Department of Science, Information Technology and Innovation

Queensland Government Chief Information Office

Queensland Government Enterprise Architecture

Queensland Government Technology classification framework

Final

April 2015

v4.0.1

PUBLIC

**Queensland
Government**

Document details

Security classification	PUBLIC
Date of review of security classification	April 2015
Authority	Queensland Government Chief Information Officer
Author	Queensland Government Chief Information Office
Documentation status	☐ Working draft ☐ Consultation release ☑ Final version

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Acknowledgements

This version of the *Queensland Government Technology classification framework* was developed and updated by Queensland Government Chief Information Office.

Feedback was also received from a number of agencies, which was greatly appreciated.

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Information security

This document has been security classified using the Queensland Government Information Security Classification Framework (QGISCF) as PUBLIC and will be managed according to the requirements of the QGISCF.

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1.1   Purpose

A Queensland Government Enterprise Architecture (QGEA) guideline provides information for Queensland Government agencies on the recommended practices for a given topic area. Guidelines are generally for information only and agencies are not required to comply. They are intended to help agencies understand the appropriate approach to addressing a particular issue or doing a particular task.

This document provides a short narrative describing each of the ICT technology domains defined within the Queensland Government Technology classification framework.

1.2   Audience

This document is primarily intended for agency staff involved in ICT planning or technology architecture related activity. This may include:

- chief information officers (CIOs)
- information standard or policy officers
- records managers
- library managers
- architects (enterprise, information, application, technology and solution).

1.3   Scope

This guideline relates to the Technology domain of the QGEA.

It should be noted that not all ICT technology domains are applicable to all departments within the Queensland Government. The determination of applicable domains is performed via ICT planning.

2   Overview of the framework

The Technology classification framework (the framework) defines the Queensland Government's generic classification scheme in terms of infrastructure systems including software, hardware and services to support business applications.

The goal of the framework is to allow a common viewpoint and understanding of the technology domains across the Queensland Government. This in turn aids standardisation as various stakeholders come to understand the possibilities for leveraging related domain activities in other departments.

This framework provides a taxonomy for categorising infrastructure technologies. It should not be used to categorise business processes or business applications which are covered by other frameworks within the QGEA.

The technology domains cover broad based or commodity products. It is unlikely that any agency would actually construct a product within any of the technology domains, although many will need to deal with implementation and integration issues between products in these domains.

The domains are primarily segmented along the lines of how technology vendors choose to bundle and target their offerings to business and government. Consequently, this domain

partitioning is not a pure technology layering along the lines of: hardware, embedded software, software (operating system, utilities, frameworks, applications), scripts and properties, because that is not how vendor offerings are typically segmented. Many vendors offer a top-to-bottom solution within their area of specialty. For instance, Cisco provides a full hardware and software technology stack within the network space.

Nor is the technology domain partitioning a pure functional segmentation along the lines of: data tier, application tier and presentation tier because many vendors offer packaged solutions that range across these tiers. For example, Microsoft Exchange and Microsoft Outlook would sit in different domains under this model but the objective of the Queensland Government Technology classification framework is that related offerings that support a single business application or business objective sit within a single domain.

Specific criteria to assist with the identification of technologies are as follows:

- software and hardware required to manage applications and other technologies
- software required to design and develop business applications
- general purpose out-of-the-box software that is commonly available and can be deployed to anyone in the organisation without the need for a business case or justification
- out-of-the-box software that does not embed a business process and is not mandated by the organisation to perform a specific function (e.g. project management)
- desktop and server software that forms part of the standard operating environment
- special purpose software such as graphics and design tools that do not include a customised user front-end
- back end platforms required to support applications that can be differentiated from the application and are technologies.

3   Queensland Government Technology classification framework

The current version of the Technology classification framework is shown in figure 1 on page 6.

Departmental technology portfolios are typically a subset of this diagram as any given department may not require all of the ICT technology domains.

The framework presents ICT technology domains at three levels of detail. Level 1 domains are the topmost and define a coarse segmentation of technologies. Each of the level 1 domains is further segmented into a number of level 2 domains which define a more focussed set of technology functionality. The level 2 domains may be further divided up into finer classifications of technology offerings (level 3 domains).
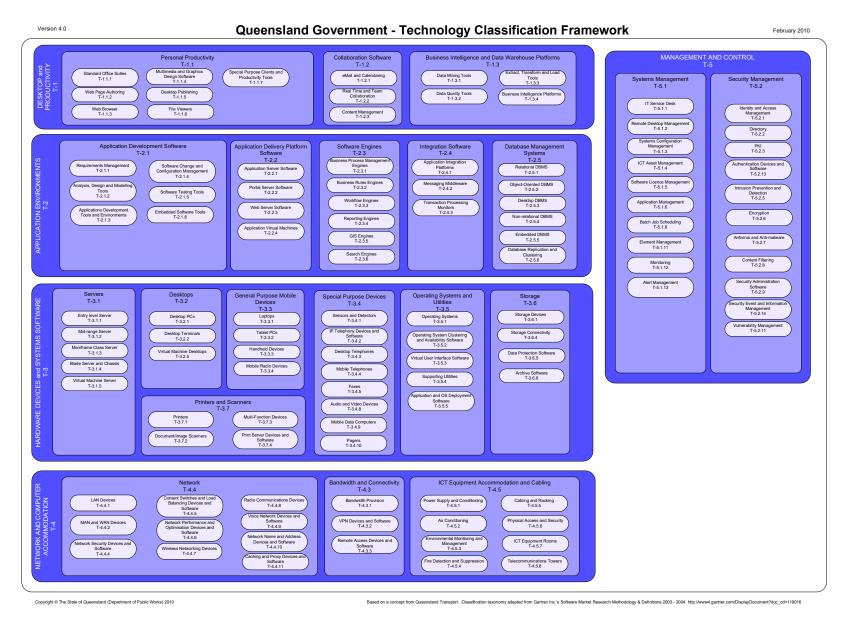
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Figure 1: Queensland Government Technology classification framework diagram

T-1 Desktop and productivity

Desktop and productivity covers those elements that are directly used by business users.

Domain	Description	Number
Personal Productivity	This domain comprises all technology elements that support personal productivity including office suites, multimedia graphics and design suites, web page authoring packages, publishing packages and file viewers.	T-1.1
Standard Office Suites	This domain describes a core desktop productivity system which is made up of a number of tools such as a word processor and a spreadsheet. Some degree of integration usually exists between the separate tools. An example of a standard office suite is Microsoft Office, which contains the word processor Microsoft Word and the spreadsheet Microsoft Excel. The database tool MS Access, for organising, accessing and sharing information, is included under another domain 'Desktop DBMS'.	T-1.1.1
Web Page Authoring	This domain includes technologies that allow a document creator to mark up (that is, annotate in a machine-readable way) a document to allow the document content to be presented in a format suitable for the Internet. This domain typically refers to standalone authoring suites. Authoring suites integrated into content management systems would normally appear in the content management domain. The most common example is the marking up of a plain text document, using HTML, so that it can be displayed on a screen as hypertext (that is, a web page in HTML format). An example of a web page authoring tool is Adobe Dreamweaver (for HTML).	T-1.1.2
Web Browser	This domain includes software programs used to locate and display information on the internet or on an intranet. Most browsers can display graphics, photographs and text; multimedia information (such as sound and video) may require additional software, known as plug-ins. Examples include Microsoft Internet Explorer and Firefox.	T-1.1.3
Multimedia and Graphics Design Software	This domain includes products that enable users to produce and edit content in a variety of presentation formats including sound, still images, video images and, animations. Examples include Adobe Photoshop and Fireworks.	T-1.1.4
Desktop Publishing	This domain includes software that creates high-quality publications combining text and graphics in a sophisticated layout following design standards. Desktop publishing often allows a single individual to create publications that would have previously required expensive printing equipment and a full team of publishing staff. Examples of desktop publishing tools include Adobe InDesign and QuarkXpress.	T-1.1.5

Domain	Description	Number
File Viewers	This domain includes software products that enable users to open and display contents of files originally stored in a variety of formats including text as well as multimedia file formats such as sound, video images, photographic images, still images or animations. Examples of file viewers include IrfanView, Adobe Acrobat Reader and Macromedia Flash.	T-1.1.6
Special Purpose Clients and Productivity Tools	This domain includes out-of-the-box desktop productivity tools deployed to specific users to perform specific functions not already covered in the other desktop productivity categories. Examples include mind mapping tools such as Mind Map. This domain also includes special purpose clients, such as front-end GIS products.	T-1.1.7
Collaboration Software	This domain comprises all technology elements that support group productivity and interaction between participants such as email, content management, file sharing, instant messaging and team collaboration environments.	T-1.2
Email and Calendaring	This domain includes email tools to support electronic mail, including composing, sending and receiving messages, managing messages and managing electronic mail address lists. Calendaring tools provide support for the managing of calendars (diaries), creating appointments and events, and organising and scheduling of meetings. An example is Microsoft Outlook. This domain also includes server components, for example, Microsoft Exchange.	T-1.2.1
Real Time and Team Collaboration	This domain includes tools to support people working together even though they may be separated physically and geographically. Workers can work with each other, with clients, or with partners from their desktop, swapping ideas, resolving ideas, sharing information, marking up files or collaborating with whiteboards. Examples of real time collaboration tools include Microsoft's Live Communications Server which provides presence awareness and instant messaging, and Microsoft's Live Meeting, a web conferencing tool for meeting with large or small groups in different locations, with each participant working from her or his desktop. Videoconferencing software is another example of real time collaboration tools. Examples of team support tools include Microsoft Windows SharePoint Services and Lotus Quickplace.	T-1.2.2
Content Management	This domain generally refers to applications for managing content intended to be published, typically over the Web or to the processes and workflows involved in organising, categorising and structuring information resources so that they can be stored, published and reused in multiple ways. A Content Management System (CMS) is used to collect, manage and publish content, storing the content either as components or whole documents, while maintaining the links between components. A CMS may include integrated authoring tools that support the design, creation, capture, editing, and integration of information from discrete multi-media components, often to produce a web site.	T-1.2.3

Domain	Description	Number
	An example of a content management system is the Interwoven product suite.	
Business Intelligence and Data Warehouse Platforms	This domain includes software tools that allow the storage, access and analysis of data in a data warehouse. They include online analytical processing tools (OLAP), data mining tools, executive information systems, data extraction, query and reporting tools, multidimensional tools and decision support systems.	T-1.3
Data Mining Tools	This domain includes tools to support the process of extracting patterns and trends from data. Often it refers specifically to the processing of large amounts of data stored in specific data mining repositories or data warehouses. SAS Enterprise Miner is an example.	T-1.3.1
Data Quality Tools	This domain includes tools to support the analysis, cleansing and standardisation of data to improve its utility for data mining by identifying and rectifying problems such as duplicate records, erroneous data, redundant data, inconsistent data and different instances of names and addresses for the same data entity. An example of a data quality tool is the SAS Data Quality Solution.	T-1.3.2
Extract, Transform and Load Tools	This domain includes tools which support the conversion and transformation of data and its associated metadata from one source to another. Often used for migrations from an old system to a new one, or for moving data from an operational system to a data warehouse or other analysis repository. The SAS Enterprise ETL Server is an example of an Extract, Transform and Load (ETL) tool.	T-1.3.3
Business Intelligence Platforms	This domain includes software that provides an integrated set of enhanced query, reporting, and possibly, OLAP tools. This includes the platforms on which the enterprise Business Intelligence (BI) capability is built. An example of BI software includes SAS BI Suite and SAP Business Information Warehouse.	T-1.3.4

T-2 Application environments

This Level 1 domain covers framework and other supporting software for the development and deployment of application software. Products that service this domain typically offer significant bundled functionality, but are not used directly by business end-users.

Domain	Description	Number
Application Development Software	This domain comprises all those elements relating to the specification, design, construction, implementation and lifecycle management of software applications.	T-2.1
Requirements Management	This domain includes tools that support the requirements gathering phase of the application development life cycle, the purpose of which is to record the stakeholders' requirements for the system which is to be developed. Tools may assist with the capture of requirements, management of requirements changes, tracing of the initial requirements to individual pieces of functionality in the final system, and management of the document lifecycle for requirements generally. Borland's CaliberRM is a requirements management tool.	T-2.1.1
Analysis, Design and Modelling Tools	This domain includes tools that support the analysis and design phases of the traditional software development life cycle. Examples are IBM's Rational Rose Data Modeller (a visual modelling tool for database analysts and designers) and Rational Rose XDE Modeller (a model-driven development tool for analysts and designers, based on UML – the Unified Modelling Language).	T-2.1.2
Applications Development Tools and Environments	This domain includes integrated sets of tools that enable software programming, packaging, testing, and distribution. These tools are used by software developers in building software applications in an integrated development environment. Examples include Borland's Jbuilder, Microsoft's Visual Studio .NET and Sybase PowerBuilder.	T-2.1.3
Software Change and Configuration Management	This domain includes tools that provide automated support for managed change, configuration or version control of software assets. An example is IBM's Rational ClearCase.	T-2.1.4
Software Testing Tools	This domain includes tools that provide automated support for the software testing cycle and include such facilities as the management of the overall test process, test development, capture/development of test scripts, replay of test scripts and test case generation for various kinds of testing including unit testing, system testing, regression testing, and integration testing. An example is HP's Business Process Testing, and Functional Testing software.	T-2.1.5
Embedded Software Tools	This domain includes software development tools that manage the embedded software development lifecycle: analysing, designing, documenting, writing, compiling, debugging, testing, optimising and verifying software. An example is the multi-embedded software	T-2.1.6

Domain	Description	Number
	development environment from Green Hills Software Inc.	
Application Delivery Platform Software	This domain includes the essential software infrastructure products that enable the running of business applications. Types of application delivery platform software include application server software, portal server software and web portal software.	T-2.2
Application Server Software	This domain includes system software used to host the business logic tier of applications, or to host application services. BEA WebLogic Server is an example of an application server.	T-2.2.1
Portal Server Software	This domain includes software to support the development, deployment and operation of a portal environment, supplying aggregation and presentation capabilities that enable users to see relevant information and personalise their environments to best meet their needs and facilitate ease of use. It provides such capabilities as centralised identity services that manage users, roles, policies, and aggregation and presentation capabilities. IBM WebSphere Portal and Microsoft SharePoint are examples of portal server software.	T-2.2.2
Web Server Software	This domain includes servers that centrally host and serve web pages. The web server software uses the client/server model and the Hypertext Transfer Protocol (HTTP) and serves the files that form web pages to web users (whose computers contain HTTP clients that forward their requests). An example is the Apache HTTP Server.	T-2.2.3
Application Virtual Machines	A process Virtual Machine (VM), sometimes called an application virtual machine, runs as a normal application inside an Operating System (OS) and supports a single process. It is created when that process is started and destroyed when it exits. Its purpose is to provide a platform-independent programming environment that abstracts away details of the underlying hardware or operating system and allows a program to execute in the same way on any platform. A process VM provides a high-level abstraction – that of a high-level programming language. This type of VM has become popular with the Java programming language, which is implemented using the Java virtual machine. Another example is the .NET Framework, which runs on a VM called the Common Language Runtime.	T-2.2.4
Software Engines	This domain includes software that enables the delivery of components of an application system through a software engine that interprets configuration information (sometimes created through an associated development tool like a business process modelling tool associated with a business process engine) in order to provide the functionality required for the application.	T-2.3

Domain	Description	Number
Business Process Management Engines	This domain includes software engines for the execution of business processes defined in models. Products in this domain generally comprise a set of services and tools that provide for process management, workflow and application integration. It has evolved from the merging of process technology covering three kinds of interaction: a) people-to-people; b) system-to-system; and c) system-to-people, from a process-centric perspective [based on Gartner]	T-2.3.1
Business Rules Engines	This domain includes software engines used to record, track, manage and revise enterprise business processes, without having to modify the software application itself. Rules are set to stipulate and outline processes and the Business Rule Engine (BRE) externalises these rules for quick and easy modification. BREs (also known simply as rule engines) are tools which manage rules which define processes. BREs can be used in conjunction with other business oriented tools such as Business Activity Monitoring (BAM), workflow engines and Business Process Management (BPM) tools. Examples include ILOG's Business Rule Management System (BRMS) and Blaze Advisor.	T-2.3.2
Workflow Engines	This domain includes software engines that support workflow management which can be of two types: • Internal and external process integration – a workflow approach that allows for the definition of business processes that span applications, including those that come from different vendors. This usually requires a standards-based commercial workflow development environment. • Workflow engines automate, manage and execute business tasks and processes and events by executing a defined sequence of tasks which can include saving, modifying or generating files, sending, responding and receiving emails, and escalating or progressing approvals. Enhydra Shark and OpenSymphony OSWorkFlow are examples of Open Source workflow engines written in Java.	T-2.3.3
Reporting Engines	This domain includes software engines for the generation of reports. Reports are usually defined through a report modelling tool and their execution can be triggered either through direct interaction with the reporting tool or through an Application Programming Interface (API) call from other software in which the engine is embedded. An example of a reporting engine is Crystal Reports.	T-2.3.4

Domain	Description	Number
GIS Engines	This domain includes server and desktop engines that combine relational databases with spatial interpretation and produce outputs in the form of maps. GIS engines capture, store, integrate, analyse and display data that is spatially referenced.	T-2.3.5
Search Engines	This domain includes tools to support both searching and indexing capabilities. A search engine is a tool used to help find information on the internet, intranet or in databases and file servers. Each search engine has its own way of gathering, classifying, and displaying information to the user. An example of an indexing search engine is Oracle Ultrasearch.	T-2.3.6
Integration Software	This domain includes platforms and other software for integrating ICT applications and systems.	T-2.4
Application Integration Platforms	This domain includes middleware products (also known as an Integration Broker Suite or IBS) that combine the core functionality of an integration broker (an engine that provides message transformation and intelligent routing services) with additional features to deliver comprehensive integration capabilities. These additional features may include various interface and integration adapters, communication middleware, orchestration, choreography, business process management and message warehousing. This domain also includes adaptors and connectors that combine design tools and runtime software that link applications to the enterprise messaging infrastructure, and ORBs (Object Request Broker) that allow objects to communicate with other software. An example is the Oracle/BEA WebLogic Integration Suite.	T-2.4.1
Messaging Middleware	This domain includes integrated Message-Oriented Middleware (MOM) that covers applications that manage the asynchronous delivery of messages and message replies. This differs from other forms of program-to-program middleware which are connection oriented and synchronous in nature. MOM receives messages and then ensures the delivery to the appropriate receivers independently of the message originator. IBM WebSphere MQ is an example.	T-2.4.2
Transaction Processing Monitors	This domain includes applications that manage transactions end to end, ensuring integrity and performance usually in complex distributed environments. They are often used to monitor information processing that must occur within a defined, predictable and near real time manner. Examples include Oracle/BEA's Tuxedo and IBM's CICS.	T-2.4.3
Database Management Systems	This domain includes different types of database management systems and related technologies.	T-2.5

Domain	Description	Number
Relational DBMS	This domain includes Database Management Systems (DBMS) in which the data is organised according to relationships between data entities as defined in a relational data model. Relational DBMS systems normally support a Structured Query Language (SQL) application programming interface. An example is Oracle's 9i Database.	T-2.5.1
Object-Oriented DBMS	This domain includes DBMS that apply an Object-Orientated (OO) paradigm to the storage, retrieval and management of data and are usually used to support object-oriented programming languages. Objective DB is an example.	T-2.5.2
Desktop DBMS	This domain includes DBMS that run on a desktop operating system such as Microsoft Windows. To be classified as a desktop DBMS, a product would need to be designed for single-user access only and, in particular, not for remote access. An example is Microsoft Access.	T-2.5.3
Non-Relational DBMS	This domain includes any DBMS that is not a relational DBMS as defined above. It may, for example follow the hierarchical or network database models. An example is IBM Lotus Notes.	T-2.5.4
Embedded DBMS	This domain includes software that is embedded within an application or a device and acts as a component of that application or device. Typically, embedded DBMSs are high-performance, have a small footprint and require no administration. The DBMS is transparent to the user, and customers for the embedding application or device do not have to purchase a separate DBMS licence. Examples are Daffodil DB Embedded Database and Birdstep RDM Embedded.	T-2.5.5
Database Replication and Clustering	This domain includes DBMS architectures that support high-availability and fault-tolerant systems. In general, clustering means that multiple servers are arranged to access a single copy of the database. Each server is able to carry part of the application workload – if one fails, the workload is shared across the remaining servers. Replication achieves similar objectives by implementing multiple instances of the database; database objects are copied and maintained in multiple databases that make up a distributed database system. An example of a system that implements replication and clustering is Oracle Parallel Server.	T-2.5.6

T-3 Hardware and virtual devices and systems software

This Level 1 domain comprises base level system functionality. Business applications may run directly on technology elements from this domain, or they may run on technology elements from the Application Environments domains which in turn run on technology elements from this domain.

Domain	Description	Number
Servers	This domain includes server hardware including entry-level server, mid-range server, mainframe class server and blade servers, as well as virtual servers.	T-3.1
Entry Level Server	These are desktop or workgroup servers that provide services to desktop workstations including the hosting of email, hosting of directories and authentication mechanisms, provision of application and operating system development infrastructure, provision of file storage services and provision of print services. These are server class machines that typically feature multiple high-throughput processors, large memory capacity, large capacity high speed storage, redundant components for high availability, fast bus speeds and high transfer rates. Examples include IBM Intel based xSeries servers. An initial purchase price cut-off of $15,000 can be used as a rule of thumb for separating them from the mid-range offerings.	T-3.1.1
Mid-range Server	This domain includes computers or servers that fall into the range above entry level servers on the low end and below mainframe servers at the high end. Mid-range systems may or may not run proprietary operating systems. Examples include IBM's pSeries p6 570. Blade servers and chassis are not considered to be midrange servers.	T-3.1.2
Mainframe Class Server	This domain includes large-capacity computer systems designed to serve large numbers of multiple users, and are typically deployed in a centralised manner to handle enterprise-wide applications. They may require specialised and specific cooling and power. Mainframe servers will be defined as such by the manufacturer. Examples include IBM's z10, HP Superdome.	T-3.1.3
Blade Server and Chassis	Blade servers are self-contained all-inclusive computer servers with a design optimised to minimise physical space. A blade enclosure, which can hold multiple blade servers, provides services such as power, cooling, networking, various interconnects and management.	T-3.1.4
Virtual Machine Server	Virtual machines (sometimes called hardware virtual machines) allow the sharing of the underlying physical machine resources between different virtual machines, each running its own operating system. The software layer providing the virtualisation is called a virtual machine monitor or hypervisor. A hypervisor can run on bare hardware or on top of an operating system. Examples include Vmware's ESXi.	T-3.1.5

Domain	Description	Number
Desktops	This domain includes desktop PC and alternative technologies that provide a similar capability.	T-3.2
Desktop PCs	This domain includes microcomputers designed primarily for individual use which remain more or less permanently on an office worker's desk; sharing resources with another computer is optional. It is not designed for portability and is usually permanently linked to the enterprise network.	T-3.2.1
Desktop Terminals	This domain includes terminals with little or no software of their own that rely on a mainframe or another computer (such as a PC server) for its intelligence. This domain includes dumb terminals and thin client network computers.	T-3.2.2
Virtual Machine Desktops	A virtual desktop is a running instance of a desktop operating system that has its own BIOS, chipset, disk drives and network. Although these devices are all virtual devices, they look, act and function just like their real counterparts. The operating system running on a virtual desktop has no idea what sort of machine it is running on www.sarcom.com. Examples include Vmware's Workstation product.	T-3.2.3
General Purpose Mobile Devices	This domain includes portable and mobile generic computing devices. These generally have some capability to install applications to provide specialist functions.	T-3.3
Laptops	A laptop computer, also known as a notebook computer, is a small personal computer designed for mobile use. A laptop integrates all of the typical components of a desktop computer, including a display, a keyboard, a pointing device (a touchpad, also known as a trackpad, or a pointing stick) and a battery into a single portable unit. The rechargeable battery is charged from an AC/DC adapter and has enough capacity to power the laptop for several hours. A netbook is a light-weight, low-cost, energy-efficient, highly portable laptop suitable for web browsing, email and general purpose applications. To achieve its small form factor, low weight and affordability, netbooks offer fewer features, less processing power and a reduced ability to run resource-intensive operating systems.	T-3.3.1
Tablet PCs	This domain includes computing devices that are operated by direct screen contact via a pen or touch interface. An example is the Lenovo Thinkpad X200t.	T-3.3.2

Domain	Description	Number
Handheld Devices	This domain also includes computing devices that can be held in the palm of the hand and that offer advanced capabilities, often with PC-like functionality. They typically use a touch screen or stylus device for data entry and navigation. Examples include the BlackBerry series of smart phones, or TomTom GPS navigation systems. Modern mobile phones may also be considered a handheld device if they incorporate networking capability and support mobile productivity applications, email, and internet access. Classification of the asset should be based on its dominant use.	T-3.3.3
Mobile Radio Devices	This domain includes two-way radio devices that are manufactured to be installed in vehicles. They may be analogue or digital radio devices that can communicate via a radio repeater or directly between devices on selected Australian Communications and Media Authority (ACMA) licensed frequencies. Mobile radios are also often installed in a fixed site location such as a building.	T.3.3.4
Special Purpose Devices	This domain includes various other special purpose devices that don't fit under the other more generic domains. These include remote sensors, dedicated IP telephony video devices, desktop telephones, mobile telephones, faxes and other audio and video devices.	T-3.4
Sensors and Detectors	This domain includes dedicated devices that are used for the measurement of some phenomena such as temperature, precipitation or water level. In general, as well as a data capture facility, the device has some means of storage to allow the recording of data, and a telecommunications capability for reporting the captured data back to either a central location or data capture device. This domain would also include Radio Frequency Identification tags and detectors (scanners), as well as GPS based tracking systems.	T-3.4.1
IP Telephony Devices and Software	This domain includes devices that support voice and video communications by means of the Internet Protocol (IP), bypassing the public switched telephone network (PSTN) and its associated charges. Examples include various softphones, the Cisco 7900 series IP phones and Cisco's Unified Video Advantage software.	T-3.4.2
Desktop Telephones	This domain relates to the familiar everyday stand-alone telephone handset that is used for voice communications. It is stand-alone in the sense that it is not incorporated into another device such as a personal computer.	T-3.4.3
Mobile Telephones	This domain includes portable wireless telephones that allow voice communication via radio signals through special ground stations that cover areas known as cells and are linked with the public telephone system. Most mobile telephones offer Short Messaging Service (SMS) for sending and receiving brief text messages. Modern mobile phones may also be considered a 'handheld device' if they incorporate networking capability and support mobile	T-3.4.4

Domain	Description	Number
	productivity applications, email, and internet access. Classification of the asset should be based on its dominant use. This domain also includes SMS gateways that transform messages to mobile network traffic. Typical use of a gateway would be to forward simple email to a mobile phone recipient.	
Faxes	This domain includes devices for the telephonic transmission of scanned-in printed material (text or images), usually to a telephone number associated with a printer or other output device. This domain also includes fax gateways that transform messages to faxes and transmit them over fax-capable modems. Fax gateways also receive faxes, and transmit them as attachments to emails over the IP network. Examples include Kofax (Topcall) software.	T-3.4.5
Audio and Video Devices	This domain includes devices not captured by the above headings including projectors, cameras, and teleconferencing equipment.	T-3.4.8
Mobile Data Computers	The Mobile Data Computer or terminal is a vehicle-mounted device that facilitates messaging, electronic dispatching, vehicle monitoring, and GPS-based vehicle tracking.	T-3.4.9
Pagers	This domain relates to pagers, which are a simple personal telecommunications device for receiving (and sometimes sending) short messages. Pagers mainly support the critical messaging markets, such as emergency service personnel, medical personnel, and information technology support staff. Examples include the Apollo range of paging devices and systems.	T-3.4.10
Operating Systems and Utilities	This domain includes operating systems and related software.	T-3.5
Operating Systems	This domain includes the main control programs that manage the operation of the computer hardware including memory, storage, networking and input and output, and interfaces the hardware to the applications and users. This domain is primarily focused on general or multi-purpose operating systems, such as IBM's AIX mid-range server operating system, Novell Netware, and Microsoft Windows for personal computers.	T-3.5.1
Operating System Clustering and Availability Software	This domain refers to software systems that manage a group of loosely-coupled servers so as to maximise availability or up time and/or share the workload; the clustered servers often share common disk storage. Cluster Manager from Red Hat is an example.	T-3.5.2

Domain	Description	Number
Virtual User Interface Software	This domain includes software that enables an enterprise to provide application access for many desktops from one centralised location, reducing the cost of provisioning desktops individually and allowing configuration and management from the central site, under the thin client model. An example is the Citrix MetaFrame Access Suite.	T-3.5.3
Supporting Utilities	This domain includes tools that work together with the core operating system to provide certain functions to users of a computer. Examples include WinZip, a file compression utility, and terminal emulation software such as PuTTY, or Reflections.	T-3.5.4
Application and OS Deployment Software	This domain includes facilities that are designed to allow the distribution and deployment of software and the associated upgrades, from a central site to a number of remote installations. This is done in a managed way so that the central site has tight control over the particular software configurations and versions loaded onto the remote machines. An example is Microsoft's System Centre Configuration Manager.	T-3.5.5
Storage	This domain includes storage devices and related connectivity and software.	T-3.6
Storage Devices	This domain includes physical storage resources and devices which are part of storage architecture and are attached to a storage interconnection network. Physical storage resources often have a high degree of redundancy, including multiple network connections and data redundancy functions (via RAID), all aimed at delivering highly available storage services. The devices typically provide a means to persistently retain data over a long time period. Examples include disk drives, disk arrays, storage controllers, array controllers, tape drives, tape libraries and a wide range of storage appliances such as Network Attached Storage (NAS) appliances. This domain should also include firmware and similar operating software, such as the Brocade Fabric OS.	T-3.6.1
Storage Connectivity	This domain includes the infrastructure and embedded software that connects elements of the storage environment. These technologies may be primarily used for access to storage devices or shared with other functions. The important characteristic is that they provide rich, high-performance, scalable connectivity upon which a storage environment can be based. The Storage Connectivity domain often provides the ability to implement multiple connections from a host, thus providing another element of redundancy for high availability environments by enabling the use of multi-path I/O software on the host, which may also provide load balancing among the redundant paths. The physical-layer network technologies that are typically (or have been) used to provide this capability include Fibre Channel, Fast and Gigabit Ethernet, InfiniBand and VAX CI network.	T-3.6.4

Domain	Description	Number
Data Protection Software	Data protection software will produce, through some method, a collection of data stored on (usually removable) non-volatile storage media for purposes of recovery, in case the original copy of data is lost or becomes inaccessible. This is often called a backup copy. To be useful for recovery, a backup must be made by copying the source data image when it is in a consistent state. Software in this domain can support methods such as: tape backup, restore; disk backup, restore; snapshots, search and retrieval; synthetic backup, roll back; real time replication; instant recovery. Enabling technologies can assist in the above methods and include de-duplication software, virtual tape libraries and continuous data protection technology.	T-3.6.5
Archive Software	This is software to automate the migration, storage and retention of both structured and unstructured information in accordance with business policies. The software supports the primary purposes of archiving, which are the long-term preservation, retention and retrieval of that data. The differentiator between archive and data protection rests in a number of attributes, including: • the length of retention • granularity of retention: the retention and control is more granular acting on objects or entities specifically identified by the business, compared with data protection which acts at a higher level of aggregation on the same objects without concern for filtering any of those objects • associating metadata with the objects, which among other things will authenticate its originality verifying that no change has occurred • the ability to search on the data stored in a richer context than typically achievable in the data protection domain.	T-3.6.6
Printers and Scanners	This domain includes printers, scanners and hybrid multi-function devices.	T-3.7
Printers	This domain includes devices that provide dedicated printing services. Typically these include large laser printers, shared by many people, but may also include personal desktop printers such as ink-jets.	T-3.7.1
Document/ Image Scanners	This domain includes dedicated scanning devices, often small enough to sit on the desk of an office worker. Its purpose is to scan paper documents, producing a digitised facsimile of the document on the personal computer to which it is connected.	T-3.7.2

Domain	Description	Number
Multi-Function Devices	This domain includes peripheral devices that perform a variety of functions that would otherwise be carried out by separate peripheral devices. Multi-function devices include at least two of the following: a printer, a scanner, a copier and a fax machine. Common examples include: • Digital copy machine: Creates copies digitally, by scanning and printing. In addition to scanning and printing, may include fax, sorter and office hardware, such as a stapler. • Fax machine: Looks like a normal fax but connects to a PC for data input/output, printing, scanning and copying. • Printer/Scanner/Copier MFP: Performs all three functions and sometimes faxing as well.	T-3.7.3
Print Server Devices and Software	This domain includes software that manages and controls network printing. Examples include the Levi Ray and Shoup Enterprise Output Management suite for the IBM z/OS. Also included are dedicated devices that connect one or more printers to a local area network. Such devices typically have a single LAN connector, such as an RJ-45 socket, and one or more physical ports (e.g. serial, parallel or USB) to provide connections to printers. An example is Hewlett Packard Print Server Appliance 4200.	T-3.7.4

T-4 Network and computer accommodation

This domain includes facilities used to house computer systems, and those technology elements that provide base level permanent or intermittent connectivity.

Domain	Description	Number
Network	This domain includes those technology elements that provide base level permanent or intermittent connectivity. This includes wired and wireless modes.	T-4.4
LAN Devices	This domain includes devices that perform an intrinsic function for a local area network. Examples include switches and hubs from Cisco.	T-4.4.1
MAN and WAN Devices	This domain includes devices that perform an intrinsic function for a Metropolitan Area Network (MAN) or a Wide Area Network (WAN). Examples include routers supplied by companies such as Cisco.	T-4.4.2
Network Security Devices and Software	This domain includes hardware and software whose main purpose is to provide security for a network, particularly in terms of preventing unauthorised access. Examples include firewalls such as the Checkpoint Firewall Software Blade and network access control, such as the Cisco NAC Appliance.	T-4.4.4

Domain	Description	Number
Content Switches and Load Balancing Devices and Software	This domain includes devices which can redirect network connections to manage the performance of applications. Connection requests, and subsequent network traffic, is redirected to appropriate servers on the basis of a defined algorithm. The algorithm can be as simple as round robin or as complex as based on an evaluation of the current workload of the participating servers. Content switches, also known as layer 3 switches, have the ability to inspect the content of the network traffic and determine where to redirect the traffic. The Cisco CSS 11500 series of switches is an example.	T-4.4.5
Network Performance and Optimisation Devices and Software	This domain includes hardware devices whose purpose is to enable to monitoring and/or improvement of activity levels (particularly traffic) on a network and its components. An example is Riverbed Appliances and Cisco's Network Analysis Modules	T-4.4.6
Wireless Networking Devices	This domain includes devices that perform some intrinsic function for a wireless network. Wireless networks usually run over IP, and can provide LAN, MAN and even WAN functionality. An example is an 802.11g wireless router.	T-4.4.7
Radio Communications Devices	This domain includes devices that use spectrum licensed from the ACMA, and are usually dedicated to voice communications. Radio communications can use long range high-frequency (HF) radio and short range ultra-high-frequency (UHF) radios. Examples include two-way radio repeaters and base stations. Mobile devices, such as hand held radios, should be classified to the Mobile Radio Devices domain.	T-4.4.8
Voice Network Devices and Software	This domain includes devices such as Private Automatic Branch Exchange (PABX) and devices that enable voice over IP (VoIP), two-way radio interfaces, and radio control console systems. A PABX is an automatic telephone switching system within a private enterprise. VoIP is an internet protocol telephony term for a set of facilities used to manage the delivery of voice information over the internet.	T-4.4.9
Network Name and Address Devices and Software	This domain includes components that manage the database of names and addresses for potential network destinations and perform the function of translating network addresses from human-readable form to machine-readable form and back again. An example is the Microsoft DNS Server. This domain also includes the software that assigns network addresses to devices on request. The primary example here is a Dynamic Host Configuration Protocol (DHCP) service.	T-4.4.10

Domain	Description	Number
Caching and Proxy Devices and Software	This domain includes components provided by a proxy server. A proxy server is a device that processes and filters all IP packets that are directed to it and decides which protocols and services can be served out of its cache. An example is Microsoft's Internet Security and Acceleration (ISA) Server.	T-4.4.11
Bandwidth and Connectivity	This domain includes services, devices and software that provide bandwidth, connectivity, virtual private network and remote access capabilities.	T-4.3
Bandwidth Provision	This domain refers to the sourcing of telecommunications capacity through third-party providers, external to the enterprise. An example of this is the provision of bandwidth from Telstra and Optus available through Queensland's SmartNet initiative.	T-4.3.1
VPN Devices and Software	This domain includes components that support the provision of secure networking between a central network and mobile workers or remote teleworkers. Cisco offers a range of hardware and software to support VPN services.	T-4.3.2
Remote Access Devices and Software	This domain includes components that provide the ability to connect to a network from a distant location. Generally, this requires a computer, a modem and remote-access software to allow the computer to connect to the network over a public communications network (such as a phone or cable network). Examples include Microsoft's RAS.	T-4.3.3
ICT Equipment Accommodation and Cabling	This domain includes those facilities used to house and connect ICT systems and associated equipment.	T-4.5
Power Supply and Conditioning	This covers all equipment which provides and conditions power including backup power systems and generation of power. To prevent single points of failure, all elements of the electrical systems, including backup system, are typically fully duplicated and critical servers are connected to both the A-side and B-side power feeds. This arrangement is often made to achieve N+1 redundancy in the systems. Static switches are sometimes used to ensure instantaneous switchover from one supply to the other in the event of a power failure. Where uninterruptible power supply is required, backup power from alternative sources such as diesel generators or other uninterruptible power sources can be utilised to mitigate the impact of events such as mains power failure.	T-4.5.1
Air Conditioning	The ambient temperature and humidity in ICT equipment accommodation rooms may affect the performance of some electronic equipment, including possible malfunction. Air conditioning provides means of controlling temperature and humidity to desired levels.	T-4.5.2
Environmental Monitoring and Management	This domain includes software and associated sensors that control and capture information on the performance of buildings, ICT equipment rooms, and associated infrastructure in real time.	T-4.5.3

Domain	Description	Number
Fire Detection and Suppression	Fire suppression systems are designed to be used in conjunction with other fire safety systems including smoke and heat detectors and alarm systems, to increase the level of fire protection within enclosed spaces such as data centres. Gaseous fire suppression is a form of suppression that uses inert gases and chemical agents to stabilise, reduce or eliminate fire propagation and resulting heat/smoke. This type of suppression system typically consists of the agent and its storage containers, release valves, piping and dispersion nozzles; as well as a system of controls linked to detection and alarm systems.	T-4.5.4
Cabling and Racking	This domain includes connectivity hardware which interconnects devices. This classification includes the cable types, patch panels, racks and cabling management systems.	T-4.5.5
Physical Access and Security	Includes cameras (CCTV), access control systems, mantraps and other security systems used to monitor and control physical access to ICT equipment rooms, racks.	T-4.5.6
ICT Equipment Rooms	A data centre is a large purpose-built facility/building that provides a secure and controlled environment to support the operation of ICT equipment A computer room is a smaller, dedicated facility (which may or may not be purpose built) which is used to house operational ICT equipment and systems. Equipment and telecommunications rooms house building and floor distributors, along with other specialised equipment. Best practice suggests these generally include redundant or backup power supplies, redundant data communications connections, environmental controls (e.g. air conditioning, fire suppression) and security devices.	T-4.5.7
Telecommun-ications Towers	This domain includes fixed infrastructure to support the antennae of two-way radio, wireless network devices and microwave radio equipment. This may include safety fencing, lightning protection earthing systems, full protection systems, cable and antenna support arrangements. Towers are typically free-standing or have guyed cable support, but antennae can also be mounted on a range of small structures attached to buildings. Towers typically have an adjacent equipment room.	T-4.5.8

T-5 Management and control

This Level 1 domain comprises those technology elements that are not core to the business functionality, but nevertheless provide integrity, control and assurance that elements within the other domains are functioning correctly.

Domain	Description	Number
Systems Management	This domain includes software that is concerned with managing the operation of an ICT environment or system.	T-5.1
IT Service Desk	This domain includes software to support call management and logging activities of the IT service desk. The IT service desk is a single point of contact for end-users who need help. Having a single point of contact prevents significant losses in time spent by individual users looking for ways to fix problems and get help. The IT service desk does the following: receives all calls and emails on problems, records, classifies and prioritises them, seeks a solution and keeps users updated. An example of software which supports this process is Computer Associates' Unicenter ServicePlus Service Desk.	T-5.1.1
Remote Desktop Management	This domain includes software that supports the management of an enterprise's IT desktop from a central location. By and large, it obviates the need for support staff to attend on-site to service a desktop device. From the central location, support professionals can scan desktop devices, check the status of software licenses, download and update software and perform diagnostics. An example is EMCO's Remote Desktop Professional.	T-5.1.2
Systems Configuration Management	This domain includes tools that allow an enterprise to manage and control all of the configurable elements of its ICT systems, including servers, operating systems, as well as networks and their elements. An example is Novell's ZENworks.	T-5.1.3
ICT Asset Management	This domain includes systems that support the management of an enterprise's ICT assets (including PCs, servers, networks, and software) throughout the lifecycle of the asset from acquisition, through servicing and support, to disposal. Computer Associates' Unicenter Asset Management is an example.	T-5.1.4
Software Licence Management	This domain includes applications that ensure compliance with vendors' software license restrictions (for example enforcing a maximum number of concurrent connections, or defined users.) An example of software that supports this process is ManageSoft from ManageSoft.	T-5.1.5
Application Management	This domain includes software that supports the management and administration of enterprise applications across a diverse, distributed environment. The software monitors application availability and performance, collects performance data and allows predictive analysis. An example is Computer Associates' Enterprise Management software, part of the UniCenter suite.	T-5.1.6

Domain	Description	Number
Batch Job Scheduling	This domain includes systems that monitor the status of processing activities across the complex, heterogeneous ICT platforms that are characteristic of a large enterprise. Assessing and responding to predefined system states, the job scheduler effectively ensures continuous and stable IT operation across all platforms. The scheduler automatically identifies critical events and either reacts to them automatically or alerts the respective user. An example is the UC4 Workload Automation Suite.	T-5.1.8
Element Management	The control consoles and utilities used by operations staff to directly manage elements such as storage areas, network devices, servers, databases etc. They are often, but not always, provided by the vendor of the element to be managed. Examples include Dell OpenManage; Cisco Works; EMC Celerra Manager.	T-5.1.11
Monitoring	This domain includes software and hardware platforms that enable operational staff to monitor and track the performance of components (whether hardware, software or networks), manage availability, and provide insight on service level management. Examples include HP Openview and IBM Tivoli Netcool.	T-5.1.12
Alert Management	This domain includes software that plans and monitors the entire alert management process, designates resources, arranges vacations, escalation plans and keeps track of all events as they occur. The alarming service has to give certainty that, if a message is issued, it will be received, acknowledged and acted upon.	T-5.1.13
Security Management	This domain includes security management devices and software.	T-5.2
Identity and Access Management	This domain includes systems that allow an enterprise to keep track of the many user accounts throughout the enterprise – not only on in-house-designed applications but also on purchased packages such as those from SAP and PeopleSoft. Sophisticated identity management systems contain middleware that gives the ability to interoperate with many types of directory systems. An example of such a system is the IBM Tivoli Identity Manager offering. Access management services provide an enterprise with the ability to separate out authorised users of their ICT systems from potentially unauthorised users and, in the case of the former, allocate to the user the pre-determined levels of access and capability. The system also provides management functions such as adding new authorised users, deleting and modifying others, and changing the levels and types of permissions associated with each user.	T-5.2.1

Domain	Description	Number
Directory	This domain includes components that map logical names to physical addresses in a network. Directories are repositories for information about network-based entities such as applications, files, printers and people. Directory services provide a consistent way to name, describe, locate, access, manage and secure information about these resources. An example is Microsoft's Windows 2000 Directory Services.	T-5.2.2
Public Key Infrastructure (PKI)	This domain includes components to manage public-key cryptography, an encryption technique that uses two mathematically related keys: a public key to encrypt messages and a private key to decrypt them. It also includes the various related systems for the issuance and accreditation of digital certificates. An example of a PKI system is the UniCert PKI software from Baltimore Technologies.	T-5.2.3
Authentication Devices and Software	This domain includes multi factor authentication, whereby at least two different factors are used in conjunction to authenticate. Factors include: human (something you are), personal (something you know) and technical (something you have). Technologies used in multi-factor authentication include: tokens; biometrics; magnetic cards; smart cards (and card reader technology); phones.	T-5.2.13
Intrusion Prevention and Detection	This domain includes systems consisting of hardware and/or software that monitor events occurring in a computer system or network for signs of intrusion or other malicious activity, and that takes measures to protect the system or network from such intrusions or activity. An example is Computer Associates' eTrust suite.	T-5.2.5
Encryption	This domain includes components that encode data in such a way that an unauthorised party cannot decode it, yet it can be readily decoded by the receiver. Encryption capability is often provided as an embedded capability in electronic messaging software, but a free-standing example is the Enterprise Encryption Suite offered by PGP (Pretty Good Privacy).	T-5.2.6
Antivirus and Anti-Malware	This domain includes software designed to detect, remove, and/or protect a computer system from the effects of computer viruses. Well known examples are McAfee's VirusScan or Symantec's Norton AntiVirus.	T-5.2.7
Content Filtering	This domain includes components that will filter content based on organisationally defined rules. Filtering can include preventing the transmission of inappropriate language or images, malware, or security-classified information. Examples of content filtering software are McAfee's Privacy Service and Symantec's Web Security.	T-5.2.8

Domain	Description	Number
Security Administration Software	This domain includes software that supports an enterprise in protecting its information assets by consolidating management of accounts, passwords and resources across a broad range of intranet and extranet platforms as well as allowing applications to be centrally managed. An example is Admin, an element of Computer Associates' eTrust suite.	T-5.2.9
Security Event and Information Management	This domain includes tools that support an enterprise in reporting and analysing the multitude of security alerts and event alarms that can be generated by tools from several vendors. An example is Computer Associates' eTrust suite.	T-5.2.14
Vulnerability Management	This domain includes security patch management tools as well as corporate security policy compliance products. This domain also includes vulnerability assessment tools such as penetration testing tools. Tools in this domain typically compare the configuration of network and security devices and compare these with known updates and either recommend or automatically deploy changes.	T-5.2.11

Appendix A   Summary of changes

- Addition of Computer Accommodation and Cabling L2 domain, including sub-domains relating to UPS, fire suppressions, air conditioning etc.
- Reworking of the Storage domain to align with industry agreed terminology, and to include technologies associated with storage networks, data replication, snapshots etc.
- Merged Network Hardware L2 and Network Software L2 domains into one, just called Network.
- Creation of new Printers and Scanners L2 domain and transfer of printing related L3 domains.
- Addition of Virtual servers and desktops into their relevant domains.
- Consolidation of all device management related domains from across the framework into the Systems Management domain, and removal or merging of some duplicate domains.
- Improved the consistency in naming of domains.
- Removed references to services – these belong in the new business service framework. The technology framework is about asset/things.
- Included references to software in many domains that previously only referred to devices.
- Major clarification of the radio and wireless domains. Previously these had significant overlap and much confusion existed. Now we have clearly distinguished between radio communication devices such as UHF/VHF radios, and wireless networks.
- Addition of some domains such as Application virtual machines, Authentication devices and software, mobile data computers, Pagers, and Mobile Radio Devices.
- Updates to underlying descriptions of many domains to clarify their meaning.

A.1   New domains

New Domain	Notes
L2. ICT Equipment Accommodation and Cabling	New Domain.
L3. Power Supply and Conditioning	New Domain.
L3. Air Conditioning	New Domain.
L3. Environmental Monitoring and Management	New Domain.
L3. Fire Detection and Suppression	New Domain.
L3. Structured Cabling and Racking	New Domain.
L3. Physical Access/Security	New Domain.
L3. ICT Equipment Rooms	New Domain.
L3. Telecommunications Towers	New Domain.

New Domain	Notes
L3. Alert Management	New Domain.
L3. Authentication Devices and Software	New Domain.
L3. Application Virtual Machine	New Domain.
L3. Authentication devices and software	New Domain.
L3. mobile data computers	New Domain.
L3. Storage Connectivity	New Domain.
L3. Print Server Devices and Software	New Domain.
L3. Blade Server and Chassis	New Domain.
L3. Mobile Radio Devices	New Domain.
L3. Pagers	New Domain.
L3. Element Management	Merged replacement for L3. Storage Management, L3. Network Management, and L3. Database Management.
L2. Network	Merged replacement for L2. Network Hardware and L2. Network Software.
L3. Network Security Devices and Software	Merged replacement for L3. Network Security, L3. Network Security Devices.
L3. Security Event & Information Management	Merged replacement for L3. Security Event Management and L3. Security Information Management.
L3. Monitoring	Merged replacement for L3. Availability and Performance Management and L3. Network Monitoring Node S/w.
L3. Data Protection Software	Split from L3. Backup, Recovery and Archive Software.
L3. Archive Software	Split from L3. Backup, Recovery and Archive Software.
L3. Virtual Machine Servers	Split from L2. Virtual Machine Software, and moved to the L2. Servers domain.
L3. Virtual Machine Desktop	Split from L2. Virtual Machine Software and moved to the L2. Desktops domain.

A.2   Deleted domains

Deleted Domain	Note
L3. File and Print Services	New L3. Print Server Devices and Software domain covers part of this deleted domain.
L3. Backup, Recovery and Archive Software	Replaced by new L3. Data Protection Software and L3. Archive Software.
L2. Virtual Machine Software	Replaced by L3. Virtual Machine Servers and L3. Virtual Machine Desktops.
L3. Availability and Performance Management	Replaced by L3. Monitoring.
L3. Network Monitoring Node S/w	Replaced by L3. Monitoring.
L3. Security Event Management	Replaced by L3. Network Security Event and Information Management.
L3. Security Information Management	Replaced by L3. Network Security Event and Information Management.
L3. Network Security	Replaced by L3. Network Security Devices and Software.
L3. Network Security Devices	Replaced by L3. Network Security Devices and Software.
L2. Network Hardware	Replaced by L2. Network.
L2. Network Software	Replaced by L2. Network.
L3. Storage Management	Replaced by L3. Element Management.
L3. Network Management	Replaced by L3. Element Management.
L3. Database Management	Replaced by L3. Element Management.

A.3   Renamed domains

Original Domain Name	New Domain Name
L3. Special Purpose Productivity Tools	L3. Special Purpose Clients and Productivity Tools.
L1. Network	L1. Network and Computer Accommodation.
L1. Hardware, Devices and Systems Software	L1. Hardware and Virtual Devices and Systems Software.

Original Domain Name	New Domain Name
L2. Security Software	L2. Security Management.
L3. Remote Sensors	L3. Sensors and Detectors.
L3. Radio Network Devices	L3. Radio Communication Devices.
L3. Network Cabling and Infrastructure	L3. Structured Cabling and Racking
L3. Network Performance Devices	L3. Network Performance and Optimisation Devices and Software.
L3. Desktop Printers	L3. Printers and Scanners.
L3. Desktop Scanners	L3. Document and Image Scanners.
L3. Laptop and Notebook PCs	L3. Laptops.

A.4 Moved domains

Domain Moved	From	To
L3. Embedded Software Tools	L2. Special Purpose Devices	L2. Application Development Software.
L3. Network Cabling and Infrastructure	L2. Network Hardware	L2. Computer Accommodation and Cabling.

Appendix B   Reference

Wikipedia references, provided as per their Terms of Use:

- http://en.wikipedia.org/wiki/Virtual_machine#Process_virtual_machines
- http://en.wikipedia.org/wiki/Virtual_machine#System_virtual_machines
- http://en.wikipedia.org/wiki/Print_server
- http://en.wikipedia.org/wiki/Laptops
- http://en.wikipedia.org/wiki/SMS_gateways
- http://en.wikipedia.org/wiki/Data_center

Document history

Version	Date	Author	Description
4.0.0	August 2010	Queensland Government Chief Technology Office	Approved for publishing
4.0.1	April 2015	Queensland Government Chief Information Office	Updated to new template and minor updates