



The ICT Profession, Professionals and the ACS Body of ICT Knowledge (CBoK)

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1. Introduction

ACS is the professional association for ICT professionals in Australia. To support a range of ACS activities, and to provide a basis for interaction with other institutions in the ICT industry, the Society has prepared this document to articulate its understanding of the ICT profession, the ICT professional and the ICT knowledge that is required of such a professional.

This document has a long history. Since its origin in mid-1990s it has been redeveloped several times to meet the changing face of ICT and the developing role of the ACS.

1.1 Applications of this document

CBoK is a reference document, that is it is independent of the various uses to which it may be applied. Some users and applications of this document include:

Industry Organisations

To assist with ICT professional position descriptions, assessment of candidates and professional development for initial and ongoing professional practice.

Educational Institutions

This document is not a curriculum for an ICT higher educational program. However, it specifies the types of knowledge any program would need to address if it were to claim that it equips a graduate with professional-level ICT knowledge and skills.

Government

CBoK is a useful document for discussions with government on workforce planning, skills classifications and so on.

The ACS

The *CBoK* is used by the ACS to support its assessment activities for:

- Accreditation of educational programs
- Certification
- Professional membership
- Skills Assessment

2. The ICT Profession

Professions Australia defines a profession as being:

“... a disciplined group of individuals who adhere to ethical standards and who hold themselves out as, and are accepted by the public as, possessing special knowledge and skills in a widely recognised body of learning derived from research, education and training at a high level, and who are prepared to apply this knowledge and exercise these skills in the interest of others.”

(Australian Council of Professions (2003) *What is a profession?*)

2.1 Defining the ICT Profession

Since the 1950s information technologies have developed to the extent that they are now pervasive in the global economy and society.

ICT captures data and information and uses computational processes for control in cyber-physical systems, for routine data processing, for providing information for human thinking and for knowledge-based activity and support such as diagnosis and advice.

The ICT industry develops, systematises, deploys and maintains information technologies while other industries, health, transport, finance, government and so on, use these technologies as part of wide range of different activities.

The ICT profession is that part of the ICT industry comprising the 'disciplined group of individuals' who occupy responsible roles in the industry. Professional roles evolve over time, more so in ICT than in most professions as the technology changes rapidly as do the contexts of its application. The roles, and the professional skills needed for practice, are the subject of a number of frameworks including:

Skills Framework for the Information Age

European framework for ICT Professionals

The Australian and New Zealand Standard Classification of Occupations ANZSCO)

Australian ICT professional roles and skills are reviewed regularly by the ACS (Digital Pulse).

In Australia, ICT professionals do not require a licence to practise. However, certification of professionals is one of a number of pre-requisites for inclusion in the ACS Professional Standards Scheme as covered by the Professional Standards Act 1994 (NSW). Professional Standards Schemes are legal instruments that bind occupational associations such as ACS to monitor and improve the professional standards of their members in order to protect consumers of ICT professional services.

2.2 Defining an ICT Professional

Professionals have specialist skills which can be relied upon. It is a legal requirement that professionals exercise those skills to an appropriate level expected by the relevant profession. Any damage arising from a failure by the professional to exercise the required level of skill may mean that a legal judgement is made against them if their lack of professionalism caused loss to others.

The hallmarks of an ICT professional are:

- Professionalism as it applies in ICT

ICT professionals adhere to the principles of professional ethics, especially as described in the ACS Code of Professional Conduct. Professionals predict and assess the consequences of their work, prioritising the greater good and the public interest and acting accordingly. They accept the responsibility that comes with professional autonomy and conduct themselves in an objective, non-discriminatory and culturally sensitive manner. They undertake continuing professional development.

- Knowledge of Core ICT

ICT professionals appreciate the breadth of the large ICT landscape. They can explain and account for new technologies as they understand ICT fundamentals and infrastructure, data and software, and how these are integrated into systems. They understand the organisational context for systems including the governance and management of ICT. Regardless of their professional role, ICT Professionals are capable of managing projects and evaluating quality, especially with respect to information and cyber security.

- In-depth knowledge in an area of ICT

ICT professionals possess in-depth knowledge and skill necessary to fulfill a particular role in the ICT profession. They have a strong theoretical base in the relevant field, informed by current standards and best practice guidelines, and by research and industry literature.

3. The ACS Body of ICT Knowledge

The ACS Body of ICT Knowledge (known as CBoK) identifies the types of knowledge that support the activities of being an ICT professional. The three hallmarks of an ICT professional provide the framework for organising the knowledge categories

- Professionalism as it applies in ICT
- Core ICT Knowledge
- In-depth ICT Knowledge

3.1 Professionalism as it applies in ICT

There is a generic knowledge base that professionals from any field will possess. Applying this to ICT produces the following knowledge categories of an ICT professional:

Professional ICT Ethics

- Fundamental ethics notions (stakeholders, responsibility, harm, benefit, rights, virtues, duty, respect and consequences) and ethics theories
- Methods of ethical reasoning, analysis and reflection, ethics canvas
- Professional ethics issues: general professional issues such as conflict of interest, confidentiality
- ICT specific ethics issues: adverse stakeholder impacts of ICT, surveillance and privacy, data matching, autonomous computing, digital divide, etc.
- Integrity systems: the ACS Code of Professional Conduct, ethics committees and protections whistle blowing

Impacts of ICT

- Impacts of ICT on society (cyber warfare; surveillance, privacy and civil liberties, cybercrime and hacking, digital divide, technology reliance, intellectual property and legal issues)
- Impacts of ICT on organisations, workplaces, jobs and skills

Working Individually and in ICT development teams

- Team organisation, development and management, especially of multi-disciplinary, diverse ICT teams; collaboration, group dynamics, leadership styles, conflict resolution, groupware and virtual teams
- Individual time management, workflow and information management
- Working effectively within an organisational context

Professional Communication

- Communication with different audiences (technical, managerial, users and non-digitally orientated audiences) in different forums (meetings, presentations, networking)
- Forms and styles of documentation - technical reports and specifications, progress reports

The Professional ICT Practitioner

- Domestic and international law as it applies to ICT
- The professional society (the ACS), certification to practise, legal liabilities and indemnity
- Continuing professional development, career upskilling, networking

3.2 Core ICT Knowledge

Knowledge of the breadth of ICT provides the foundation of a professional's in-depth knowledge and the context of its application. Core ICT knowledge may be conceptualised as covering the topics identified in Figure 1, showing the components that make up an ICT system (centre box) the fundamentals on which it rests, the projects that create it and the governance structure within which it operates.

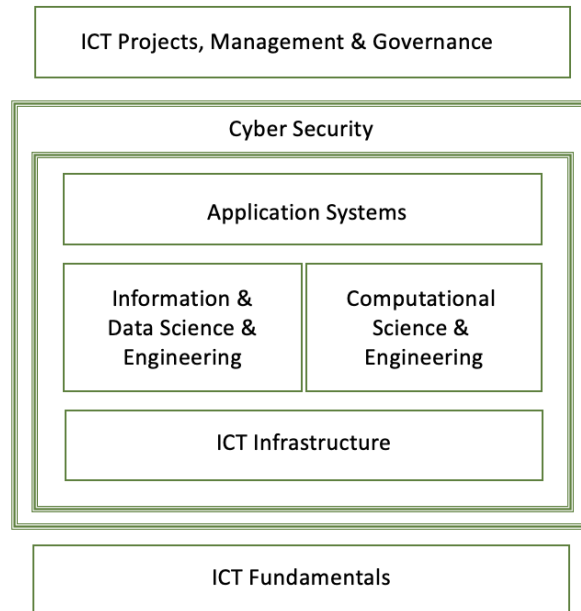


Figure 1: The Concepts comprising Core ICT Knowledge

ICT Fundamentals

- Computational thinking: situation analysis and modelling using a range of methods and patterns to frame it so a computer system could operate effectively within it.
- Design thinking: methods and tools that are used for handling abstraction could vary a great deal with the branch of ICT, from circuit diagrams to data modelling tools to business process modelling
- Information processing in humans and machines, artificial intelligence
- Systems thinking: components and interactions between them, structure and function, emergent properties and functions, systems layers
- History of computing and ICT, drivers of technology evolution and trends for the future
- Social and individual impacts of ICT deployment

ICT Infrastructure

- ICT hardware components and organisation: the creation, communication and processing of digital signals using sensors and activators, processors and storage
- Cyber-physical systems: process control, the internet of things, robotics, biometrics, autonomous vehicles, GPS
- Network and internetwork concepts and protocols, wireless and mobile computing, cloud and distributed systems
- Systems software and operating systems managing the architecture

Information & Data Science and Engineering

- Nature of data, information and knowledge, meta-data, abstraction and representational quality
- Data modelling and semantics, relational data engineering processes
- Database Management Systems and SQL, non-relational systems (blockchain, NoSQL, files)
- Data Science and Engineering, data analytics, mining and visualisation, big data

Computational Science and Engineering

- Nature of computational functions, states and transitions, procedural, declarative and artificial neural net approaches to creating computational functions, abstraction and virtualisation, complex and adaptive computing
- Process and algorithm modelling: methods of algorithm design, software quality
- Programming: programming language constructs, coding methods, scripts and apps, interfaces
- Software Engineering: systematic practices of specification, development and testing to produce reliable, safe, maintainable computing systems, integrated development and configuration management environments

Application Systems

- Analysis of human activity systems, ontological modelling, specifying organisational and external context of computing systems, impact and user experience analysis
- Integration of systems components into coherent socio-technical systems
- Types of application: organisational operations (transaction processing, executive information systems), simulation and decision support, information management (digital document (text, video, sound, image) creation, storage, communication and information retrieval), knowledge management, digital platforms and markets
- User experience: interface design, physical and cognitive ergonomics
- Application context where specifically linked to ICT: Domain attributes (e-health, e-business, transport and logistics, agriculture, e-government, etc), language and cultural factors, users work practices and organisational contexts

Cyber Security

- Nature of Cyber Security: forms of attack, prevention, detection, mitigation and repair
- Information assets to be secured (hardware, networks, software, data) and the different means of securing them, cryptography
- Human security roles and behaviours, rights and obligations (privacy)
- Cyber Security risk assessment, policy, management and testing, forensics

ICT Projects

- Nature and types of projects: exploratory, prototype, agile, maintenance, construction and acquisition, etc
- Project initiation: stakeholders, benefits specification, scope and requirements, quality and acceptance criteria, cost/benefit, risk and time budgets
- Project management: team management, estimation techniques, project scheduling, quality assurance, configuration management, project management tools, progress analysis, reporting and presentation techniques
- Installation and change management, benefits realisation and impact assessment

ICT Management and Governance

- Fundamental governance principles (strategy development, establishment and monitoring systems for management and policy)
- Organisational context, staffing roles and skills (SFIA, e-CF), organisational culture
- Digital transformation and disruption, change management
- Service and product management, the ongoing operation of ICT using frameworks like the Information Technology Infrastructure Library (ITIL) and Control Objectives for Information and Related Technology (COBIT)

3.3 In-depth ICT Knowledge

An ICT professional has in-depth knowledge and experience to perform a significant professional role or roles. The ACS is a signatory to the Seoul Accord which, in Section D, requires of an ICT professional the in-depth knowledge to solve complex computing problems.

The in-depth knowledge and skills needed by a business analyst are not like those of a network engineer, or a cyber security specialist. Knowledge areas change over time and present quite differently in different professional situations. Professional practice often involves knowledge and skills outside the ICT domain.

Many knowledge areas have well developed disciplines associated with them which have their own Bodies of Knowledge (See SFIA *List of Bodies of Knowledge*). Some examples include:

Information Technology *ITBoK*, ACM, European Union

Computer Science: *CSBoK*

Software Engineering: *SweBoK* IEEE, *SWBoK* ACM (and see the *ACS-Engineers Australia Joint Board*)

Information Systems: *ISBoK*, *BABoK*

Cyber Security: *CyBoK*

Data Science: *DSBoK*

Project Management: *PMBok*

Each of these bodies of knowledge have been created within their own context and for their own purposes. Each contains knowledge areas beyond the *Core ICT knowledge* identified in this ACS CBoK and none fully cover all required Core ICT knowledge areas. Figure 2 provides an impression of the relationship between Core ICT Knowledge and other bodies of Knowledge. The diagram is not an accurate depiction of relative contents of the various BoKs but an illustration bringing together some of the disparate BoKs and showing their relationship with the ACS CBoK.

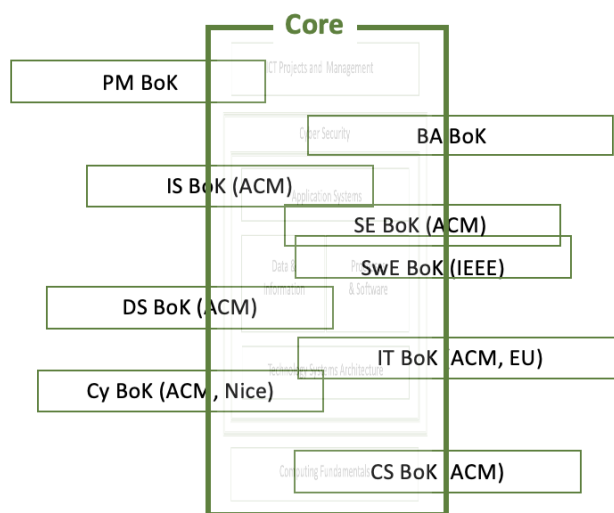


Figure 2: An Impression of the Relationship between Core ICT knowledge and some related Bodies of Knowledge

References (*links current at 1 August 2021*)

[ACM](#) Association for Computing Machinery

[ACS](#) Australian Computer Society

- [Digital pulse](#)
- ACS-EA Joint Board

[ANZSCO](#) Australian and New Zealand Standard Classification of Occupations

[COBIT](#)

[IEEE Computer Society](#)

[ITIL](#) IT Infrastructure Library

[e-CF](#) European e-Competence framework

- [EU IT BoK](#)

[SFIA](#) Skills Framework for the Information Age

- [List of Bodies of Knowledge](#)

VERSION HISTORY

Date	Document Version	Revision History (reason for change)	Author /Reviser
1997	1.0	Creation of original document	Alan Underwood
2008	2.0	Creation of Version 2	Shirley Gregor, David Wilson
2015	3.0	Creation of Version 3	Andrew Johnson, Graeme Low
February 2019	3.1	Update of Cyber Security and SFIA to level 7	Rupert Grayson, Craig McDonald
October 2021	3.2	Refreshed BoK areas of knowledge, decluttered text, and updated references	

APPROVALS

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