • Edit the home page with CMS editor • Test the web site with different web browsers to ensure compatibility • Create login accounts and provide tutorial sessions for web designers to use the CMS editor to create web pages on the web site 3. Exhibit professionalism <ul style="list-style-type: none"> • Be familiar with W3C web standards and ensure the CMS and web site are W3C compliant • Always look after the interest of the organisation when dealing with external parties

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Web Support

Assessment Criteria	The integrated outcome requirements of this UoC are the abilities to: <ul style="list-style-type: none">• Fully comprehend the requirements of the type of web site the organisation is building and acquire sufficient technical details to subscribe to a web hosting service• Install the CMS on the hosting server and be able to use the CMS editing tools to create the web site's home page that is compatible with common web browsers• Provide sufficient tutorial and assistance to web page designers that enable them to construct other web pages without any difficulties
Remark	

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Web Support

Title	Maintain website
Code	107912L3
Range	This unit of competency applies to IT personnel who are responsible to maintain the organisation's website. The website is the window of companies to the Internet world. It represents the organisation. Hence, it is essential to be always in operation and the contents are update without any embarrassing issues, such as customer cannot complete purchasing transaction or students cannot upload (hand in) projects or homework. This UoC concerned with the website maintenance of the content rather than the physical server which the website is hosted on.
Level	3
Credit	3
Competency	<p>Performance Requirements</p> <p>1. Knowledge for maintaining website:</p> <ul style="list-style-type: none">• Possess interpersonal and coordination skills• Possess basic knowledge of principles of website design and maintenance• Possess good knowledge of creating web contents• Possess basic knowledge of operating common web browsers• Possess good knowledge of operating website testing tools• Understand user feedbacks or complaints related to the website• Understand the organisation's website performance requirements• Possess basic knowledge of the organisation document standards and procedures

Specification of Competency Standards for ICT Operation and Support

Unit of Competency

Functional Area: Web Support

Competency	<p>2. Maintain website</p> <ul style="list-style-type: none"> • Coordinate with various parties in the organisation to implement new features, upload new contents to website • Create various channels to receive information related to the organisation’s website, included but not limited to the following: <ul style="list-style-type: none"> • Visitor feedbacks or user complaints • Results of website testing tools • Monitoring/log statistics • Alerts of website outage • Periodically perform tests including but not limited to the following: <ul style="list-style-type: none"> • Access to the website is still possible • Web contents are compatible with different browsers and different clients (mobiles and desktops) • No broken links • Software are updated • Access and download speed • Functions/features are operational as expected, such as: checkout, blog, forum, registration, upload, download, etc. • Correct or coordinate with appropriate parties to correct any detected issues and remove redundant contents • Collect visitor traffic statistic for security purpose and/or business use <ul style="list-style-type: none"> • Pages entered on and exited on • Time spent on the site • Bounce rate • Referring sites • Countries of visitors are from • Use monitoring tools for “Reputation management” of the organisation’s name, brands and contents of the website appeared on the Internet, such as Google alert • Apply backup strategies: <ul style="list-style-type: none"> • Perform scheduled backups • Perform drills for recovery, in the event of website corruption • Document and create reports that comply with the organisation’s standards and procedures for assisting website developers and management decision making <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Look after the interest and reputation of the organisation • Apply industry best practices and web technologies when maintaining website • Adhere to Intellectual Properties and copyright laws
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Use different tools to monitor and test organisation’s website • Liaise with appropriate parties to correct issues and ensure the website is fully functional, updated and tested with different browsers on different clients • Ensure the website is well backup according to the organisation’s planned schedules and can be recovered within the organisation standard
Remark	

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

Functional Area - Operations Management

Title	Perform script programming
Code	107936L4
Description	This unit of competency applies to all Digital Media Technology (DMT) practitioners who are involved in script programming. Script is a sequence of instruction carried out by another program but not the computer processor directly and is widely used in games for non-player character (NPC) behavior, quest, items, etc. This UoC is concerned with the development of script program modules based on its game design documents, using specified programming engines, and following the organisation's coding standards.
Level	4
Credit	3
Competency	<p>Performance Requirements</p> <p>1. Knowledge for script programming</p> <ul style="list-style-type: none"> • Realize the philosophy and guidelines of the organisation towards game development • Master basic programming knowhow, concepts and techniques • Possess good understanding about the requirements of game specifications prepared by the development team • Master languages engines commonly used for script programming, such as: <ul style="list-style-type: none"> ○ LUA ○ Python ○ C++ ○ BASIC, etc. • Possess good understanding about the essential features of those script programming engines, such as: <ul style="list-style-type: none"> ○ Variable declaration ○ Flow control ○ Mathematical calculation ○ String manipulation ○ Subroutine / function calls, etc. <p>2. Perform script programming</p> <ul style="list-style-type: none"> • Fully explore the advantages offered by those aforementioned script languages, such as: <ul style="list-style-type: none"> ○ Ease of understanding ○ Ease of maintenance ○ Ease of modifications ○ Low resources consumption, etc. • Plan for the usage of script languages facilities for game applications, such as: <ul style="list-style-type: none"> ○ Use variable declaration for dynamic text generation, such as showing names in a dialog ○ Use the initialization functions to define game elements such as: <ul style="list-style-type: none"> ▪ Player status and properties ▪ Player position and facing direction ▪ NPC details and positions ▪ Active spots and item spots, etc. ○ Use string functions for string copy, concatenation, conversion, and so on ○ Use flow control capabilities for NPC dialog, event movement, battle event, etc. ○ Use function calls to access different script files, etc.

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

Functional Area - Operations Management

	<ul style="list-style-type: none"> • Judge on the pros and cons in using existing instead of self-developed scripts, based on considerations such as: <ul style="list-style-type: none"> ○ Existing scripts are well tested ○ There may be library support ○ But they can be more complicated for game designers, etc. • Conduct script programming according to the above understandings and considerations, such as: <ul style="list-style-type: none"> ○ Develop script for various NPC behavior ○ Develop script for battle artificial intelligence (AI) ○ Develop script for graphical user interfaces (GUI) ○ Make use of script tools to handle script data such as: <ul style="list-style-type: none"> ▪ Position in 3 dimensional coordinates ▪ Color value ▪ Movement data, etc. • Carry out the following programming stages iteratively until completion of the specific script programming modules: <ul style="list-style-type: none"> ○ Coding ○ Testing ○ Debugging <p>3. Exhibit professionalism</p> <ul style="list-style-type: none"> • Always develop script program modules with full effort and in an efficient and effective manner • Always develop script program modules according to organisational and / or international standards, regardless of those personal preferences
Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> • Complete the script programming work within required time frame and budget constraints; and • Develop the script program modules based on designated program documents and specifications
Remark	

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Define data governance policies and architecture principles
2. Code	111123L6
3. Range	This UoC involves defining the data governance policies and scope of data assets for the establishment of data architecture to support the development of organisational data being accurate, accessible, consistent and protected.
4. Level	6
5. Credit	3
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the data governance policies and scope of data throughout the data lifecycle</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ Have knowledge of data governance policies (see Remark 1) and scope of data (see Remark 2) <p>6.2 Define the data governance policy for the establishment of data architecture to support the development of organisational data being accurate, accessible, consistent and protected</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ define the processes to be implemented in your data governance initiative ■ define roles and assign responsibilities ■ initialize the data governance framework ■ define the required deliverables and organization structure for data governance <p>6.3 Review the data governance policy</p> <ul style="list-style-type: none"> ● review the data governance policy such that the data asset are consistent and confident for the business decisions based on trustworthy data aligned with all the various purposes within the enterprise
7. Assessment Criteria	<ul style="list-style-type: none"> ● The integrated outcome requirement of this UoC is the abilities to define the governance policy to make consistent and confident business decisions based on trustworthy data aligned with all the various purposes for the use of the data assets within the enterprise
8. Remark	<p>1. The data governance policy will deal with the internal policies and external policies for data quality, access, security, privacy and usage, as well as roles and responsibilities for implementing those policies and monitoring compliance with them against organisational culture, types of business, ethics, regulatory, compliances, standards, etc.</p> <p>2. The appropriate protection and security levels for different classifications of data within the scopes of data include (but not limited</p>

	to) data ownerships, data custodians, data retention, data sharing, data archive and data disposal
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Specification of Competency Standards
for the Information and Communications Technology Industry
Unit of Competency

1. Title	Develop application integration architecture
2. Code	111124L6
3. Range	Evaluate, develop and apply appropriate resources and model to support application integration architecture, based on business drivers, requirement of specific problem and existing IT infrastructure of the organisation with aid of emerging technologies such as AI and ML.
4. Level	6
5. Credit	3 (for reference only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand new technology and development trend of proprietary and open technology products</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ understand new technologies and products provided by specific vendor for supporting the end stage of application integration ■ understand open source and open technology products ■ leverage emerging technologies to come up with metrics that better evaluate the appropriateness of these products to be used as application integration architecture resources (Remark) <p>6.2 Understand the latency and accessibility of computer systems across multiple processing environment</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ define resources requirements and project plan to support the implementation of proposed application integration architecture model ■ select relevant application integration architecture resources (in-source and/or outsource) based on the skills and competencies for intended purposes <p>6.3 Implement application integration architecture resources</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ develop and implement (i.e. buy, build, and apply any combinations of them) application integration architecture resources to support the application integration architecture as well as to become part of IT architecture of an organisation ■ develop quality assurance procedures and checkpoints to ensure the compliance to defined principles, policies and standards
7. Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to :</p> <ul style="list-style-type: none"> ● select relevant application integration architecture resources based

	<p>on the proposed application integration architecture; and</p> <ul style="list-style-type: none">● develop application integration architecture resources to support the application integration architecture as well as to become part of IT architecture of an organisation.
8. Remark	Examples of application integration resources are software products, platforms, and headcount with strength in emerging technologies

Specification of Competency Standards
for the Information and Communications Technology Industry
Unit of Competency

1. Title	Review, design and re-engineer business processes to form a new business architecture
2. Code	111125L6
3. Range	Promote and explain the adopted business processes to stakeholders in an organisation to obtain their buy-in and support in a general business environment
4. Level	6
5. Credit	6 (for reference only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Define business performance indicators to meet with business goals in consistent to stakeholders' expectation</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ identify the stakeholders from different categories: <ul style="list-style-type: none"> ◆ Internal stakeholders ◆ External stakeholders ◆ Primary stakeholders ◆ Secondary stakeholders ■ understand the different stakeholders' expectation from different stakeholders' categories ■ define business performance indicators to meet with strategic drivers, and stakeholders' concerns (Remark) <p>6.2 Identify, design, and re-engineer business processes of an organisation with new technologies to improve business performance</p> <ul style="list-style-type: none"> ● Be able to identify, design, and re-engineer business processes of an organisation with new technologies to achieve the pre-defined business performance indicators <p>6.3 Continuously measure and monitor the business performance of using the existing technologies</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ continuously measure the business performance of applying the existing technologies ■ continuously measure the technology capability of the existing technologies ■ monitor and report the effects of the technology capability on the business performance <p>6.4 Establish management structure to continuously improve business performance with new technologies</p>

	<ul style="list-style-type: none"> ● Be able to design and establish management structure <ul style="list-style-type: none"> ■ review current business performance in relation to existing technology capability ■ review new technologies with respect to improving business performance ■ conduct cost-benefit analysis on adopting new technologies and check for any improvement in business performance ■ formulate a new business architecture
7. Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to :</p> <ul style="list-style-type: none"> ● identify, design, and re-engineer business processes of an organisation with new technologies to improve business performance ● continuously monitor the business performance of using the existing technologies ● design and establish management structure and guidelines to continuously improve business performance with new technologies
8. Remark	<p>Examples of metrics and methodologies are:</p> <ul style="list-style-type: none"> ● Key Performance Indicators (KPIs); ● Objective and key results (OKRs); ● Return on investment (ROI) analysis; ● Internal rate of return (IRR); ● Balanced scorecard

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Develop compliance framework for the meeting of ethical and regulatory requirements related to enterprise data
2. Code	111132L6
3. Range	This UoC involves developing a compliance framework for meeting ethical standards, local and international regulatory requirements for every stage in the enterprise data lifecycle (e.g. data ownership and data privacy) for an enterprise to achieve business objectives and goals.
4. Level	6
5. Credit	9 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Know the enterprise data ethical and regulatory requirements</p> <ul style="list-style-type: none"> ● understand the types of data involved ● identify how legal, policy and/or ethical constraints might impact enterprise data ● explain how ethical, compliance, and legal issues should/must be considered in enterprise data ● Demonstrate awareness of personal privacy issues related to the collection and usage of enterprise data (See remark 1) <p>6.2 Develop the compliance framework</p> <ul style="list-style-type: none"> ● evaluate some of the established ethical and legal issues in enterprise data faced by the organisation ● Create compliance framework that addresses the ethical and regulatory concerns about the enterprise data <p>6.3 Exhibit professionalism</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ apply industry best practices to the develop compliance framework ■ comply with the organisation's guidelines and procedures as well as any (local and international) laws and regulatory requirements, if applicable
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to identify data governance obligations, challenges, emerging legal and ethical data privacy, security best practices and uncertainties within a given context
8. Remark	1. To meet regulatory requirements and avoid fines by documenting the lineage of the data assets and the access controls related to the data

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Define data classification policy for enterprise
2. Code	111133L6
3. Range	This UoC involves defining the data classification policy for enterprises to achieve enhancement in data performance and utilisation based on identifiability, level of sensitivity, and criticality to the enterprise data.
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the data classification and types of data classification policies</p> <ul style="list-style-type: none"> ● Have knowledge of: <ul style="list-style-type: none"> ■ data classification (See Remark 1) and various types of data classification policies (See Remark 2) ■ the key performance indexes of data performance and utilisation (See Remark 3) <p>6.2 Define the data classification policy for enterprise</p> <ul style="list-style-type: none"> ● Be able to define and establish the data classification policy for enterprise to achieve enhancement in data performance and utilisation <p>6.3 Evaluate the data performance and utilisation</p> <ul style="list-style-type: none"> ● Be able to evaluate the data performance and utilisation based on identifiability, level of sensitivity, and criticality to the enterprise data
7. Assessment Criteria	The integrated outcome requirement of this UoCs is the ability to define the data classification policy for enterprise to achieve enhancement in data performance and utilisation based on identifiability, level of sensitivity and criticality to the enterprise data
8. Remark	<p>1. Data classification categorises data in a way that conveys the sensitivity of information with respect to the confidentiality, integrity, and availability. For example, the data can be categorised as sensitive, public, confidential or personal.</p> <p>2. Data classification policy concerned with:</p> <ul style="list-style-type: none"> - the management of information to ensure that sensitive information is handled with respect to the threat it poses to an organisation - how this gathered data is being used and structured within an organisation to allow authorised personnel to get the right pieces of information at the right time, view and access information <p>3. Data performance and utilisation should consider the identifiability, level of sensitivity and criticality to the enterprise data.</p>

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Enforce enterprise data standards for business needs
2. Code	111134L6
3. Range	This UoC involves defining, maintaining and enforcing data standards for business needs with data privacy and security in information systems adapted for the organisation
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Appraise the existing data standards and principles</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ appraise the existing data standards and principles for modelling, metadata, security, reference data and master data <p>6.2 Defines the enterprise data standards and principles</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ define the enterprise data standards and principles concerning the business requirements (See Remark 1) for modelling, metadata, security, reference data, master data, etc. throughout the data lifecycle (See Remark 2) <p>6.3 Review enterprise data standards and principles</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ review the enterprise data standards and principles such as data privacy policies, ethical and social issues, proactively complying with regulations, and allow easy collaboration with data professionals <p>6.4 Assign data quality responsibilities</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ assign data quality responsibilities in order to measure and follow up on data quality KPIs related to the general performance KPIs within the enterprise
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to assign data quality responsibilities in order to measure and follow up on data quality KPIs related to the general performance KPIs within the enterprise
8. Remark	<p>1. The business requirements include (but not limited to) ethical concerns, regulatory compliances, international and local standards, etc.</p> <p>2. Data lifecycle includes (but not limited to) data ownerships, data custodians, data retention, data sharing, data archive and data disposal</p>

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Understand the use of data concepts and topologies to design data topology suitable for an enterprise
2. Code	111135L6
3. Range	Understand the use of data concepts and typologies with data dimensions to read, work with and communicate about data by putting it in proper context throughout the data life cycle for any enterprise to be successful with any type of analytics.
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the use of data concepts and topologies with data dimensions under different categories</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the use of data concepts and topologies with data dimensions (See Remark 1) under different categories (See Remark 2) <p>6.2 Familiar with the flows of enterprise data</p> <ul style="list-style-type: none"> ● Have knowledge of the data flow, such as in which parts of the organization will data be generated, which divisions require data to function, how data flows are managed, and how data changes in transition <p>6.3 Know the various layers of data</p> <ul style="list-style-type: none"> ● Have knowledge of various data layers (See Remark 3) from raw statistics or snippets of unstructured data (for example, social media post) to actionable insight throughout the data lifecycle.
7. Assessment Criteria	<ul style="list-style-type: none"> ● The integrated outcome requirement of this is the ability to have a properly designed data topology that is sustainable, future-proofing and resistant to the continuous changes that are associated with data characteristics (See Remark 4), providing the foundation for any enterprise to be successful with any type of analytics
8. Remark	<p>1. The data topology is an approach for classifying and managing real-world data scenarios. There are three core elements of a data topology:</p> <ul style="list-style-type: none"> - zone map - data flow - data layer <p>2. The data categories include (but not limited to):</p> <ul style="list-style-type: none"> - discrete vs. continuous - structured vs. unstructured - number of dimensions <p>3. The data layers include data sources layer, data storage layer, data</p>

	<p>processing/analysis layer and data output layer. The data layers connects with the types of data management approach such as data warehousing or data lake, types of data acquisition options such as new data collection, data extraction or data-as-a-services</p> <p>4. The data characteristics include volume, variety, velocity, veracity, and perception of the data's value</p>
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Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Identify and evaluate the data sources to fulfil the data requirements in support of business objectives
2. Code	111136L6
3. Range	This UoC involves identifying the reliable and dependable data sources with respect to defined data policies, enterprise data standards or use cases in support of business objectives
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Identify and understand the data sources and data requirements</p> <ul style="list-style-type: none"> ● appreciate data requirements and issues of availability and accessibility ● understand the business objectives ● identify data requirements that are in support of business objectives ● identify data sources that aligned with the data requirements <p>6.2 Evaluate the data sources against the requirements</p> <ul style="list-style-type: none"> ● establish the key required internal and external data sources as well as data availability and accessibility for data projects ● Utilise extensive knowledge of a range of data sources both internal and external to the organisation, including where and how they were collected from (See Remark 1), where and how they are stored, and their interrelationships, to verify the relevance of potential data sources <p>6.3 Exhibit professionalism</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ apply industry best practices to identify and evaluate the data sources ■ comply with the organisation's guidelines and procedures as well as any (local and international) laws and regulatory requirements, if applicable
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC are the abilities to:</p> <ul style="list-style-type: none"> ● manage the processes of data source identification in establishing the availability and accessibility of data from different sources to fulfil the data requirements in support of business objectives ● identify and evaluate data sources effectively
8. Remark	1. Customer data platforms are primarily focused on collecting and aggregating first-party data, but they can also store second and third party data as well

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Manage and implement different data acquisition options for the identified internal or external sources
2. Code	111137L6
3. Range	This UoC involves managing and implementing the different data acquisition options for the identified data sources (both internal and external). The options include collecting new data, converting/transforming legacy data, sharing/exchanging data and purchasing data through subscription or data-as-a-service solution
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Know of different data acquisition options</p> <ul style="list-style-type: none"> ● Have knowledge of the data description, various data acquisition and wrangling techniques (See Remark 1) ● Appraise and manage various data acquisition options <p>6.2 Manage and implement different data acquisition options</p> <ul style="list-style-type: none"> ● Acquire data from all the identified internal and external sources (both structured or unstructured data) using different techniques, such as ETL batch processing, streaming ingestion, scrapers, APIs and crawlers ● Utilise various data wrangling techniques, such as parsing, and algorithms for complex and multi-source data ● Aware of the privacy and ethical implications of sourcing internal and external data <p>6.3 Exhibit professionalism</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ apply industry best practices to manage and implement different data acquisition options ■ comply with the organisation's guidelines and procedures as well as any (local and international) laws and regulatory requirements, if applicable
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to collect the appropriate and up-to-date data through various data acquisition and wrangling techniques to obtain the data being valid, accurately interpreted, and applicable to the desired contexts with respect to the identified data sources
8. Remark	1. Various data acquisition options (for first-party, second-party and third-party data) include (but not limited to) new data collection, legacy

	data transformation/conversion, data sharing/exchange, data subscription and/or data-as-a-service solution. This includes automated collection (e.g., of sensor-derived data), the manual recording of empirical observations, and obtaining existing data from other sources.
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Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Define and establish the data architectures
2. Code	111138L6
3. Range	Evaluate, define, and apply appropriate practices and methodologies to establish data architecture to support the defined data policies, standards and rules
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand various data policies and architecture principles</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the data governance and relevant strategies throughout the data lifecycle ■ understand data policies for data ownership, data custody, data retention, data sharing (both internal and external), data archive and data disposal ■ understand data architecture framework, standards and principles for data modelling, metadata, data security, reference data, master data, etc. <p>6.2 Define data policies for different data assets</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the data governance and define the data policies for the organisation based on the business objectives ■ define data architecture framework for different data assets to align with the standards, practices, and regulatory requirements on the use of data in the organisation and the business environment <p>6.3 Define architecture principles</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the data governance and define architecture principles (See Remark 1) for different data assets to align with their data management requirements and policies
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to define data policies and architecture principles for an organisation's data assets for considering the industrial standards and regulatory requirements
8. Remark	1. Architecture principles include (but not limited to) how data should be identified, requested, organised, accessed, processed/analysed, presented, etc.

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Check usability of a target data architecture
2. Code	111139L6
3. Range	This UoC involves reviewing the correctness and completeness of a target data architecture via mapping and gap analysis between data assets and target data architecture to ensure the constructed data architecture meets the data policies of the organisation
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand various architecture viewpoints supported by different data architecture artefacts in terms of various data categories or data classification (See Remark 1)</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand how various architecture viewpoints can be used to address the needs of different stakeholders, e.g. managers, software developers and the information requirements, meeting the data policies of the organisation ■ understand the advantages and disadvantages of different architecture viewpoints in representing data assets (See Remark 2) <p>6.2 Baseline the existing data assets</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ stock take the existing data assets in the organisation ■ develop descriptions for existing data assets ■ provide guidelines to incorporate the data assets into the data architecture <p>6.3 Select relevant data architecture viewpoints to represent data assets</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ select and define suitable data architecture viewpoints to represent data assets to address stakeholders' needs and information requirements ■ perform trade-off analysis (e.g. completeness vs. simplicity) to resolve conflicts in the selection of architectural viewpoints <p>6.4 Develop mappings between existing data assets and the target data architecture</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ document the mappings between the data entities used in the existing data assets and the data entities defined in the data architecture ■ define suitable document formats for different disciplines of

	<p>stakeholders so that they can understand and review the mappings of their managed data assets to the target data architecture</p> <p>6.5 Perform gap analysis between existing data assets and the target data architecture</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ perform the gap analysis between the existing data assets and the target data architecture ■ review the architecture viewpoints used in the data architecture to confirm whether they can accurately represent data assets in order to address stakeholders' needs and information requirements ■ review discrepancies between the data structures in existing data assets and those defined in the target data architecture
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC are the abilities to:</p> <ul style="list-style-type: none"> ● develop mappings between existing data assets and the target data architecture; and ● perform gap analysis between existing data assets and the target data architecture to assure that the target data architecture can meet the business requirements
8. Remark	<p>1. For example, one of the data categories refers to structure data, semi-structured data or unstructured data. And the data classification refers to public data, personal data, sensitive data or confidential data</p> <p>2. Different architecture viewpoints are supported by different types of artefacts. For example,</p> <ul style="list-style-type: none"> - business process models (e.g. flowcharts, UML activity diagrams) provide the viewpoints to understand how data is flowed between business processes; - conceptual and logical models present the structures and relationships of data entities; and - Multilayered architecture is used for different data categories and/or data classifications - Data dictionaries list and specific data entities in a table format, e.g. spreadsheet

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Conduct and review pre-processing and transformation of the data with data quality assessment
2. Code	111140L6
3. Range	This Uoc involves conducting pre-processing and transformation of the data and review data quality to ensure that it is in the optimal format, layout or shape for the project purposes using feature engineering, exploratory data analysis and a range of data audit techniques and approaches
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Have knowledge of pre-processing and exploratory data analysis (See Remark 1)</p> <p>6.2 Appraise and manage pre-processing and transformation of the data to ensure that it is in the optimal format, layout or shape for the project purposes, i.e., feature engineering</p> <p>6.3 Conduct exploratory data analysis to perform initial investigations on data so as to discover patterns, to spot anomalies, to test hypothesis and to check assumptions with the help of summary statistics and graphical representations</p> <p>6.4 Conduct data quality assessment with extensive knowledge of the data, potential issues such as missing values, duplicates and inconsistent formats, and the implications for the data science/analytics process</p>
7. Assessment Criteria	The integrated outcome requirement of this UoCs are the abilities to have relevant knowledge and conduct the appropriate pre-processing, exploratory data analysis and data quality assessment to ensure the data in the optimal format and perform initial investigation on data quality (See Remark 2)
8. Remark	<p>1. Preprocessing of the data will be performed by analysing the data either categorical or numerical, visualizing them and some statistical decision. Exploratory data analysis (EDA) is a term for certain kinds of initial analysis and findings done with data sets, usually early on in an analytical process.</p> <p>2. Data should be valid, accurately interpreted, and applicable to the desired contexts</p>

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Appraise and select the appropriate data management tools, services and/or platforms to manage the target data based on different requirements
2. Code	111141L6
3. Range	Appraise different data management tools/services/platforms in the existing market and select the appropriate data management tools/services/platforms to manage the target data based on different requirements including capacity, performance, reliability, recoverability, discovery scheme, security, etc.
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the practices of data management throughout its lifetime through the internal (and external) data streams of an enterprise</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the data management being a comprehensive set of concepts, procedures, practices, processes, and a number of systems that allow for an organization to gain control of the data assets ■ know the data operations covered in data management (See Remark 1) ■ know the requirements of using different data management tools/services/platforms (See Remark 2) <p>6.2 Appraise various data management tools and services in the existing market</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ appraise various data management tools/services/platforms (See Remark 3) in the existing market based on different knowledge areas (See Remark 4) <p>6.3 Select the appropriate data management tools/services/platforms to manage the target data based on different requirements</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ select the appropriate data management tools/services/platforms to manage the target data based on different requirements <p>6.4 Perform supplier management of data management tools/services/platforms</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ perform supplier management of the data management tools/services/platforms to ensure the right suppliers are

	<p>chosen to meet the data objectives</p> <p>6.5 Assess the target data management tools/services/platforms</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ assess the target data management tools/services/platforms for the data management effectiveness and maturity
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC is the ability to know the practices of data management and select the appropriate data management tools/services/platforms to manage the target data. While at the same time achieving high availability and disaster recovery, securing data, providing privacy, and following compliance requirements, etc.</p>
8. Remark	<p>1. Data management covers the following operations (but not limited to):</p> <ul style="list-style-type: none"> - create, access, and update data across diverse data tiers - store data across clouds and on-premise - use data across applications, analytics, and algorithms - provide high-availability and disaster recovery - secure data and provide privacy - archive and destroy data based on retention rules and compliance requirements. <p>2. The requirements of using different data management tools and services include (but not limited to) capacity, performance, reliability, recoverability, discovery scheme, security, etc.</p> <p>3. There are various popular data management tools/services/platforms in the existing market, i.e., Oracle Data Management Suite, SAP Data Management, IBM Infosphere Master Data Management Server, Microsoft Master Data Services, Talend, Tableau, Amazon Web Services - Data Lakes and Analytics, Google Cloud - Big Data Analytics, etc.</p> <p>4. Knowledge areas found in Data Management:</p> <ul style="list-style-type: none"> - Open source data management - Data architecture and data model design software - Master and reference data management - Database management - Data storage and operations: data warehousing and data lake - Document collection and analysis - Metadata management - Data quality management - Data analysis - Data security and protection

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Design customised data management tools and services to manage the target data for an organisation
2. Code	111142L6
3. Range	This Uoc involves designing and developing data management tools and services that are not available from the existing markets to manage the target data based on different requirements including capacity, performance, reliability, recoverability, discovery scheme, etc.
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the practices of data management throughout its lifetime through the internal (and external) data streams of an enterprise</p> <ul style="list-style-type: none"> ● know the data management being a comprehensive set of concepts, procedures, practices, processes, and a number of systems that allow for an organization to gain control of the data assets ● know the data operations covered in data management (See Remark 1) ● know the requirements of using different data management tools/services/platforms (See Remark 2) ● know the differences among in-house, outsourced and hybrid development of data management tools/services/platforms <p>6.2 Design and develop the right data management tools/services/platforms to fill the gap between the data management requirements and the data management tools/services/platforms from existing markets</p> <ul style="list-style-type: none"> ● select the appropriate design and development tools/environments for building the targeted data management tools/services/platform ● design and develop the right data management tools/services/platforms to fill the gap between the data management requirements and the outsourced data management tools/services/platforms from existing markets ● test the developed data management tools/services/platforms <p>6.3 Evaluate the developed data management tools/services/platforms with the integration of existing ones based on the use of the data</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this UoCs are the abilities to:</p> <ul style="list-style-type: none"> ● design and develop the right data management tools and services that are not available from the existing markets to perform the necessary data management processes to meet the data requirements for the organisation

	<ul style="list-style-type: none"> ● evaluate the developed data management tools/services/platforms with the integration of existing ones based on the data objectives
8. Remark	<p>1. Data management covers the following operations (but not limited to):</p> <ul style="list-style-type: none"> - create, access, and update data across diverse data tiers - store data across clouds and on-premise - use data across applications, analytics, and algorithms - provide high-availability and disaster recovery - secure data and provide privacy - archive and destroy data based on retention rules and compliance requirements. <p>2. The requirements of using different data management tools and services include (but not limited to) capacity, performance, reliability, recoverability, discovery scheme, security, etc.</p>

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Perform the overall data management processes from the in-house, outsourced or hybrid tools/services/platforms using the identified tools.
2. Code	111143L6
3. Range	This UoC involves performing the overall data management processes (such as extraction, transformation, load, storage, disposal, etc.) using the identified tools to manage the data across diverse data tier and data retrieval processes in a growing variety of data usages.
4. Level	6
5. Credit	9 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Know the data management process</p> <ul style="list-style-type: none"> ● understand the different processes need to carry out the task ● assess and identify the best tools for each process ● understand the complexity of tools/services/platforms that are involved ● identify the data tier involved and potential problems that could arise <p>6.2 Perform the overall data management processes</p> <ul style="list-style-type: none"> ● create, access and update the data across a diverse data tier and data retrieval processes in a growing variety of apps, analytics, and algorithms ● manage the storage of data across multiple / distributed data stores (See Remark 1) ● perform the relevant tasks of archiving and destroying the data in accordance with retention schedules and compliance requirements ● manage the infrastructures and environments of performing the data management processes for both in-house and outsourced data management tools/services/platforms ● review the overall data management tools/services/platforms for the data management effectiveness and maturity <p>6.3 Exhibit professionalism</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ apply industry best practices to perform the data management processes ■ comply with the organisation's guidelines and procedures as well as any (local and international) laws and regulatory requirements, if applicable
7. Assessment	The integrated outcome requirement of this UoC are the abilities to:

Criteria	<ul style="list-style-type: none">● perform the overall data management processes from the in-house, outsourced or hybrid tools/services/platforms to meet the requirements of effectiveness, maturity, compliances, etc. in a growing variety of data usages● review the overall data management tools/services/platforms for the data management effectiveness and maturity
8. Remark	1. Data storage platforms include (but not limited to) database server, data warehouse, data lake, etc.

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Appraise, select and integrate the appropriate data analytics and/or modelling solutions to perform the data analytics process based on different requirements
2. Code	111144L6
3. Range	Appraise different data analytics solutions and/or modelling tools in the existing market and select the appropriate data analytics solutions and/or modelling tools to perform the data analytics process with handling bigger and more complex data, getting more precise results, having faster responses, etc.
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the practices of data analytics solutions and/or modelling tools throughout its lifetime through the internal (and external) data streams of an enterprise</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the data analytics and data model being a comprehensive set of concepts, procedures, practices, processes, and a number of systems that allow for an organization to analyse the data ■ aware of a wide range of core data science/analytics techniques, their advantages, disadvantages and areas of application in different dimensions (See Remark 1) ■ aware of the necessity of the data analytics and data models, relevant objectives, time and resource requirements <p>6.2 Appraise various data analytics solutions and/or modelling tools in existing market</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ appraise various data analytics solutions and/or modelling tools (See Remark 2) in the existing market based on different analytics capabilities (See Remark 3) <p>6.3 Select the right data analytics solutions and/or modelling tools</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ select the right data analytics solutions and/or modelling tools with different analytics capabilities based on different business values <p>6.4 Perform supplier management of data analytics solutions and/or modelling tools</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ perform supplier management of the data analytics solutions

	<p>and/or modelling tools to ensure the right suppliers are chosen to meet the analytics capabilities based on different business values</p> <p>6.5 Assess the target data analytics solutions and/or modelling tools</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ assess the target data analytics solutions and/or modelling tools for the data analytics effectiveness and maturity
7. Assessment Criteria	<p>The integrated outcome requirement of this UoCs are the abilities to:</p> <ul style="list-style-type: none"> ● have knowledge of the practices of data analytics/models ● select the appropriate data analytics solutions and/or modelling tools to perform the analytic processes to meet the requirements with different analytics capabilities based on different business values
8. Remark	<p>1. Data dimensions:</p> <ul style="list-style-type: none"> - traditional vs. emerging data - structured vs. unstructured data <p>2. There are various popular data analytics solutions and/or modelling tools in the existing market, i.e., Apache Spark, Apache Storm, PIG and HIVE, SAS, Tableau, Microsoft Power BI, SAP BusinessObjects, Google Data Studio, IBM Cognos, Oracle Analytics Cloud, Amazon Web Services (Analytics), etc.</p> <p>3. Different analytics capabilities (with algorithms and modelling techniques) includes (but not limited to):</p> <ul style="list-style-type: none"> - discover relationships between variables (regression) - discover relationships over time (time series analysis) - distinguish between noise and meaningful information (signal analysis) - discover meaningful groupings of data points (cluster analysis) - experiment to find the most effective variation of a website, product, etc. (A/B/N Testing) - organize data points into known categories (classification) - experiment with a system virtually (simulation modelling) - extract geographic or topological information (spatial analysis) - use data to forecast or infer behaviour (predictive modelling) - combine data sources to recognize events (complex event processing) - extract consumer reactions based on social media behaviour (sentiment analysis) - discover meaningful nodes and relationships on networks (network analysis) - improve a process or function based on criteria (optimization) - find answers to human questions using artificial intelligence (deep question answering) - extract meaning from human speech or writing (natural language processing)

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Build the analytics solutions/models to support better business decisions and improve performance
2. Code	111145L6
3. Range	This UoC involves building and managing the data analytics solutions/models using identified data analytics tools and/or modelling tools/processes with precise and faster results to support better business decisions and improve performance
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the practices of data analytics solutions/models, data analytics tools and/or modelling tools throughout its lifetime through the internal (and external) data streams of an enterprise</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the data analytics solutions/models and relevant data analytics tools and/or modelling tools/processes being a comprehensive set of concepts, procedures, practices, processes, and a number of systems that allow for an organization to analyse the data ■ aware of a wide range of core data science/analytics techniques (See Remark 1), their advantages, disadvantages and areas of application in different dimensions (See Remark 2) ■ aware of the necessity of the data analytics solutions and data models, relevant objectives, time and resource requirements <p>6.2 Build the right data analytics solutions/models/processes based on the data analytics requirements</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ design and build the right data analytics solutions/models/processes using identified analytics tools and/or modelling tools from existing markets based on requirements ■ test the developed data analytics solutions/models/processes <p>6.3 Evaluate the developed data analytics solutions/models/processes</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ evaluate the developed data analytics solutions/models/processes based on the data objectives
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to design and build right data analytics solutions/model/processes using identified data analytics tools and/or modelling tools with obtaining precise and

	faster results to support better business decisions and performances of organisation
8. Remark	<p>1. The analytics techniques include (but not limited to) statistical methods, data mining methods, machine learning, deep learning, reinforcement learning, artificial intelligence</p> <p>2. Data dimensions:</p> <ul style="list-style-type: none">- traditional vs. emerging data- structured vs. unstructured data

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Perform model training, testing and validation in evaluating and optimising the model based on various metrics
2. Code	111146L6
3. Range	This UoC involves performing model training, testing and validation to evaluate the model by modifying the parameters based on various metrics to obtain an appropriate and/or optimised model
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the needs of model training, testing and validation</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ have to knowledge of model training, testing and validation ■ have knowledge of various evaluation methods and tools to evaluate the model based on various metrics (See Remark 1) <p>6.2 Create a model evaluation plan to test model quality and validity</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ create model evaluation plan with procedures or mechanisms to test model quality and validity by using separate data set in train, validation sets and test sets based on various metrics <p>6.3 Perform model training, testing and validation and evaluate the model</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ perform model training, testing, validation and evaluation by modifying the parameters based on the model evaluation plan to obtain an appropriate and/or optimised model
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC are the abilities to:</p> <ul style="list-style-type: none"> ● have knowledge of model training, testing and validation, create the model evaluation plan based on various metrics ● perform model training, testing and validation to evaluate the model by modifying the parameters based on model evaluation plan to obtain an appropriate and/or optimised model with appropriate model quality and validity
8. Remark	1. The evaluation metrics include (but not limited to) performance, fairness, explainability, robustness, safety, etc.

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Design customised analytics and modeling tools for an organisation
2. Code	111147L6
3. Range	This UoC involves designing and developing the customised data analytics solutions and/or modelling tools (if ready-made solutions/tools are not sufficient) by applying different technologies (such as ML and AI techniques) for an organisation.
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the practices of data analytics processes, data analytics solutions and/or modelling tools throughout its lifetime through the internal (and external) data streams of an enterprise</p> <ul style="list-style-type: none"> ● know the data analytics solutions and/or modelling tools/processes being a comprehensive set of concepts, procedures, practices, processes, and a number of systems that allow for an organization to analyse the data ● know a wide range of core data science/analytics techniques, their advantages, disadvantages and areas of application in different dimensions (See Remark 1) ● know different analytics technologies (See Remark 2) ● know the necessity of the data analytics and data models, relevant objectives, time and resource requirements <p>6.2 Plan and develop the right data analytics solutions and/or modelling tools/processes to fill the gap between the data analytics/models requirements and the data analytics solutions and/or modelling tools/processes from existing markets</p> <ul style="list-style-type: none"> ● select the appropriate design and development programming tools, languages and environments (See Remark 3) for building the targeted data analytics solutions and/or modelling tools/processes ● design and develop the right data analytics solutions and/or modelling tools/processes to fill the gap between the data analytics/models requirements and the outsourced data analytics solutions and/or modelling tools/processes from existing markets ● test the developed data analytics solutions and/or modelling tools/processes <p>6.3 Evaluate the developed data analytics solutions and/or modelling tools/processes with the integration of existing ones based on the data objectives</p>
7. Assessment	The integrated outcome requirement of this UoC are the abilities to:

Criteria	<ul style="list-style-type: none"> ● design and develop the right data analytics solutions and data model using the right data analytics solutions and/or modelling tools/processes which are not available from the existing markets in order to meet the data requirements for the organisation ● Evaluate the developed data analytics solutions and/or modelling tools/processes with the integration of existing ones based on the data objectives
8. Remark	<ol style="list-style-type: none"> 1. Data dimensions: <ul style="list-style-type: none"> - traditional vs. emerging data - structured vs. unstructured data 2. The analytics technologies include (but not limited to) statistical methods, data mining methods, machine learning, deep learning, reinforcement learning through various AI techniques 3. The programming languages/platforms include (but not limited to) R, Python, Anaconda, IDLE, Jupyter Notebook, Spyder, etc.

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Understand the use of data visualisation and the factors in selecting and using various data visualisation tools
2. Code	111148L6
3. Range	This UoC involves understanding the use of data visualisation and the factors (such as the usage, user habits and user expectations) of selecting and using data visualisation tools to provide an accessible way to see and understand trends, outliers, and patterns in business data
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the use of data visualisation and various visualisation tools</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ have knowledge of data visualisation and use of data visualisation through the exploration and explanation to benefit from making enterprise data more understandable <p>6.2 Have knowledge of various data visualisation tools</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ have knowledge of various visualisation tools with different data visualisation types (See Remark 1) for different functions (See Remark 2) and purposes (See Remark 3) <p>6.3 Have knowledge of evaluating the visual representation with the targeted visualization tools</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ evaluate the visual representation with the targeted visualization tools with the various requirements (See Remark 4)
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC are the abilities to:</p> <ul style="list-style-type: none"> ● have knowledge of data visualisation and the factors of selecting the right data visualisation tools ● use identified data visualisation tools to provide an accessible way to see and understand trends, outliers, and patterns in business data
8. Remark	<p>1. Different types of visualisation tools include (but not limited to) "Graphs/Plots", "Diagrams", "Tables", "Maps/Geographical", "Others"</p> <p>2. Different functions of visualisation tools include (but not limited to) "Comparisons", "Proportions", "Relationships", "Hierarchy", "Concepts", "Location", "Part-to-a-whole", "Distribution", "How things work", "Processes and methods", "Movement or flow", "Patterns", "Range", "Data over time", "Analysing text", "Reference tool", "Network"</p>

	<p>3. Different functions of visualisation tools include (but not limited to) dashboards, annual reports, sales and marketing materials, investor slide decks, and virtually anywhere else information needs to be interpreted immediately</p> <p>4. Different requirements of visualisation tools include (but not limited to) ease of use, ability to handle huge sets of data, ability to output an array of different chart, graph, and map types, cost effectiveness</p>
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Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Appraise the various data visualisation tools and select the appropriate tools according to user requirements
2. Code	111149L6
3. Range	Appraise different data visualisation tools in the existing market and select the appropriate data visualisation tools to grasp difficult concepts or identify new patterns interactively
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Have knowledge of various data visualisation and various visualisation tools in the existing market</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ have knowledge of data visualisation and various visualisation tools (See Remark 1) in the existing market <p>6.2 Appraise the data visualisation tools in existing market to the business needs</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ appraise the data visualisation tools in the existing market to the data requirements for the business needs <p>6.3 Select and use the right data visualisation tools</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ select the right data visualisation tools to provide an accessible way to see and understand trends, outliers, and patterns in business data ■ use the visualisation tools to create visual representations of large data sets based on various factors such as the usage, user habits and user expectations <p>6.3 Develop the automated process of creating visual representations</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ develop the automated process of creating visual representation for key analytics results <p>6.4 Evaluate the visual representation with the targeted visualization tools</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ evaluate the visual representation with the targeted visualization tools with the various requirements (See Remark 5)
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC are the abilities to:</p> <ul style="list-style-type: none"> ● have knowledge of data visualisation and the factors of selecting the right data visualisation tools ● use the identified data visualisation tools to provide an accessible

	way to see and understand trends, outliers, and patterns in business data
8. Remark	1. Different visualisation tools in existing market include (but not limited to) Tableau, Infogram, Looker, Zoho Analytics, Sisense, IBM Cognos Analytics, Microsoft Power BI, SAP Analytics Cloud,

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

Functional Area – Data Science #20

1. Title	Design customised data visualisation tools based on the business requirements
2. Code	111150L6
3. Range	This UoC involves designing customised data visualisation tools (if ready-made solutions/tools are not enough) based on the final business purpose (such as, what data for visualization? what decision to be made?) of the organisation.
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the practices of data visualisation processes, customised data visualisation tools throughout its lifetime through the internal (and external) data streams of an enterprise</p> <ul style="list-style-type: none"> ● know the data visualisation being a comprehensive set of concepts, procedures, practices, processes, and a number of systems that allow for an organization to give the business insight through the visual data representations ● know a wide range of core data visualisation techniques, their advantages, disadvantages and areas of application in different dimensions (See Remark 1) ● know different development technologies for data visualisation (See Remark 2) ● know the necessity of the visual data representations, data visualisation tools, relevant objectives, time and resource requirements <p>6.2 Plan and develop the right customised data visualisation tools to fill the gap between the data visualisation requirements and the data visualisation tools from existing markets</p> <ul style="list-style-type: none"> ● select the appropriate design tools, programming language and environment and development packages/libraries (See Remark 3) for building the customised data visualisation tools ● design and develop the right customised data visualisation tools to fill the gap between the data visualisation requirements and the outsourced data visualisation tools from existing markets ● test the customised data visualisation tools <p>6.3 Evaluate the developed customised data visualisation tools with the integration of existing ones based on the required business insights</p>
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC are the abilities to:</p> <ul style="list-style-type: none"> ● design and develop right visual data representations using right customised data visualisation tools which are not available from the existing markets in order to meet the required business

	<p>insights for the organisation</p> <ul style="list-style-type: none"> ● evaluate the developed customised data visualisation tools with the integration of existing ones based on the required business insights.
8. Remark	<p>1. Data dimensions:</p> <ul style="list-style-type: none"> - traditional vs. emerging data - structured vs. unstructured data <p>2. The development technologies for data visualisation include (but not limited to) computer graphics, UX design, ergonomic design, statistical knowledge, programming, etc.</p> <p>3. The design tools include (but not limited to) Spyder (Python), Jupyter Notebook (Python), RStudio (R). The programming language and environment include (but not limited to) R (data analysis), Python (data analysis), javascript (web), Java (general), C++ (general), etc. The development packages/libraries include (but not limited to) Matplotlib (Python), Ggplot (Python)/Ggplot2 (R), Leaflet (R, Javascript), D3.js (Javascript), Chart.js (Javascript), Google Chart Tools (API), Microsoft Power BI (API)</p>

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Utilise the preset data visualisation dashboard/display tools for visual data representations.
2. Code	111151L4
3. Range	This UoC involves a good understanding of the basic functionalities of data visualisation dashboard/displays in order to obtain the key visual data representations and to generate business insights.
4. Level	4
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the basic functionalities of data visualisation dashboard/displays</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ understand the basic functionalities of data visualisation dashboard/displays ■ have knowledge of the operation of preset data visualisation dashboard/display ■ have knowledge of the business insights by using the preset data visualisation dashboard/display <p>6.2 Utilise the preset data visualisation dashboard/display tools for key visual data representation based on the required business insights</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ utilise the preset data visualisation dashboard/display tools (such as Tableau, Power BI, Sisense, etc.) for key visual data representation <p>6.3 Manage and evaluate the preset data visualisation dashboard/display tools</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ manage and evaluate the visual representation result of the preset data visualisation dashboard/display tools based on the required business insights
7. Assessment Criteria	<p>The integrated outcome requirement of this UoCs are the abilities to:</p> <ul style="list-style-type: none"> ● understand the basic functionalities of data visualisation dashboard/displays ● utilise the preset data visualisation dashboard/display tools to obtain the key visual data representations based on the required business insights
8. Remark	

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Develop clear and actionable recommendations based on the analysis results to the stakeholders for decision support
2. Code	111152L6
3. Range	This UoC involves developing the clear actionable recommendations and decision supports based on complex or multiple data analytics output to identify long-term trends with the potential to impact business outcomes
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Utilise extensive knowledge of the organisation context and strategies, the data analytics capability and extensive experience in the practical application of outputs/models</p> <p>6.2 Identifies trends and patterns in complex data sets and the implications for the organisation</p> <p>6.3 Develop actionable insights and decision making supports based on complex or multiple data science/analytics outputs</p> <p>6.4 Utilise organisational and data science/analytics knowledge to identify long-term trends with the potential to impact operational outcomes</p>
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to develop clear actionable recommendations and useful decision supports based on complex or multiple data analytics output to identify long-term trends with the potential to impact business outcomes
8. Remark	

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Keep awareness towards autonomous decision making process on the impact of business
2. Code	111153L6
3. Range	Keep awareness of various issues towards the autonomous decision-making process on the impact of business. Identify the technologies used in the autonomous decision-making process and appraise the relevant ethical challenges. For example, AI is one of the technologies widely used. The relevant ethical challenges include lack of transparency of AI tools, neutrality issues, new concerns for fairness and risk for human rights and other fundamental values
4. Level	6
5. Credit	3 (For Reference Only)
6. Competency	Performance Requirements 6.1 Keep awareness of various issues (See Remark 1) towards autonomous decision making process 6.2 Identify the technologies for system design and analytics tools used in the autonomous decision making process 6.3 Appraise the relevant ethical challenges (See Remark 2) for autonomous systems
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to keep awareness on the feasibility of using autonomous systems in business operations in a responsive and trustworthy fashion
8. Remark	1. The issues include (but not limited to) trends, applicability, insight, etc. 2. For example, AI is one of the technologies widely used. The relevant ethical challenges include lack of transparency of AI tools, neutrality issues, new concerns for fairness and risk for human rights and other fundamental values

Specification of Competency Standards
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Unit of Competency

1. Title	Perform and evaluate the autonomous decision making process
2. Code	111154L6
3. Range	This UoC involves performing the autonomous decision-making process with various approaches (such as AI and data mining) to identify significant patterns, and make probabilistic predictions for business intelligence. Various evaluation methods are used to evaluate the autonomous decision-making process
4. Level	6
5. Credit	6 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the fundamental aspects of autonomy (See Remark 1), classification for autonomy levels and complexity issues of autonomous system design (See Remark 2)</p> <p>6.2 Develop the autonomous decision-making process with various technologies (See Remark 3) to identify significant patterns and make probabilistic predictions for business intelligence</p> <p>6.3 Familiar with various evaluation methods for the autonomous system, including ontology & phenomenology-based method and cognitive & computational-based methods</p>
7. Assessment Criteria	The integrated outcome requirement of this UoC is the ability to develop and perform the autonomous decision making process to obtain significant patterns and probabilistic predictions with trustworthiness and reliability for business intelligence
8. Remark	<p>1. Fundamental aspects of autonomy include (but not limited to) perception, reflection, goal management, planning and self-adaptation.</p> <p>2. Complexity issues of autonomous system design: degree of trustworthiness, autonomic complexity, design complexity and implementation complexity</p> <p>3. The technologies include (but not limited to) statistical machine learning, computer vision, natural language processing, knowledge retrieval and reasoning, formal methods of planning, etc</p>

Specification of Competency Standards
for the Information and Communications Technology Industry
Unit of Competency

1. Title	Verify and validate that the deployed / migrated software and the existing software are functioning properly
2. Code	111159L4
3. Range	Verify and validate that the deployed/migrated software and the existing software are functioning properly in the context of deploying and migrating software
4. Level	4
5. Credit	6 (for reference only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the relationship between the deployed or migrated software with other systems</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ state the features of the newly deployed software ■ state which functionalities from the retired software were replaced by that from the migrated software ■ identify the position of the deployed or migrated software in the integrated environment within an organization <p>6.2 Perform verification and validation on the deployed or migrated software</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ draw up a verification and validation plan on the deployed or migrated software for subsequent verification and validation process ■ trace the recorded results from deployment or migration process and any other traceable reports to determine whether the software was implemented correctly and completely according to defined requirements such as those in the area of <ul style="list-style-type: none"> ◆ Performance ◆ Data security and integrity ◆ Interoperability with other system components <p>6.3 Ensure independent operation in verification and validation process</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ conduct additional tests to verify and testify that the deployed / migrated software and any existing software are functioning properly ■ walkthrough all steps in verification and validation plan ■ review documentary evidence received and fully document audit works ■ ensure audit documentations are properly retained by

	<p>following the organisation's / auditor's guidelines</p> <p>6.4 Verify and validate the deployed / migrated software and the existing software are functioning properly professionally</p> <ul style="list-style-type: none"> ● Be able to verify and validate the deployed / migrated software and the existing software are functioning properly in accordance with organization's guidelines as well as any (local and international) laws and regulatory requirements, if applicable
7. Assessment Criteria	<p>The integrated outcome requirement of this UoC are the abilities to :</p> <ul style="list-style-type: none"> ● confirm that the deployed or migrated software delivers its expected outcomes ● confirm that the deployed or migrated software and the existing software are functioning properly
8. Remark	

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Perform system testing against user, technical and hosting requirements
2. Code	111160L4
3. Range	Identify all elements of the system that need to be tested against user and system requirements, including data that should be used to fully test the system.
4. Level	4
5. Credit	3 (For Reference Only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Have the knowledge to design and develop test plans and software/sensor simulator to facilitate different levels of testing</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ identify the requirements of test plans ■ identify the requirements of software/sensor simulator, if applicable <p>6.2 Perform various levels of testing, which may involve the use of a software/sensor simulator</p> <ul style="list-style-type: none"> ● Be able to: <ul style="list-style-type: none"> ■ design and develop software/sensor simulator, if applicable, to facilitate different levels of testing ■ perform the required testing activities of various levels of testing according to the corresponding test plans <p>6.3 Perform all testing activities in a professional manner</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ perform the testing activities of various levels of testing in an efficient and effective manner ■ ensure that all such testing activities are complied with the organisation's guidelines as well as any (local and international) laws and regulatory requirements, if applicable
7. Assessment Criteria	<p>The integrated outcome requirements of this UoC are the abilities to:</p> <ul style="list-style-type: none"> ● develop appropriate software/sensor simulators, if necessary, for testing purposes; ● perform various levels of testing; and ● document all testing activities in test reports.
8. Remark	Various levels of testing include unit testing, integration testing, system testing – functional testing and performance testing, and user-acceptance testing.

Specification of Competency Standards
for the Information and Communications Technology Industry
Unit of Competency

1. Title	Formulate business strategies and policies
2. Code	111201L6
3. Range	Formulate the business strategies and policies for an organisation in alignment with its approved vision and mission statements by considering the potential impacts and implications of both current and emerging technologies
4. Level	6
5. Credit	6 (for reference only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand business objectives and envisioned future of an organisation</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ articulate the core values and purpose of an organisation ■ articulate the current trends of business and the envisioned future of an organisation <p>6.2 Understand issues related to both business and IT perspectives of the industry</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ understand the issues related to both business and IT perspectives of the industry ■ have insights of technology trends and viability of technology products under market forces ■ understand the potential impacts and implications of current and new technologies in the fields related to the organisation ■ think of possible ways to utilise new technologies in the organisation operation and marketing strategy. <p>6.3 Understand the current development trends of a business</p> <ul style="list-style-type: none"> ● Be able to summarise the business trends related to the organisation ● Aware of the business profile and positioning of the organisation ● Understand and state up to date with the business field related to the organisation <p>6.4 Understand the ICT applications related to a business</p> <ul style="list-style-type: none"> ● Be able to summarise the ICT applications related to the operational aspect of the organisation ● Consider and make suggestions on updating current or adopting new technologies to enhance the operation and governance aspect of the organisation

	<p>6.5 Analyse the strengths, weaknesses, opportunities and threats (SWOT) of an organisation</p> <ul style="list-style-type: none"> ● Be able to perform a SWOT analysis for an organisation to develop business strategies and policies that bring reasonable and acceptable return of investment (ROI) <p>6.6 Formulate strategies and policies for the sustainability of the business</p> <ul style="list-style-type: none"> ● Be able to <ul style="list-style-type: none"> ■ formulate the strategies and policies for the long-term sustainability of the business taking into consideration Business-IT alignment and enablement ■ formulate partnership/alliance strategies with external partners like vendors/suppliers, investors, distributors to win the market ■ carry out the above in accordance with the organisation's business goals, objectives, policies and guidelines as well as any (local and international) laws and regulatory requirements, where applicable <p>6.7 Formulate ideas where IT can help the growth of the business</p> <ul style="list-style-type: none"> ● Be able to identify and think of ways to update and implement technologies that could strengthen the operational goal and governance of the organisation
7. Assessment Criteria	<p>The integrated requirements of this UoC are the abilities to :</p> <ul style="list-style-type: none"> ● formulate business strategies and policies for an organisation in alignment with its approved vision and mission statements to support its sustainable development ● suggest updates to current technologies and adaptation of new technologies that could assist the development and governance of the organisation
8. Remark	<p>Some examples of emerging ICT technologies are:</p> <ul style="list-style-type: none"> ● Artificial intelligence and machine learning ● Cloud computing ● Internet of things ● Security and automation

Specification of Competency Standards
for the Information and Communications Technology Industry
Unit of Competency

1. Title	Review and comply with organisational policies and procedures, relevant laws and regulatory requirements
2. Code	111205L6
3. Range	This UoC involves reviewing practices to ensure that the service delivered adhere to the organisational policies and procedures, relevant laws and regulatory requirements
4. Level	6
5. Credit	6 (for reference only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Have knowledge of organisational practices, infrastructures, policies and procedures</p> <ul style="list-style-type: none"> ● know the operational structure of the organisation ● aware of the different technologies, tools, equipment and online services that are related to the service or tasks delivered ● understand the organisation's policies, procedures and goals ● observe organisational practices and procedures <p>6.2 Have knowledge of relevant laws and regulatory requirements related to the industry of the organisation</p> <ul style="list-style-type: none"> ● comprehend the latest regulatory requirements applicable to the organisation, including but not limited to: <ul style="list-style-type: none"> ■ Intellectual property right protection ■ Personal data (Privacy) ordinance ■ National security law ■ Telecommunications ordinance ● refer to the appropriate experts for guidance where necessary <p>6.3 Review and comply with organisational policies and procedures, relevant laws and regulatory requirements</p> <ul style="list-style-type: none"> ● Identify the applicable laws and compliances ● observe and adhere to relevant policies and procedures, laws and regulations in an efficient and effective manner ● take the initiative to improve the organisation's policies and procedures where appropriate ● obtain the endorsement of relevant stakeholders ● obtain prior approvals for system resources and access, such as communication protocols and ports, data storage, online services,

	<p>other system peripherals, computer time as well as data of another person</p> <ul style="list-style-type: none"> ● review practices, identify and rectify any noncompliance procedures ● make use of tools, infrastructures, equipment and online services available to enhance the service delivered ● make suggestions to enhance existing or purchase of new tools, infrastructures, equipment and online services if it helps to improve on the compliance to related regulations or the effectiveness of the service delivered ● make effective and efficient use of external experts where necessary to meet its business goals and objectives ● report serious misconducts and noncompliance procedures to relevant management and suggest methods to avoid future occurrences (such as provide training programs or workshops to highlight issues to relevant personnel)
7. Assessment Criteria	<p>The integrated requirements of this UoC are the abilities to :</p> <ul style="list-style-type: none"> ● review of own practices; identify and rectify any noncompliance procedures ● comply to organisational policies and procedures, relevant laws and regulatory requirements ● obtain prior approval for system access and resources according to the aforementioned policies and requirements ● Utilise existing resources and make suggestions on updating or acquiring new resources to enhance the service delivered and adhesion to various related policies and regulations ● Report serious misconducts and noncompliance procedures to relevant management and suggest methods to avoid future occurrences (such as provide training programs or workshops to highlight issues to relevant personnel)
8. Remark	

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Review the emerging technologies and cross-functional strategies
2. Code	111207L6
3. Range	Review cross-functional strategies to enable an organisation to identify suitable emerging technologies for supporting its business strategies
4. Level	6
5. Credit	3 (for reference only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand issues associated with emerging technologies</p> <ul style="list-style-type: none"> ● evaluate the values of the emerging technologies with respect to business-technology alignment and enablement of the organization ● understand the deployment procedures of the emerging technologies ● keep updated of the application development areas of various emerging technologies, including but not limited to: <ul style="list-style-type: none"> ■ Artificial intelligence and machine learning ■ Cloud computing ■ Internet of things ■ Security and automation ■ Streaming technologies ● aware of the data security and privacy concerns in the domains of various emerging technologies <p>6.2 Review cross-functional strategies for deploying and managing the emerging technologies</p> <ul style="list-style-type: none"> ● review the organization business strategies, and conduct a mapping between the possible application areas of emerging technologies with the business strategies ● setup a clear digital strategy, if necessary, to <ul style="list-style-type: none"> ■ identify the appropriate technology applications for different operations of the organization ■ prioritize projects that require cross-functional collaboration ■ setup the project management team for cross-functional projects
7. Assessment Criteria	<p>The integrated outcome requirements of this UoCs are the abilities to</p> <ul style="list-style-type: none"> ● conduct a mapping between the possible application areas of emerging technologies with the business strategies ● setup digital strategy to support the deployment and management

	of cross-functional projects
8. Remark	

Specification of Competency Standards
for the Information & Communications Technology Industry
Unit of Competency

1. Title	Review the ethical and social issues for IT applications
2. Code	111208L6
3. Range	This UoC involves reviewing/addressing the social, environmental, political and legal challenges related to the emergence and convergence of information and communication technologies from the point of view of morality and ethics.
4. Level	6
5. Credit	3 (for reference only)
6. Competency	<p>Performance Requirements</p> <p>6.1 Understand the moral and ethical dimensions for IT applications</p> <ul style="list-style-type: none"> ● identify and understand the major moral and ethical dimensions that tie together ethical, social, and political issues in IT applications including <ul style="list-style-type: none"> ■ Information rights and obligations ■ Property rights and obligations ■ Accountability and control ■ Application/system quality ■ Culture and lifestyle: economic disparity, equality and ethnicity on rights ● understand the impacts from technology advancement on individual and society such as data collection and analysis, privacy invasion etc. <p>6.2 Review the ethical and social issues for an organisation</p> <ul style="list-style-type: none"> ● review the IT applications and/or processes within the organization from the point of view of morality and ethics ● identify and properly record any shortfalls relevant to moral and ethical considerations <p>6.3 Exhibit Professionalism</p> <ul style="list-style-type: none"> ● always look after the interest of the organisation as well as customers.
7. Assessment Criteria	The integrated outcome requirements of this UoC is the ability to review the social, environmental, political and legal challenges related to IT applications/systems to support organisation's business strategies from the point of view of morality and ethics
8. Remark	

**Information and Communications Technology Industry Training Advisory Committee
Software Products and Software Services (SW) branch
Unit of Competencies**

1. Title	Establish a business case for an IT investment	
2. Code	ITSWG617A	
3. Range	Establish a business case for an IT investment for the organization including the assessment criteria [Generic Skills – Financial Management]	
4. Level	6	
5. Credit	11	
6. Competency	<p>6.1 Have good mastery on basic investment concepts</p> <p>6.2 Establish business cases</p> <p>6.3 Develop assessment criteria</p>	<p><u>Performance Requirement</u></p> <p>Be able to</p> <ul style="list-style-type: none"> ▪ comprehend qualitative finance and investment concepts ▪ master basic quantitative finance techniques and ratios <p>Be able to</p> <ul style="list-style-type: none"> ▪ identify the development as either an infrastructure groundwork or application development ▪ understand the importance / benefits of IT development toward organizational objectives ▪ develop the storyline for the business case <p>Be able to</p> <ul style="list-style-type: none"> ▪ list the qualitative benefits to the organization ▪ quantify the benefits wherever possible ▪ establish baseline ratios for assessment
7. Assessment Criteria	The integrated outcome requirements of this UoCs are the abilities to: (i) establish the business case for the software/system development; and (ii) develop assessment criteria and their baselines.	
Remark		