TOWARDS A DEFINITION OF THE IT PROFESSION

Information Technology Committee
Professional Activities Board
IEEE Computer Society

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1. INTRODUCTION

The IT Committee of the Professional Activities Board (PAB-IT) was established to provide leadership and suggested course(s) of action for the IEEE Computer Society in the IT field of computing. The PAB-IT committee was asked to consider the needs of computing professionals (specifically in the IT field) as they may relate to IEEE CS products and services. The PAB-IT committee wishes to take into consideration the broader issue of an "IT Profession" in order to arrive at suitable recommendations for the IEEE CS in the long term, much as IEEE CS done already in software engineering with their definition of the SWEBOK.

This whitepaper documents some key models (both existing externally in the IT domain and internally within the CS) that will be used to describe aspects of the IT Profession. These models represent some of the common terms and taxonomies used to describe the discipline and the profession; they are presented by PAB-IT before issuing specific plans and recommendations to the IEEE CS, because a common vocabulary is needed within the IEEE CS in order to proceed with further discussions, planning and recommendations. The models documented in this whitepaper include:

- The scope of "IT",
- The elements of the IT Profession,
- Relationships between "the elements of the IT Profession" and the priority issues and opportunities of IT practitioners and their employers, and
- Relationships between existing artifacts and "the elements of the IT Profession".

These models will be used for planning IEEE Computer Society initiatives, products and policies in the IT domain. In planning, priority will be given to advancing those elements of the IT profession that will have the most impact on priority issues and opportunities.

The IT Committee realized that other organizations have developed their own artifacts that correspond to various elements of the IT profession. These artifacts include bodies of knowledge, skills and competency definitions, and even job / role definitions. But there was not a great deal of uniformity, so the Committee resolved to evaluate these other models by developing a meta-model of the elements of the IT profession. Each existing artifact can then be mapped to the meta-model to determine which need it satisfies. The meta-model will also provide a means to compare artifacts by determining which elements the artifacts address and then comparing them on an element by element basis.

The meta-model will be used as the basis of performing a "current state" assessment of the elements of the IT profession. A gap analysis will then be done between the current state and an ideal future state where all the elements of the IT profession are established and being effectively utilized. A phased, work program will then be developed to close the gaps on a prioritized basis based on each element's contribution to resolving priority issues of IT practitioners and their employers.

This document should not be considered complete; it should be continuously reviewed and updated as the IT domain evolves. Artifacts generated by other organizations such as SFIA, ACM, and SHRC/ICTC are constantly changing, and the model(s) described here should regularly be compared, validated against and harmonized with these external models if possible.

Finally because of the important work and accomplishment of the IEEE CS in defining the discipline and profession of Software Engineering, this document discusses the overlap between several IT sub-disciplines and sub-disciplines already defined by the IEEE CS in Software Engineering.

2. ELEMENTS OF THE IT PROFESSION

Various types and forms of technologies are covered within the technical scope of Information Technology and the list of technologies is continually changing. The list of technologies is vast, from computing devices, application software, communications technologies, to computing services.

However the committee declares that a complete view of the IT Profession (and the IT Professional) includes more than the actual technology components. The profession of Information Technology must include everything needed to allow a professional (practitioner) to assume responsibility for all aspects of computing technology itself (such as specification, development, testing, operation, support and maintenance of the technology) as well as the application and management of such technology.

Responsibility for performance of these activities, as they apply to information technologies, defines the scope of responsibility for the IT practitioner. Given the breadth of these activities, an individual practitioner is typically assigned responsibility for a related sub-set of these activities through a defined job role. Each job role therefore carries competency requirements defined by the knowledge and skills required to competently perform the activities associated with the job role. The exception would be a CIO (Chief Information Officer) who may be responsible for the complete set of IT activities.

A robust IT profession will provide the means for an IT practitioner to gain and maintain required knowledge and skills associated with defined job roles. Certification and licensing provides a means to demonstrate the attainment of competencies.

Figure 1 below depicts some of the important elements of a (generic) profession[1].

[1] Gary Ford and Norman E. Gibbs, A Mature Profession of Software Engineering, Technical Report (Carnegie Mellon University: Software Engineering Institute, 1996).

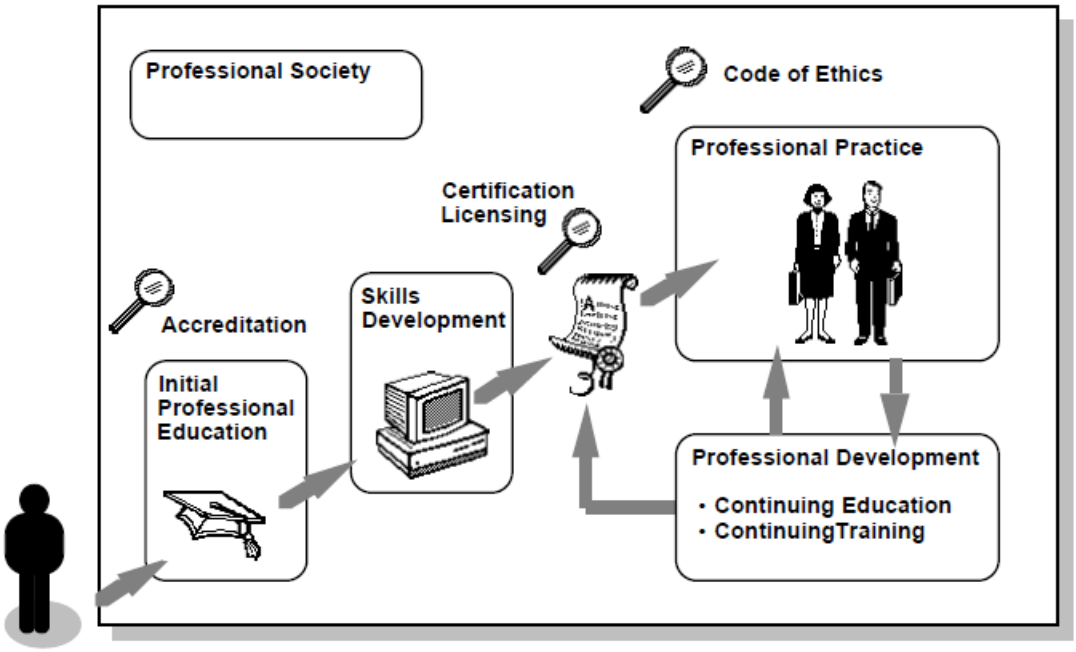

Figure 1 - Elements of a Profession

Note that different elements of a profession are required by a professional at various points in his/her professional development. While one can define any one element such as a Syllabus (via a sub-model perhaps) in detail, it is important to recall that the formation and maintenance of a professional within a professional regime requires the integration of all of these elements – they must align and be consistent with each other; i.e. the sub-models do not stand in isolation. An organization seeking to build or establish a true "IT profession" must be aware of all of these elements and ensure that they are aligned.

Figure 2 shows some of the relationships between elements of a profession that must be kept in alignment.

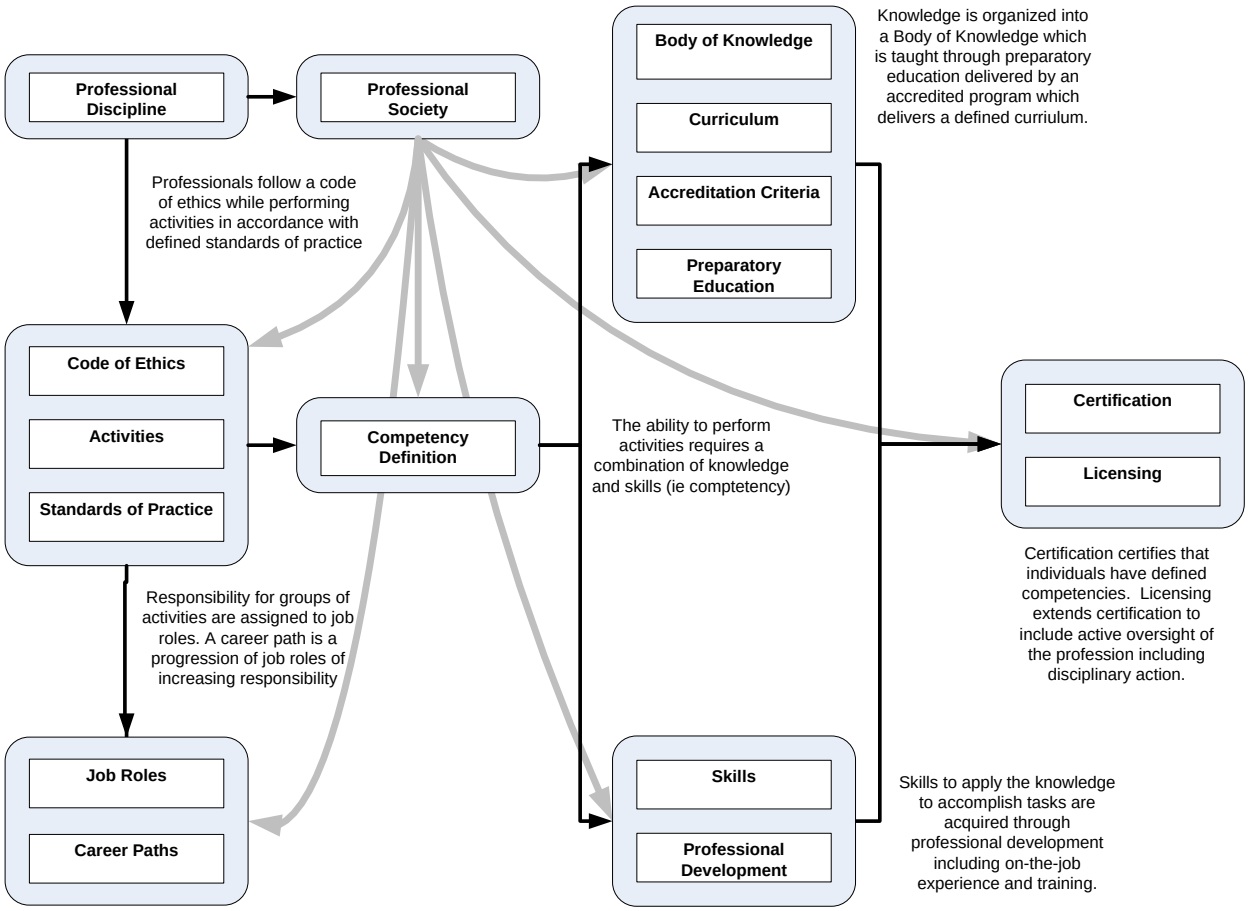

Figure 2 - Relationships Between Elements of a Profession

Definitions

The required elements of an IT profession include:

Professional Societies

- Existence of professional organizations that support the advancement of the profession.
- Sufficiency and sustainability of employment in the profession.
- There are active research efforts to advance the state of the profession's knowledge

Code of Ethics

- Common code of ethics to all IT sub-disciplines

- A code of ethics which specifies appropriate professional conduct to engage in the profession.

Activities

- Specification, development, testing, operation, support and maintenance of information technologies as well as the application and management of such technologies.

Standards of practice

- Application of current best practice
- Means to track evolving technologies, methods
- Standards that specify techniques, methods, procedures and performance norms, agreed to by the profession, which supports the best in professional practice.

Competency definitions

- Comprehensive competence architecture in place
- Ongoing maintenance regime for the competence architecture

Body of Knowledge

- Clearly defined core body of knowledge
- Specialized bodies of knowledge beyond “core”
- Supporting knowledge areas such as technical management, etc
- A description of the knowledge, methods, and practices that define the content of the profession.
- Consensual validation of the knowledge.
- A rational and scientific foundation for the knowledge.

Curriculum

- Defined by recognized, authoritative bodies
- Curriculum models that support the establishment and improvement of educational programs.

Accreditation criteria

- Aligned to certification regimes
- An accreditation system that assures the quality and suitability of the preparatory education.

Preparatory Education

- Readily available programs that comply with curriculum and accreditation criteria

- The education and training necessary to be employed in an entry level position in the profession.

Skills

- The ability to influence things; to take what you know and apply it so as to cause a real effect to occur.
- A certain amount of knowledge is a prerequisite of skill; you can't be skillful without first being knowledgeable; however, you can easily be knowledgeable without being very skillful.

Professional Development

- Multiple means to maintain and advance skills and knowledge
- Education, training and experience necessary to keep current and advance in the profession.

Certification

- Standard and recognized certification regime
- Consistent with body of knowledge
- Mechanisms for certification (to prove competence) that do not require compliance with education requirements
- Defined means of re-certification/CPD & de-certification
- Includes professionalism aspects
- Includes demonstration of competency through practice (apprenticeship / experience)
- Mechanisms to support specialist competence areas
- Validation, by a community of peers, that an individual possesses the knowledge and competence of a professional.

Licensing

- Implemented by other authoritative bodies
- Supported by clear body of knowledge, certification standards, competency standards, code of ethics and a clear boundary of a licensed discipline
- Validation, by a community of peers, that an individual possesses the knowledge and competence of a professional.

Job Roles

- A type of position in an organization characterized by the responsibilities for performance of activities assigned to the position
- Level of responsibility varies between job roles
- Job roles should be clearly defined in terms of responsibilities and the competencies required

Career Paths

- The series of jobs a person holds in their life is their career.
- A career path is a pre-defined series of job roles where experience in previous job roles is relevant to subsequent job roles.

3. RELATIONSHIPS TO PRIORITY ISSUES & OPPORTUNITIES

Priority issues and opportunities for IT Practitioners and their employers have been identified. This section identifies which elements of the IT profession contribute to each issue and opportunity. This relationship will be used to prioritize the recommended work program in order to first advance those elements that have the most impact on priority issues and opportunities.

IT Practitioner Issues & Opportunities

Issue / Opportunity	Related Element
Staying current with technology change	• Professional development • Body of Knowledge
Recognition of expertise, professionalism, experience	• Accreditation Criteria • Certification • Licensing
Knowledge of best practices	• Standards of practice • Professional development
Career development	• Professional development
Ambiguity/lack of specificity of skills required for various roles	• Competency definitions

IT Employer Issues & Opportunities

Issue / Opportunity	Related Element
Attracting, developing and retaining IT professionals	• Professional development
Working with enterprise management to assure IT's alignment	• Preparatory education • Professional development • Body of Knowledge
Building business skills in IT	• Preparatory education • Professional development • Body of Knowledge
Reducing the cost of doing business	• Competency definitions • Certification • Professional development
Improving IT application and service delivery quality	• Preparatory education • Professional development

	• Body of Knowledge
Assuring information security and privacy	• Preparatory education • Professional development • Body of Knowledge
Managing change	• Preparatory education • Professional development • Body of Knowledge
IT strategic planning	• Preparatory education • Professional development • Body of Knowledge
Making better use of information	• Preparatory education • Professional development • Body of Knowledge
Evolving IT's leadership role in the enterprise	• Professional development • Competency definitions
Customer-Facing Innovation	• Professional development • Competency definitions

4. EXISTING ELEMENTS

This section of the document maps a few key existing artifacts to the model of the IT profession. This demonstrates the usage of the model for comparing existing artifacts and determining the degree to which they satisfy the priority needs of each element.

The following subset of existing artifacts are mapped:

- SFIA
- ICT Competency Profile (OSPM)
- IEEE/ACM IT Curriculum Model
- The ACS CBoK Model
- ABET Accreditation Criteria
- Washington Accord Grad Profiles
- European eCompetence Framework

Figure 3 shows a summary of the mapping of these existing artifacts to the model of the IT profession.

Elements of the IT Profession	SFIA	ICT Competency Profile (OSPM)	IEEE/ACM IT Curriculum Model	The ACS CBoK Model	ABET Accreditation Criteria	Washington Accord Grad Profiles	European eCompetence Framework
Professional Society							
Code of Ethics							
Activities		Activities, Tasks, Performance Indicators					Competence Areas
Standards of Practice							
Job Roles	Level of Responsibility	Streams, Sample Job Titles					
Career Paths		Clusters					
Competency Definition		Business/Interpersonal Competencies, Technical Competencies, Behaviour Indicators				Professional Competency Profile	Competences
Body of Knowledge			Knowledge Areas	Core BOK KAs, Role Specific BOK KAs, Complementary BOK KAs, Topics		Knowledge Profile	Knowledge
Curriculum			Units, Topics, Learning Outcomes				
Accreditation Criteria					General Criteria for Baccalaureate Level Programs, Program Criteria	Graduate Attribute Profile	
Preparatory Education							
Skills	Skill Category, Skill Subcategory, Skills			Graduate Skill Sets			Skills
Professional Development							
Certification							

Figure 3 - Mapping of Existing Artifacts to Model of the IT Profession

SFIA

According to its website (http://www.sfia.org.uk/) “the Skills Framework for the Information Age (SFIA) provides a common reference model for the identification of the skills needed to develop effective Information Systems (IS) making use of Information & Communications Technology (ICT). …The SFIA Foundation coordinates activities to facilitate the availability and implementation of SFIA throughout the UK and beyond.”

SFIA “is a simple and logical two-dimensional framework consisting of areas of work on one axis and levels of responsibility on the other.”

“The skills relate both to the e-skills UK National Occupational Standards and to the BCS’s SFIAplus which incorporates its Industry Structure Model.”

How the framework was developed is explained briefly as “The Framework has been validated through a series of pilot assessments of large and small organizations in the private and public sector. These have been conducted by independent professional assessors from the BCS and from the Institution of Electrical Engineers (IEE).”

"The SFIA skills categories are broken down into sub-categories and then "individual skills". This model goes on to describe each skill as it is demonstrated at various levels of competence.

The SFIA model groups skills into the following categories:

1. Strategy & architecture
2. Business change
3. Solution development and
4. Implementation
5. Service management
6. Procurement & management support
7. Client interface

These categories are then broken down into subcategories and specific skills.

Each of these categories is recognizable as a specific area for which a CIO would be responsible.

The Australian Computer Society's CBOK recognizes the weakness of the SFIA, saying

"The SFIA defines ICT skills, but does not list underlying knowledge areas, which may be ICT discipline or domain dependant. These knowledge areas include methodologies, technologies, programming paradigms or specific ICT tools, libraries or languages that may be specific to a given ICT discipline, position description or academic study program.

"For the purposes of this paper, skill and knowledge are defined as follows:

> "**Skill**: the application of knowledge and know-how to complete tasks and design ICT solutions.
>
> "**Knowledge**: the body of facts, principles, theories and practices that forms the basis for a given discipline."

Figure 4 shows the information in the SFIA model.

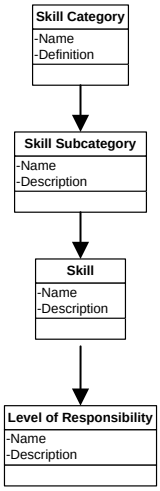

Figure 4 - SFIA Information Model

The information in the SFIA model maps to the elements of the IT profession as follows:

Elements of the IT Profession	Elements of SFIA
Professional Society	
Code of Ethics	
Activities	
Standards of Practice	
Job Roles	Level of Responsibility
Career Paths	
Competency Definition	
Body of Knowledge	
Curriculum	
Accreditation Criteria	
Preparatory Education	
Skills	Skill Category, Skill Subcategory, Skills
Professional Development	
Certification	
Licensing	

ICT Competency Profile (OSPM)

The Information and Communications Technology Council (ICTC) of Canada has produced its Occupational Skills Profile Model (OSPM) “in response to an urgent need for standardized skills in the Canadian ICT sector, the public sector and educational institutions. It is the foundation for identifying, recruiting, retaining and retraining workers. The 36 current occupational profiles defined by the OSPM

include jobs to be compared across industries and over time, and give employers the ability to target and address skills gaps within their organizations."

The OSPM model is defined in terms of career streams, each of which contains related jobs representing a feasible progression ("career stream") through a career. Orthogonal to this, the OSPM model defines both managerial and technical competencies at various levels, and maps them to jobs.

Table 2 below shows the major job / career streams, broken down into job areas based on what is produced by work efforts. The model also maps each of the job areas listed to one or more specific job roles/titles used in the IT industry.

Table 1 OSPM Model - Streams job / roles

SOFTWARE PRODUCTS
Analysis / Design
Analysis/ Programming
Application Software Implementation
Business Analysis and Service Level Management
Programming
Software Design and Delivery (Engineering)
Technical ICT Architecture
Web Design
Web Development
INFRASTRUCTURE
Data Administration
Database Administration
Capacity and Performance
Help Desk
Network Planning and Support
Operations
Problem Management
Security
Systems Programming
User Technical Support
MANAGEMENT
ICT Management
Intellectual Property Management
Production Management
Project Management
Supply Chain Management
ICT Consultancy

HARDWARE PRODUCTS
Design Engineering
Hardware Scientist
Manufacturing Engineering
Product Line Management
Technical Marketing
TESTING / QUALITY CONTROL
Audit
Validation
Quality Assurance
Quality Professional
DOCUMENTATION AND TRAINING
Education/Training Management
Technical Writing

Like SFIA, the OSPM model also includes specific skills and competencies (both professional and technical), are associated with (mapped to) to job/roles.

Figure 5 shows the information model for the ICT Competency Profile.

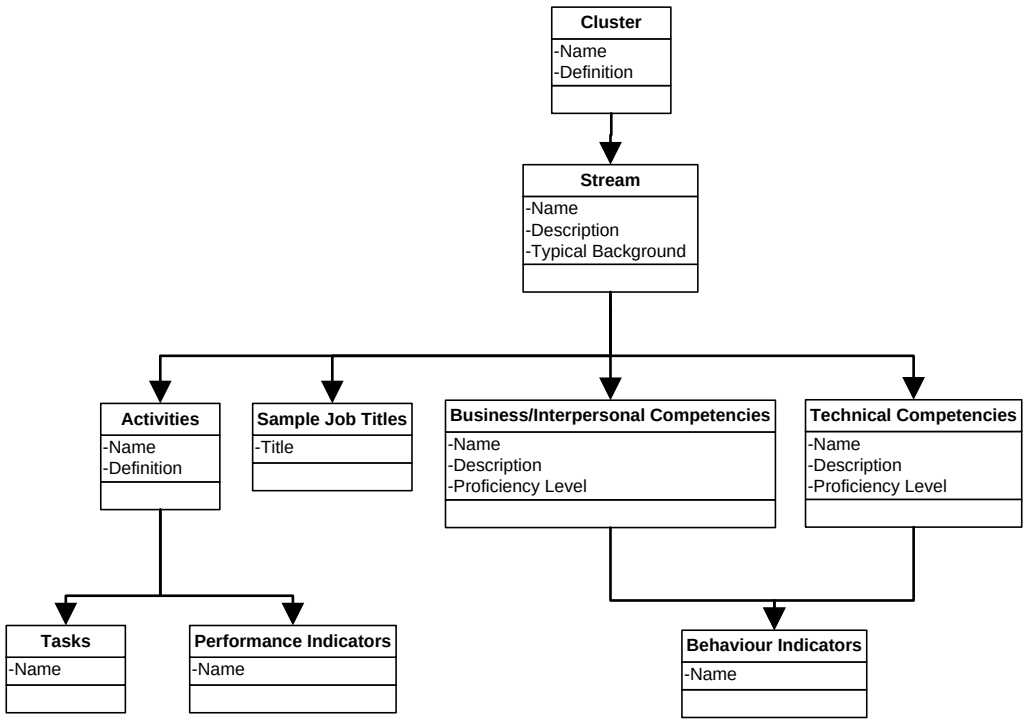

Figure 5 - ICT Competency Profile Information Model

The elements of the information model map to the elements of the IT profession as follows:

Elements of the IT Profession	Elements of ICT Competency Profile
Professional Society	
Code of Ethics	
Activities	Activities, Tasks, Performance Indicators
Standards of Practice	
Job Roles	Streams, Sample Job Titles
Career Paths	Clusters
Competency Definition	Business/Interpersonal Competencies, Technical Competencies, Behaviour Indicators
Body of Knowledge	
Curriculum	
Accreditation Criteria	
Preparatory Education	
Skills	
Professional Development	
Certification	
Licensing	

IEEE/ACM IT Curriculum Model

In addition to the SFIA and OSPM, we also took into account the IT Computing curriculum[2] published in 2008. This curriculum posits the following knowledge areas as comprising IT (i.e., this is the ACM/IEEE

[2] Computing Curricula Information Technology Volume "Information Technology 2008: Curriculum Guidelines for Undergraduate Degree Programs in Information Technology"

academic model of IT):

ITF	Information Technology Fundamentals
HCI	Human Computer Interaction
IAS	Information Assurance and Security
IM	Information Management
IPT	Integrative Programming and Technologies
MS	Math and Statistics for IT
NET	Networking
PF	Programming Fundamentals
PT	Platform Technologies
SA	Systems Administration and Maintenance
SIA	System Integration & Architecture
SP	Social and Professional Issues
WS	Web Systems and Technologies

In defining the curriculum for IT, this project defined what they termed “the IT body of knowledge.”

It is described thusly in Appendix A of the report: “The IT body of knowledge is organized hierarchically into three levels. The highest level of the hierarchy is the knowledge area, which represents a particular disciplinary subfield. Each knowledge area is identified by a two- or three-letter abbreviation, such as or PF for Programming Fundamentals or ITF for IT Fundamentals. The knowledge areas are broken down into smaller divisions called units, which represent individual thematic modules within a knowledge area. Each unit is identified by adding a numeric suffix to the area name; as an example, PF3 is a unit on object-oriented programming. Each unit is further subdivided into a set of topics, which are the lowest formal level of the hierarchy.”

Figure 6 shows the information model for the IT 2008 Curriculum guidelines.

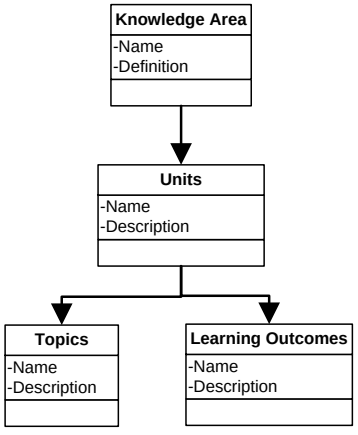

Figure 6 - Information Model for IT 2008 Curriculum Guidelines

The elements of the information model map to the elements of the IT profession as follows:

Elements of the IT Profession	Elements of IT 2008 Curriculum Guidelines
Professional Society	
Code of Ethics	
Activities	
Standards of Practice	
Job Roles	
Career Paths	
Competency Definition	
Body of Knowledge	Knowledge Areas
Curriculum	Units, Topics, Learning Outcomes
Accreditation Criteria	
Preparatory Education	
Skills	
Professional Development	
Certification	
Licensing	

The ACS CBoK Model

The Professional Standards Board of the Australian Computer Society has published **THE ICT PROFESSION Body of Knowledge** , which seeks to define what an IT curriculum should address**.** They propose the following framework:

- **Graduate Skill Sets**: the technical and professional skills, developed during a given program of study, that qualify graduates to undertake one or more ICT roles.
- **Core Body of Knowledge**: the Core Body of Knowledge (CBOK) shared by all ICT programs, encompassing (i) ICT problem solving; (ii) Professional knowledge; (iii) Technology building; (iv) Technology resources; (v) Services management; and (vi) Outcomes management.
- **Role Specific Body of Knowledge**: knowledge that is specific to a particular degree program or ICT discipline, and that is necessary to undertake the intended ICT role(s). In some programs predefined curriculum may assist in defining the components of this block.
- **Complementary Body of Knowledge**: Complementary knowledge that broadens a student's education, enhances employability and prepares graduates for ICT careers in the global economy, and to be of service to society and the local community.

Component knowledge areas for each block are then suggested. For example, the core block would include:

- ICT Problem Solving (PS)
- Professional Knowledge (PK)
- Technology Building (TB)

- Technology Resources (TR)
- Services Management (SM)
- Outcomes Management (OM).

Each knowledge area is taken broken down further into topics. For example, Technology Resources contains Hardware and software fundamentals, Data and information management, and Networking. The table in the following section shows these topics.

Figure 7 shows the information model for the ACS CBOK.

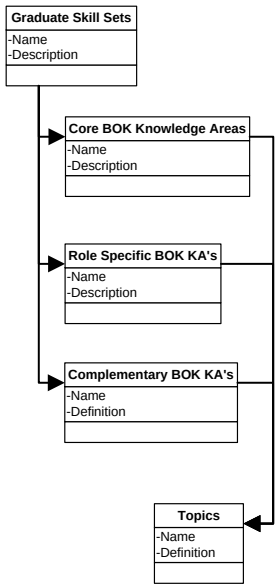

Figure 7 - ACS CBOK Information Model

The elements of the information model map to the elements of the IT profession as follows:

Elements of the IT Profession	Elements of ACS CBOK
Professional Society	
Code of Ethics	
Activities	
Standards of Practice	
Job Roles	
Career Paths	
Competency Definition	
Body of Knowledge	Core BOK KAs, Role Specific BOK KAs, Complementary BOK KAs, Topics
Curriculum	
Accreditation Criteria	
Preparatory Education	
Skills	Graduate Skill Sets

Professional Development	
Certification	
Licensing	

ABET Accreditation Criteria

"As part of establishing its criteria for evaluating computer-related programs, ABET/CAC has defined specific criteria that distinguish computer science, information systems, and IT degree programs. In seeking ABET accreditation, schools must align the names of their programs with these criteria.

The criteria do not preclude programs specifying additional competencies beyond the minimal criteria that their graduates will possess. This encourages programs to focus their curricula on meeting the needs of specific sectors of future employers while simultaneously presenting a unified expectation about the baseline qualifications that all computer scientists, information systems professionals, and information technologists will possess. Concurrently, it lets educators concentrate on making their courses and curricula consistent with the common criteria used to define and measure the success of each program discipline.

In the end, potential students and employers will be able to distinguish between the expected competencies that graduates of these programs should demonstrate."[3]

Figure 8 shows the information model for the ABET Accreditation Criteria.

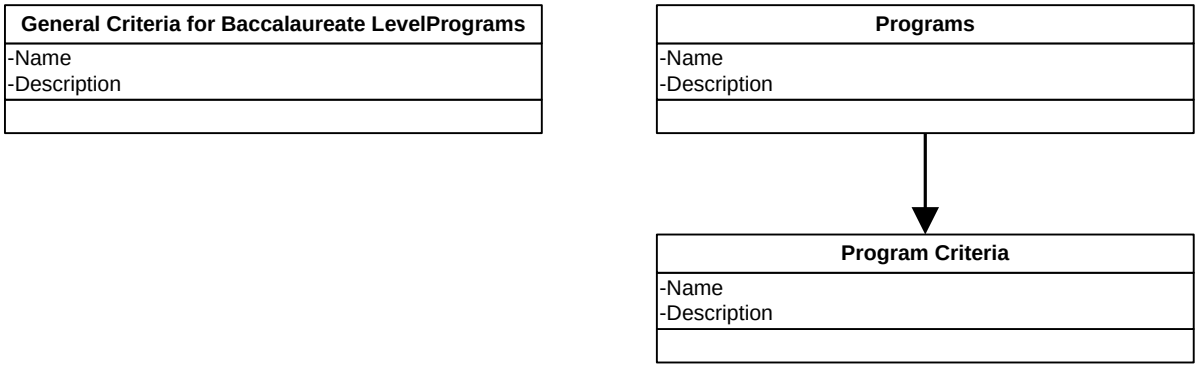

Figure 8 - ABET Accreditation Criteria Information Model

[3] Reif, Harry J. Trends in Accreditation, IEEE Computer, Nov 2009

The elements of the information model map to the elements of the IT profession as follows:

Elements of the IT Profession	Elements of ABET Accreditation Criteria
Professional Society	
Code of Ethics	
Activities	
Standards of Practice	
Job Roles	
Career Paths	
Competency Definition	
Body of Knowledge	
Curriculum	Expectations on curriculum are included in some criteria.
Accreditation Criteria	General Criteria for Baccalaureate Level Programs, Program Criteria
Preparatory Education	
Skills	
Professional Development	
Certification	

Washington Accord Grad Profiles

Several accrediting bodies for engineering qualifications have developed outcomes-based criteria for evaluating programmes. Similarly, a number of engineering regulatory bodies have developed or are in the process of developing competency-based standards for registration. Educational and professional accords for mutual recognition of qualifications and registration have developed statements of graduate attributes and professional competency profiles. This document presents the background to these developments, their purpose and the methodology and limitations of the statements.

Several international accords provide for recognition of graduates of accredited programmes of each signatory by the remaining signatories. The Washington Accord (WA) provides for mutual recognition of programmes accredited for the engineer track. The Sydney Accord (SA) establishes mutual recognition of accredited qualifications for engineering technologist. The Dublin Accord (DA) provides for mutual recognition of accredited qualifications for engineering technicians. These accords are based on the principle of substantial equivalence rather than exact correspondence of content and outcomes.

Graduate attributes form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The graduate attributes are exemplars of the attributes expected of graduate from an accredited programme.

Graduate attributes are clear, succinct statements of the expected capability, qualified if necessary by a range indication appropriate to the type of programme.

The professional competency profiles for each professional category record the elements of competency necessary for competent performance that the professional is expected to be able to demonstrate in a holistic way at the stage of attaining registration.

Figure 9 shows the information model for the Washington Accord.

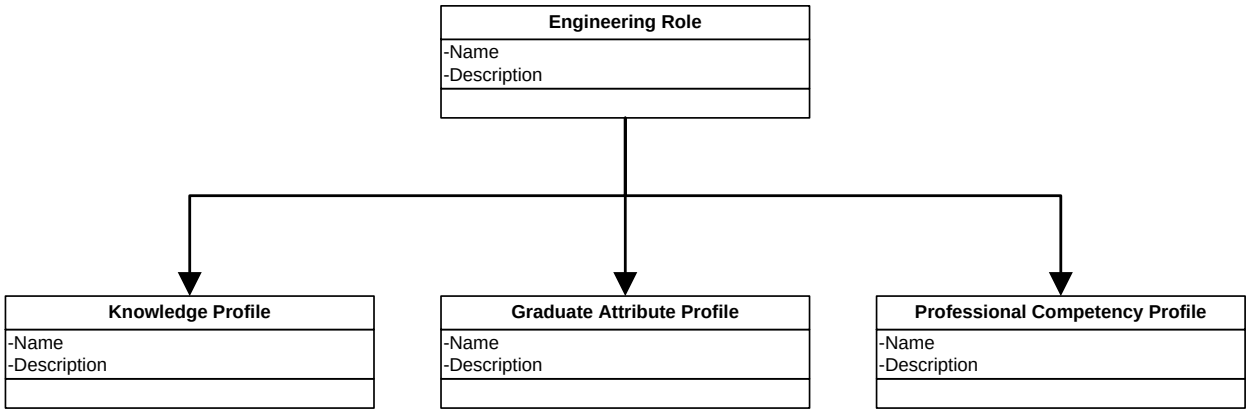

Figure 9 - Washington Accord Information Model

The elements of the information model map to the elements of the IT profession as follows:

Elements of the IT Profession	Elements of Washington Accord
Professional Society	
Code of Ethics	
Activities	
Standards of Practice	
Job Roles	
Career Paths	
Competency Definition	Professional Competency Profile
Body of Knowledge	Knowledge Profile
Curriculum	
Accreditation Criteria	Graduate Attribute Profile
Preparatory Education	
Skills	
Professional Development	
Certification	

European eCompetence Framework

The European e-Competence Framework (e-CF) is a European wide reference framework of information and communication technologies (ICT) competences that can be used and understood by ICT professionals and human resources managers from ICT user and supply companies, small and medium sized enterprises, the public sector, as well as educational and social partners across the European Union.

The European e-Competence Framework is structured from four dimensions. These dimensions reflect different levels of business and human resource planning requirements in addition to job/ work proficiency guidelines and are specified as follows:

Dimension 1: 5 e-Competence areas, derived from the ICT business processes
PLAN – BUILD – RUN – ENABLE – MANAGE

Dimension 2: A set of reference e-Competences for each area, with a generic description for each competence. 32 competences identified in total provide the European generic reference definitions of the framework.

Dimension 3: Proficiency levels of each e-Competence provide European reference level specifications on e-Competence levels e-1 to e-5, which are related to the EQF levels 3 to 8.

Dimension 4: Knowledge and skills related to the e-Competences are indicated as optional framework components for inspiration. They are not intended to be exhaustive.

Figure 10 shows the information model for the European eCompetence Framework.

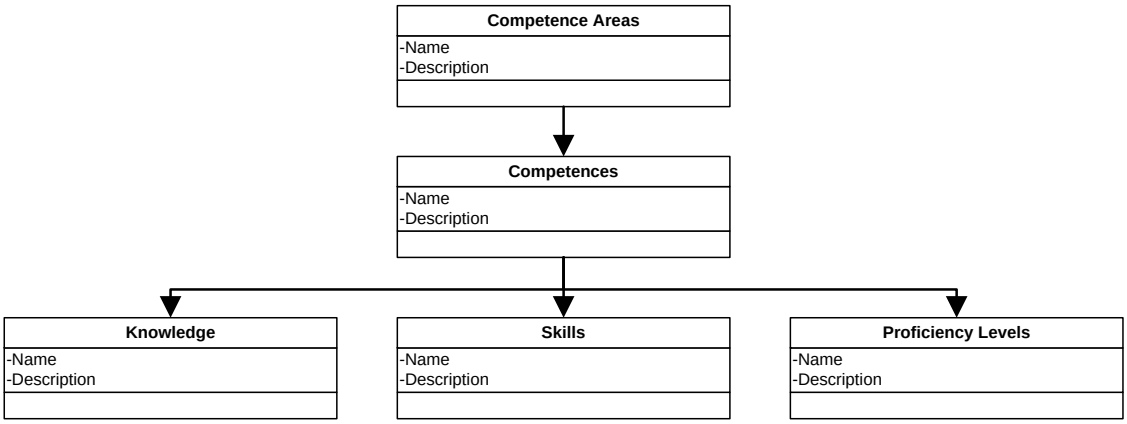

Figure 10 - European eCompetence Framework Information Model

The elements of the information model map to the elements of the IT profession as follows:

Elements of the IT Profession	Elements of European eCompetence Framework
Professional Society	
Code of Ethics	
Activities	Competence Areas
Standards of Practice	
Job Roles	
Career Paths	
Competency Definition	Competences
Body of Knowledge	Knowledge
Curriculum	
Accreditation Criteria	
Preparatory Education	
Skills	Skills
Professional Development	
Certification	

5. OVERLAP & GAP ANALYSIS

Figure 3 shows the coverage of the elements of the IT profession provided by the existing artifacts that were assessed. It shows where multiple artifacts specify an element, and where there are gaps.

The artifacts that were mapped were only a representative set of artifacts that were mapped to illustrate the usage of the meta-model for the IT profession. Against this limited subset of artifacts the following observations can be made:

Elements not covered at all by the set of artifacts:

- Professional societies
- Code of ethics
- Preparatory education
- Professional development
- Certification

Elements consistently covered by one or more artifacts:

- Career paths
- Curriculum
- Skills

Elements covered by multiple artifacts that need rationalization:

- Job roles
- Competency definition
- Body of knowledge
- Accreditation criteria

6. RELATIONSHIPS BETWEEN COMPUTING DISCIPLINES

Software Engineering

Figure 11 below shows the software lifecycle processes defined in IEEE standard 12207. The standard defines all the processes required for developing and maintaining software. Figure 12 shows the knowledge areas defined in the 2004 version of the Software Engineering Body of Knowledge (SWEBOK). Clearly these activities and knowledge areas will be common to software engineering practitioners and to IT practitioners responsible for developing and maintaining software. The scope of the IT profession is different than software engineering in that it includes activities such as “business solution analysis” and “IT operations and support” which are not included in the scope of software engineering activities. While the scope of activities performed by software engineering practitioners overlaps those performed by IT practitioners, often the computing technologies involved differ. Software engineering often develops embedded, real-time software, operating systems and software tools which are not typically the domain of IT practitioners. IT practitioners are often applying existing products, technologies and services, whereas software engineers are typically involved in developing new products and technologies. Figure 13 shows these relationships between the two computing disciplines.

Much work has been accomplished by IEEE CS and others to define the elements of the software engineering profession. As a result, software engineering has achieved the status of an evolving, well-defined profession. As the IT committee works to define and mature the elements of the IT profession, the overlap between the two disciplines must be recognized. The intent will be to promote utilization of the elements of the software engineering profession in the area of overlap, namely “solution development and maintenance”. As there are commonalities and differences between the work of an IT professional and a software engineer, the IT committee will continue to work with the Software Engineering Committee to clarify both the overlaps and the differences.

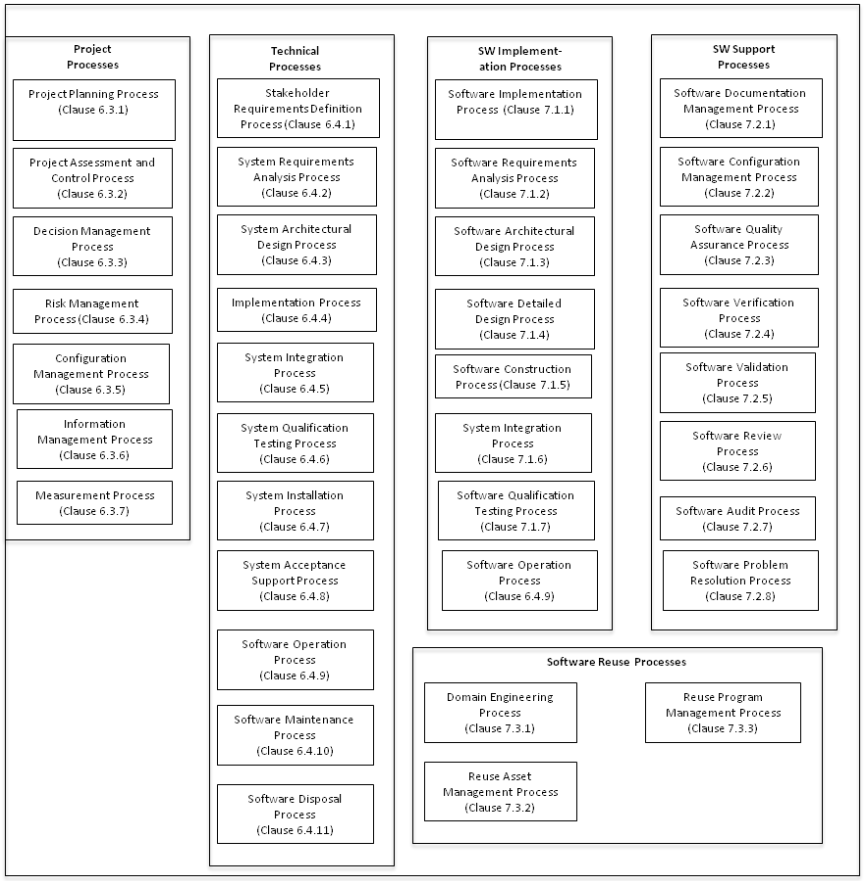

Figure 11 -Software Life Cycle Process Groups (Figure 1, IEEE Std 12207-2008)

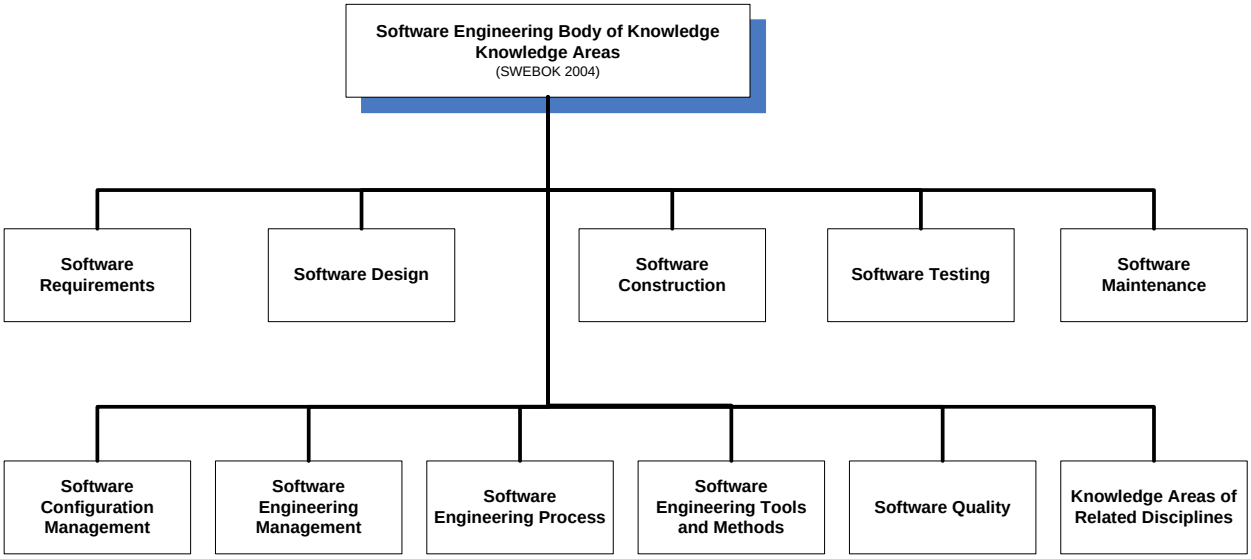

Figure 12 - SWEBOK 2004 Knowledge Areas

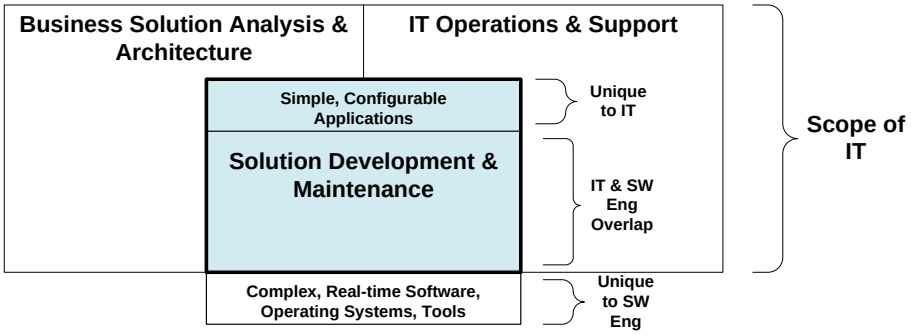

Figure 13 - Relationship Between Software Engineering and IT

IT Sub-disciplines

The IT Committee felt that the profession of IT was too broad to handle as a single profession and has decided to partition IT into the following three sub-disciplines:

1. Business Solution Analysis and Architecture
2. Solution Development and Maintenance
3. IT Operations and Support

The elements of the profession will be assessed against the needs of each sub-discipline to determine if a common element will satisfy the needs of all three sub-disciplines, or if a sub-discipline specific element will be required. As discussed above, the "Solution Development and Maintenance" sub-discipline will heavily utilize the elements of the software engineering profession.

It should be noted that the scope of "Information Technology" adopted by the IT Committee includes the disciplines of "information technology" and "information systems" as defined in "Computing Curricula 2005". One industry issue is the definition of the boundary between IT functions and business functions outside of IT in the areas such as business process analysis, etc.

7. SUMMARY

This white paper has documented an approach to:

- identifying a set of elements of the IT profession,
- their role in contributing to resolution of priority issues and opportunities of IT practitioners and their employers, and
- assessing existing artifacts to determine the degree to which they meet the needs of each element of the IT profession.

This approach will be applied to a more complete set of existing artifacts in order to identify gaps between what exists (current state) and what is needed (future state) to meet the priority needs of IT practitioners and their employers.

A prioritized work program will then be developed to close the gaps identified. This work program will involve:

- adopting of existing artifacts where appropriate,
- influencing the development of artifacts that are in the process of being developed, and initiating work to develop missing elements required to satisfy priority needs.