

**REDEFINING AND BUILDING THE ICT PROFESSION:  
CORE BODY OF KNOWLEDGE REVIEW  
DISCUSSION PAPER**

**Australian Computer Society  
Professional Standards Board**

21 June, 2007

Version 2.0

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**List of Acronyms**

ACPHIS	Australian Council of Professors and Heads of Information Systems
ACS	Australian Computer Society
AAIS	Australasian Association of Information Systems
AIIA	Australian Information Industry Association
AQF	Australian Qualifications Framework
CBOK	Core Body of Knowledge
CORE	Computing Research and Education Association of Australasia
CPP	Computer Professional Program (offered by the ACS)
CS	Computer Science
EQF	European Qualifications Framework
IS	Information Systems
IT	Information Technology
ICT	Information and Communications Technology
IFIP	International Federation of Information Processing
PS	Professional Standards
SE	Software Engineering
SFIA	Skills Framework for the Information Age

## **1. Introduction**

In January 2007, the Professional Standards (PS) Board replaced the Accreditation, Assessment and Appeals Board and the Membership Standards Board of the Australian Computer Society (ACS).

An important responsibility for the new Board is the ACS Core Body of Knowledge (CBOK). A review of the CBOK is to be undertaken, with an outcome expected no later than June 2008.

The PS Board was constituted in early 2007 with membership as shown in Appendix A. The Board members represent a broad cross-section of the Information and Communications Technology (ICT) profession and their willingness to contribute to the Board's activities is appreciated. The first meeting of the Board took place in Melbourne on 4 April, 2007, and the CBOK agenda item was discussed in small group sessions and by the Board as a whole.

The purpose of this discussion paper is to outline the results of the Board's discussions and to provide a basis for moving the CBOK review forward. The paper documents matters on which there was a reasonable degree of consensus by the Board and will serve as a basis for a CBOK Working Party, which will help progress the CBOK review. The paper also provides a means of communicating progress on the CBOK review to the broader group of stakeholders who have an interest in it. These stakeholders include the ACS Council and relevant industry and academic bodies.

Since the initial meeting of the PS Board, Version 1.0 of this document was presented at the ACS Council meeting in Canberra on 26 May, 2007. As a result of comments made at that meeting, the paper has been further updated and a wider view taken of its scope. Moreover, it now appears appropriate for the PS Board to take a wider view of what it is doing, and to think more of "Redefining the ICT Profession", which has led to a change in title for the paper. Appendix B has been added to give an overview of the development of ICT professionals and qualifications required at different professional levels.

This paper is very much a working document and further change is to be expected as wider consultation occurs. Feedback on any aspect of the CBOK review can be forwarded to members of the PS Board, or to Christine McLeod, who provides the PS Board with administrative support ([Christine.McLeod@acs.org.au](mailto:Christine.McLeod@acs.org.au)).

## **2. CBOK Revision Process**

The CBOK Working Party of the PS Board was established in June 2007 to work on the CBOK. The Working Party is intended to be a true Working Party and will refer the outcomes of its activities back to the PS Board for discussion at intervals before progress continues. The Working Party can be small, as the Board is the wider representative body that will provide a broad range of views. The working party initially consists of Shirley Gregor, Bob Hart and Brian von Kinsky.

A paid Research Assistant may be employed to assist the Working Party.

The PS Board will review progress at its second meeting, which is expected to be in September/October 2007.

It is important that as many key stakeholders as possible are engaged in the CBOK revision process. The establishment of the CBOK in a way that has wide acceptability could have an influence on a number of the key issues currently impacting the ICT industry. The identification of career roles in framing the CBOK means that nomenclature for careers and programs of study could become clearer. The lack of identification and differentiation of ICT Professionals is seen as a key problem in the marketing of ICT careers and thus as a contributor to the ICT skills shortage.

It is appreciated that the lack of standard terminology is a very difficult problem and that agreement on a CBOK is also not an easy task. However, the Board believes that it is important that we address the task and will act in a consultative manner as far as possible. Members of the PS Board will be encouraged to promote discussion and obtain input from relevant bodies on the CBOK revision as it proceeds. These bodies will include other ACS bodies, Computing Research and Education Association of Australasia (CORE), Australian Council of Professors and Heads of Information Systems (ACPHIS), Australasian Association of Information Systems (AIS), Australian Information Industry Association (AIIA), Engineers Australia and Federal and State Government agencies, amongst others.

### 3. Defining the ICT/Computing Profession

At this point we have accepted that the terms “IT” and “ICT” and “Computing” are used more or less interchangeably in Australia to refer to the Profession as whole. We will accept this usage and not attempt to resolve the issue of a single overall nomenclature as part of the CBOK review.

However, an important consideration for the review of the CBOK is a further understanding of the word “profession”.

The definition given by Professions Australia stresses both the possession “of special knowledge and skills in a **widely recognized body of learning** derived from **research, education and training** at a high level” as well as the possession of a **Code of Ethics**” (Professions Australia, 2007).

A number of the documents and frameworks that have been produced in recent times in respect to Information Technology make use of the words “Skill”, “Competence” and “Training”. It should be kept in mind that these things are only part of what is required for a Profession; **“knowledge”** is needed as well.

The view compatible with the ACS charter is that a **Profession**, as opposed to a craft or a **trade**, requires its members to:

1. possess an underlying core body of specialized, in-depth, knowledge;
2. adhere to a code of ethics and code of conduct; and
3. engage in continuing knowledge and skills development.

It is recognized that ICT/Computing is a very new discipline and other disciplines have had much longer to develop; for example, medicine, accounting and engineering. Following Whitley (1984) it is noted that when a discipline is highly professionalized there is more likely to be:

- High task certainty;
- routine activities for common tasks;
- Reputations becoming prestigious;
- Established standards of competencies, skills and knowledge;

- Unique symbol systems to exclude outsiders and allow unambiguous communication;

When not highly professionalized it is more likely that local contingencies will have high impact (for example, politics). We have this situation in Australia and worldwide with respect to ICT, as understanding of what the profession entails and the nomenclature used varies across countries, across university departments and with the background of individual professionals. Many people in our profession had initial training in other fields before they turned to ICT and their views can reflect their different understanding of the nature of disciplinary knowledge.

The problems of professionalism in ICT are not new and a paper by Nathan Ensmenger “The ‘question of professionalism’ in the Computer Fields” shows many of the issues that are still prominent now were also of concern in the 1950s and 1960s (Ensmenger, 2001).

**Action Item:** Wider discussion and understanding of what it means to be an ICT professional and the relationship between knowledge, skills, competence and training is desirable. Board members and the wider ICT community could be encouraged to prepare opinion and discussion papers on the issue and how the ICT profession is evolving over time.

#### 4. Rationale for the ACS Core Body of Knowledge

The ACS maintains a description of a Core Body of Knowledge for the ICT Profession in Australia in order to:

- Establish the boundaries of the profession;
- Establish a shared knowledge base from which a unified and consistent version of IT related terminology can be derived;
- Establish the breadth of knowledge required, including mandatory knowledge areas;
- Clarify to employers and users the basis of the expertise of ICT Professionals and what to expect from them;
- Provide guidelines to educators and course designers of what knowledge and skills to deliver.

#### 5. Current CBOK

A full description of the current CBOK can be found on the ACS web site (Underwood, 1997).

In summary, for accreditation at the Professional Level, a program of study must address the following knowledge requirements:

- Mandatory topics – Interpersonal Communication, Ethics/Social Implications, Project Management and Quality Assurance
- A minimum of one equivalent full-time year of IT material (for example, 8 subjects in a 24 subject degree)
- At least one-third of “IT material” at genuine third-year level (that is, 2-3 subjects at third-year level)
- The meaning of “IT material” is fairly broadly interpreted, but descriptions are given for a number of areas (for example, data structures and algorithms, software engineering, systems analysis and design, and security).

It is some time since the CBOK had a major review and it is recognized that the current CBOK is in need of updating. New knowledge areas have gained in prominence since the last major review and yet are not included in the specified knowledge areas (for example, management of information systems). There have also been further specification of curricula internationally.

The contributions provided to date on the development and application of the CBOK by many ACS members are recognized and appreciated (including Alan Underwood, John Hughes, Gerry Maynard, Peter Juliffe and Bob Hart). Having a current CBOK means that we do have a starting platform to consider and some prior experience with the development process in Australia.

## **6. Some initial common ground**

The PS Board accepted at its first meeting that some common ground could be assumed to underlie the CBOK review process:

- ICT Knowledge can be acquired over a period of time from a number of sources, but the primary source for ICT professionals will be a basic bachelor degree in ICT.
- The primary target for specification of the CBOK is entry level professionals. However, it was noted that at some point two professional development stages could be recognized. The undergraduate degree is the first stage, with a second stage at some period after graduation (for example, the Computer Professional Program (CPP) offered by the ACS).
- Much reference material for ICT bodies of knowledge already exists and should be made use of in the review process (for example, CC2005, ACM Computing Curricula, SFIA, existing ACS Core Body of Knowledge, SWEBOK).
- There is a need for a CBOK to be updated over time.
- A CBOK should be flexible, in part to accommodate rapid change in the IT industry, but also to accommodate differing requirements among stakeholders.
- The CBOK should not specify curriculum or syllabus tightly, but rather indicate areas of knowledge that can be addressed in varying ways by education providers. When the word “curriculum” is used, it is meant to refer to areas of knowledge. The aim is to provide guidelines and illustrative syllabus, rather than tight prescriptive syllabus specification.
- The CBOK should be linked to outcomes, in terms of the different roles of professionals in the IT industry.
- The CBOK review process will involve consultation, especially with ACS technical boards, academic groups (e.g., CORE, ACPHIS) and industry.
- The CBOK should remain in the public domain and be pro-actively maintained.
- The CBOK should be available free of charge.

## **7. Moving Forward**

The PS Board addressed a number of issues that need to be considered before deciding an approach to the CBOK review. The thinking of the PS Board at its first meeting is shown below. This thinking will guide the Working Party, which will carry out further investigation of options for proceeding.

### **7.1 Retaining current CBOK rules in part?**

Should the requirement for at least 8 subjects of IT-related material with 1/3 at third year level be retained ?

The general response was “yes”, but with at least one view that the minimum requirement of 8 subjects could be increased to 10.

It was also agreed that we should keep the existing “generic” requirements (ethics, project management, interpersonal communication). However, these subjects could possibly be expanded in some areas, for example, to include risk management.

### **7.2 Should the degree of guidance in the CBOK be increased?**

Does the CBOK need to have a bit more “bite”? That is, should it be more prescriptive with more mandatory subjects?

The feeling was that more guidance could be provided, although the specification of further mandatory subjects might need to vary with the major disciplines that compose the ICT Profession (for example, Computer Science, Information Systems, Software Engineering, Telecommunications and so on). There should also be sufficient flexibility to allow “new” developments and programs outside the major disciplines to be accommodated.

### **7.3 Is there any common IT core apart from the non-technical generic skills?**

Can we aim at finding some knowledge areas (possibly named differently) that are “core” across all (or most) of the disciplines that underlie the IT Profession ?

It was recognized that establishing a common core of IT knowledge is a desirable aim as it is a way of showing what typifies “ICT” and distinguishes it from other professions.

However, it is recognized that at this point it is very difficult to identify a common IT core. This issue will be revisited after the knowledge requirements for different IT disciplines are considered.

There was some suggestion of what these common core areas might be: for example - computer systems modelling of various types; systems theory; storage and retrieval of information using computer systems; computer software and systems development processes.

### **7.4 A Framework for the new CBOK Specification**

Assuming that parts of the CBOK will vary with specific disciplines, how can an overarching framework be produced that will allow standardization of nomenclature and linking of disciplinary knowledge to professional roles in industry?

The PS Board formed break-out groups at its meeting and then reflected on this problem as a whole. Its ideas were broadly as follows.

To be accredited, a program should have the following characteristics:

- At least 8 subjects in an IT-related discipline with 1/3 at third year level;

- Cover the generic non-technical requirements of ethics and professionalism, project management and interpersonal communication (and possibly some further topics such as risk management).
- Address to some extent the knowledge areas that are identified as being truly “core” across all branches of Computing/Information technology, although these knowledge areas possibly are addressed under different labels. These core areas are yet to be identified (one possibility is systems/data/process modelling).
- Breadth, with broad coverage of the identified discipline.
- Depth, with coverage of the identified discipline to the higher levels of Bloom’s educational taxonomy (Bloom, 1984): that is,
  - Analysis (make inferences and find evidence to support generalizations),
  - Synthesis (compile information together in a different way by combining elements in a new pattern or proposing alternative solutions), and
  - Evaluation (present and defend opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria)
- Have a program of study in an IT discipline or sub-discipline that is linked to a particular role or roles of professionals in IT. The responsibility would be placed on the educational institution to demonstrate the coherence and justification for the program of study presented. However, some guidelines/examples for what are recognized as coherent, justifiable programs would be derived for some well-recognized disciplines in IT, including:
  - Computer Science
  - Computer Engineering
  - Information Systems
  - Software Engineering
  - Telecommunications.

Some examples/guidelines for degrees in other areas such as multimedia and a generalist IT degree could also be developed.

The peak bodies in the relevant disciplinary areas would be consulted in drawing up these guidelines, as would the existing international curriculum specifications available. (e.g. SWEBOK, ACS CBOK etc) and/or established curriculum (e.g., see Computing Curricula 2005). For new and emerging disciplines or sub-disciplines, the applicant would have to make a case that the discipline/breadth/depth is acceptable.

Note that an academic discipline, or field of study, is a branch of knowledge which is taught or researched at the college or university level. Disciplines are defined and recognized by the academic journals in which research is published, and the learned societies and academic departments or faculties to which their practitioners belong. Fields of study usually have several sub-disciplines or branches, and the distinguishing lines between these are often both arbitrary and ambiguous.

The discipline or sub-discipline must be clearly relevant to Information and Communications Technology (ICT), a broad subject concerned with computing technology and its use, particularly for the management and processing of information.

- The designers of the program should identify graduate attributes and typical roles that graduates will fill, explaining how/why these are the target and how the course structure and content contributes to the development of these attributes.

The figure on the next page gives a diagrammatic view of what could be used as an overarching framework.

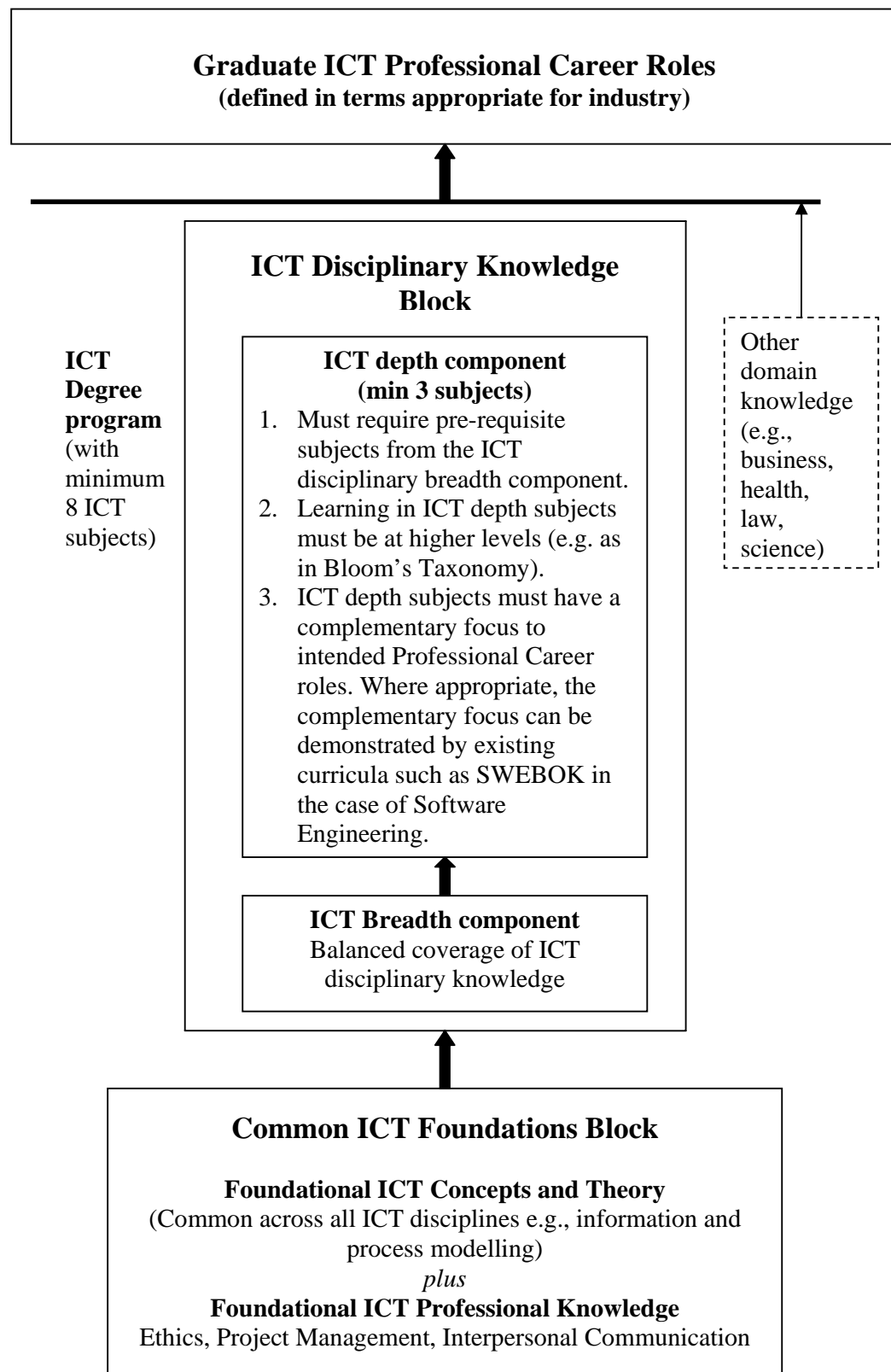


Figure 1: A Framework for ICT Professional Careers and Supporting Knowledge

Notes:

1. The topics in the ICT Common Foundations Block may not require a dedicated single subject, but may be integrated across a number of subjects.
2. Guidelines for “Disciplinary knowledge blocks” are to be developed for a number of specific areas, such as Computer Science, Software Engineering and Information Systems. However, other Knowledge Blocks can be proposed if required, with a rationale provided for their link to some professional role.

## 8. Remaining Issues

Some issues were listed as set aside for future consideration:

- Marketing and student interest in IT programs remains a significant problem. The PS Board needs to liaise with the Membership Board to ensure this problem is addressed.
- Different levels of the profession will be further considered at some point (see Appendix B). At this point we are focusing mainly on the CBOK for the provisional Professional Member (degree graduate). In particular we need to consider the CPP with respect to standards and topics covered.
- There needs to be ongoing communication with other groups and new members of the Board.
- There is an issue about how many IS/IT courses are needed at postgraduate level for accreditation.
- What happens about accreditation when a program as a recognizable, named entity is not explicitly registered as accredited?
- Is a capstone project to be required (as an individual or in a group)?

## 9. Reference Material

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## **Appendix A**

### **Professional Standards Board Membership**

#### Members of PS Board:

- Professor Shirley Gregor, Australian National University (Director, PS Board)
- Phillip Argy, President, ACS (ex officio member)
- Bob Hart, Manager, Professional Standards and Development, ACS (ex officio member)
- Professor Chris Avram, Monash University (Chair: ACS Disciplinary Committee)
- Derek Goh, Executive General Manager, IT & Facilities Management, Challenger Financial Services (Nominee of CIO Executive Council)
- Professor Doug Grant, Swinburne University (Representative from Software Engineering)
- Bev Hart, Australian Government Information Management Office (AGIMO), Department of Finance and Administration.
- Professor Michael Johnson, Macquarie University (Representative from Computer Science Heads)
- Dr Brian von Konsky (Representative of Computer Science and Software Engineering Education Research community)
- Dr Paul O'Brien, University of Queensland (ACS Queensland Branch Executive Council)
- Dennis Street (ACS Victoria Branch Executive Council)
- Professor David Wilson, University of Technology, Sydney (Representative from Australian Council of Professors and Heads of Information Systems (ACPHIS))

Additional members may be added to the Board.

**Appendix B: ACS Qualifications Framework for ICT Professionals**  
 (Drawing on the Commission of the European Communities (2006) Qualifications Framework)

	<b>Provisional Associate</b>	<b>Associate</b>	<b>Provisional Member</b>	<b>Computer Professional</b>	<b>Specialist</b>
<b>Knowledge</b>	Factual and theoretical knowledge of ICT in broad contexts OR Specialised factual knowledge within a narrow field and an awareness of the boundaries of that knowledge	Factual and theoretical knowledge of ICT in broad contexts OR Specialised factual knowledge within a narrow field and an awareness of the boundaries of that knowledge	Factual and theoretical knowledge of ICT in broad contexts PLUS Advanced, coherent body of knowledge in a discipline/field involving critical understanding of theories and principles	Factual and theoretical knowledge of ICT in broad contexts PLUS Advanced, coherent body of knowledge in a discipline/field involving critical understanding of theories and principles	Highly specialised knowledge in a specialist field, some of which is at the forefront of knowledge in that field AND Awareness of issues at the interface between different fields
<b>Skills</b>	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems	Range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Range of cognitive and practical skills required to generate creative solutions to abstract problems in a discipline or field of ICT	Advanced skills, demonstrating mastery and innovation required to solve complex and unpredictable problems in a discipline/field of ICT	Highly specialised problem solving skills required in research and/or innovation in order to develop new knowledge and leadership in the specialist discipline/field
<b>Competence</b>	Take responsibility for completion of tasks Adapt own behaviour to circumstances in solving problems	Exercise self-management within guidelines of work that is predictable, but subject to change	Exercise self-management within guidelines of work that is predictable, but subject to change Supervise the routine work of others, taking	Exercise management and supervision in contexts of work activities where there is unpredictable change Take responsibility for complex technical and	Take responsibility for managing professional development of individuals and groups Manage and transform work contexts that are complex, unpredictable

			some responsibility for the evaluation and improvement of work activities	professional activities or projects Review and develop performance of self and others NOTE 1	and require new strategic approaches Contribute to professional knowledge and practice
<b>Ethics/Social Responsibility</b>	Aware of broad ethical issues in the application of ICT	Aware of broad ethical issues in the application of ICT AND Fully conversant with organisational codes of behaviour across all social aspects of work	Basic factual and theoretical knowledge of the social implications of the application of ICT	Critical understanding of theories and principles of ethics and social implications of ICT. Take responsibility for own and team codes of behaviour and practice. Critical awareness of social/ethical implications of new technology	Critical understanding of theories and principles of ethics and social implications of ICT. Take responsibility for organisational codes of behaviour and practice. Critical awareness of social/ethical implications of new technology Contribute to continuous improvement of codes
<b>Pathway</b>	AQF Diploma, Advanced Diploma or Associate Degree in ICT OR AQF Bachelor Degree with minor study in ICT OR Appropriate Vendor Certification	As for provisional PLUS Two years relevant work experience OR 6 years relevant work experience with demonstration of 3 years at this level of skills, knowledge and competence	Completion of an accredited AQF Bachelor Degree OR 8 years of relevant work experience with demonstration of four years at this level of skills, knowledge and competence	As for Provisional Member PLUS either 18 months relevant work experience and completion of CPP OR 7 years experience at this level OR Senior Manager or Academic Pathway	As for Computer Professional PLUS Completion of accredited course in specialisation OR 5 years experience in specialisation at this level of competence

**NOTE 1:** Competence expanded for this level would be:

### **Autonomy**

- ❖ Is capable of working under a broad direction.
- ❖ Fully accountable for own technical work or project responsibilities.
- ❖ Receives assignments in the form of objectives.
- ❖ Establishes own milestones, team objectives and can delegate assignments.
- ❖ Work is often self-initiated. May have defined authority for a significant area of work.
- ❖ Accountable for actions and decisions taken by self and others.

### **Influence**

- ❖ Influences organisation, customers, suppliers and peers within the profession on contribution of discipline/field.
- ❖ Significant responsibility for the work of others and the allocation of resources.
- ❖ Decisions impact on success of projects (results, timelines and budget).
- ❖ Develops business relationship with customers and suppliers.

### **Complexity**

- ❖ Challenging range and variety of complex technical or professional work activities.
- ❖ Work requires application of principles in a wide and often unpredictable range of contexts.
- ❖ Understands relationship between discipline/field and wider customer/organisational requirements.
- ❖ Work may involve application of wide range of technical and/or management principles.

### **Management**

- ❖ Advises on available standards, methods, tools and applications in the discipline/field and can make correct choices from alternatives,
- ❖ Can analyse, diagnose, design, plan, execute and evaluate work to time, cost and quality targets.
- ❖ Communicates effectively both formally and informally with colleagues, subordinates and other stakeholders.
- ❖ Clear understanding of the relationship between own area of responsibility/discipline to the organisation and takes customer requirements into account when making proposals.
- ❖ Demonstrates clear leadership skills and the ability to influence and persuade.
- ❖ Understands and communicates the role and impact of ICT in the organisation.
- ❖ Takes initiative to keep both own and subordinates' skills up to date.
- ❖ Is aware of new developments in the discipline/field.