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The Software Engineering Competency Model (SWECOM)

presented by

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Presentation Agenda

- The SWECOM development process
- Attributes of a Profession
- Elements of SWECOM
- SWECOM Technical Skill Areas
- SWECOM Competency Levels
- SWECOM Use Cases
- Next Steps
- SWECOM Gap Analysis
- Discussion Questions
- Call for Public Reviewers



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The SWECOM Development Process

- A team of six members developed SWECOM
 - sponsored by the IEEE Computer Society
 - originally called SECOM
- 22 subject matter reviewers submitted comments
- Team adjudicated the comments
 - provided feedback to the reviewers
 - revised SWECOM for public review comments
 - public review period is now open



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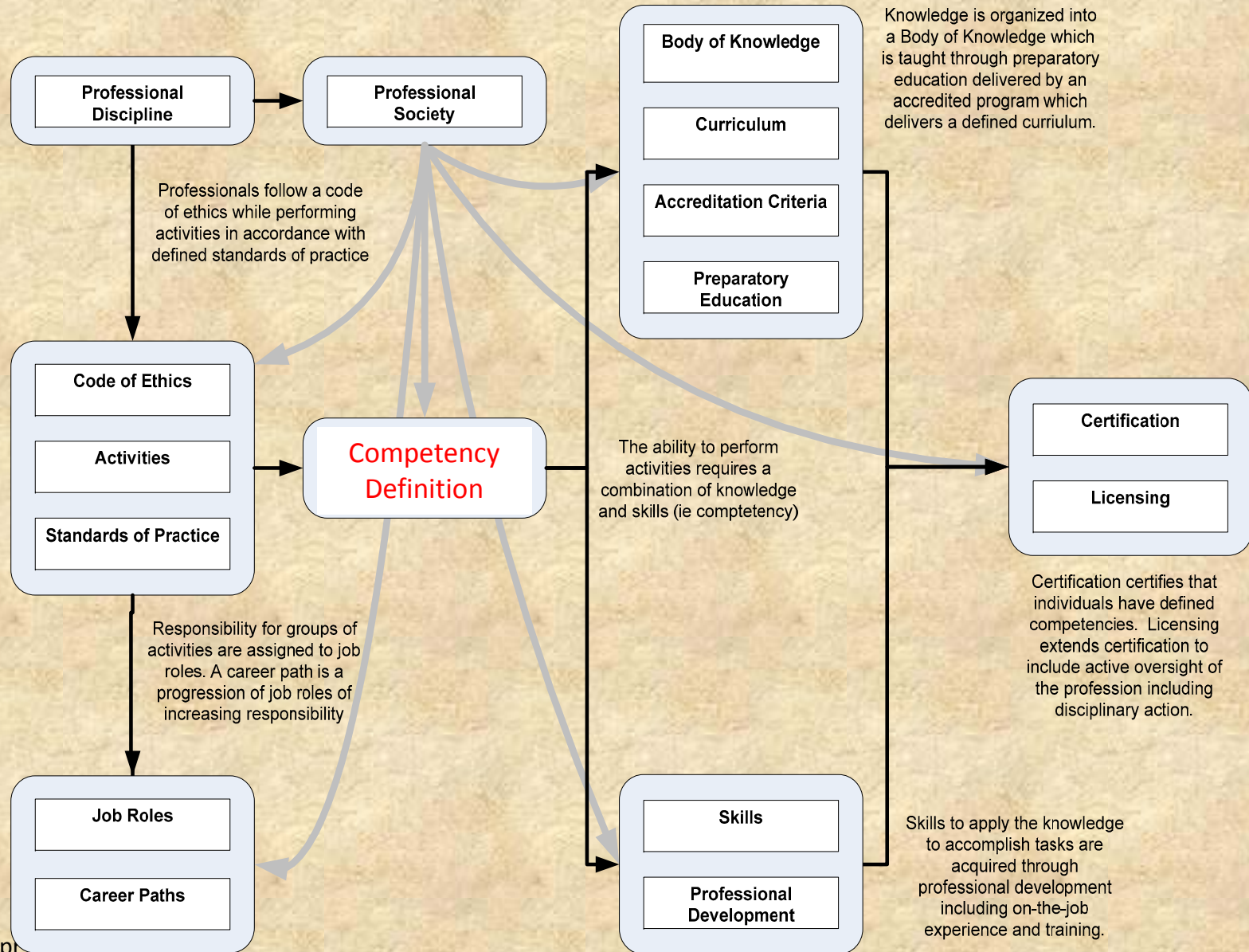
The SWECOM Team

- Mark Ardis, Stevens Institute
- Dick Fairley, S2EA, Team Leader
- Kate Guillemette, IEEE Computer Society
- Thomas Hilburn, Embry Riddle University
- Ken Nidiffer, Software Engineering Institute
- Massood Towhidnejad, Embry Riddle University
- Mary Jane Willshire, S2EA



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Model of a Profession





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Knowledge, Skill, and Competency

- Knowledge is what one knows; skill is what one can do
 - SWECOM is based on software engineering knowledge sources
- A competent person has the knowledge and ability to perform work activities at a given competency level
- SWECOM includes five competency levels for each of 13 software engineering skill areas



Scope of SWECOM

- SWECOM includes
 - cognitive attributes
 - behavioral attributes and skills
 - technical skills
 - extensive references
- SWECOM does not include
 - project management skills related to scheduling, budgeting, and resource management
 - industry-sector technical skills
 - ✓ i.e., embedded systems, IT, or applications
 - domain-specific skills
 - ✓ i.e., health sciences, communication, automotive domains



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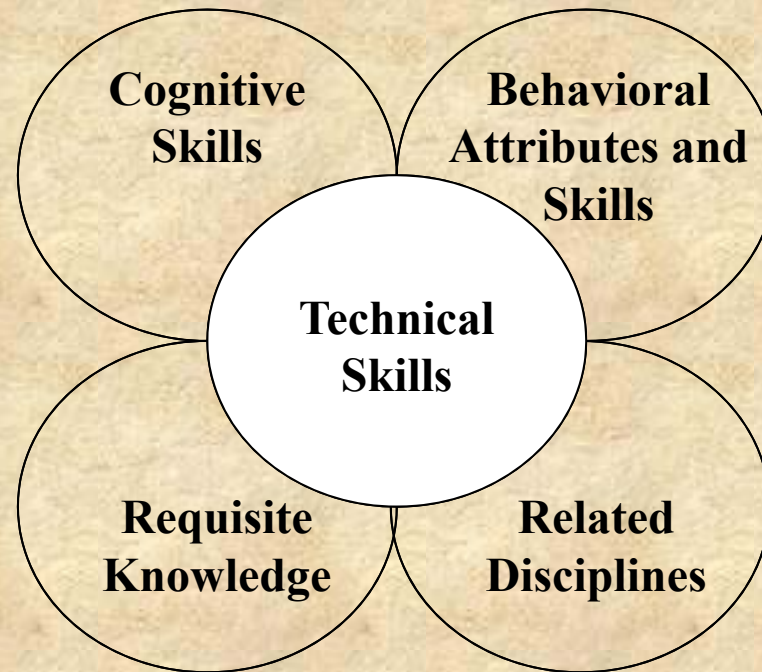
SWECOM TOC

1. Introduction
2. SWECOM and the US IT Competency Model
3. The Elements of SWECOM
4. SWECOM Technical Skills
5. SWECOM Competency Levels
6. Employer and Individual Gap Analysis
7. SWECOM Validation
8. Acknowledgements
9. References
10. Glossary of Terms
11. Software Requirements Skill Area
12. Software Design Skill Area
13. Software Construction Skill Area
14. Software Testing Skill Area
15. Software Sustainment Skill Area
16. Software Process and Life Cycle Skill Area
17. Software Systems Engineering Skill Area
18. Software Quality Skill Area
19. Software Security Skill Area
20. Software Safety Skill Area
21. Software Configuration Management Skill Area
22. Software Measurement Skill Area
23. Human-Computer Interaction Skill Area
24. Appendix A: Contributors
25. Appendix B: SWECOM Intended Audiences
26. Appendix C: SWECOM Use Cases
27. Appendix D: Gap Analysis Worksheets



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Elements of SWECOM



Only the Technical Skills are rated by competency level



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SWECOM Knowledge Sources

- Primary knowledge sources include:
 - SWEBOOK
 - IEEE/ISO Standards
 - Textbooks
 - Curricula
- SWECOM includes 49 references
 - compiled from the 13 skill areas



Related Disciplines

Related disciplines include, but are not limited to:

- Computer Engineering,
- Computer Science,
- General Management
- Mathematics
- Project Management,
- Quality Management, and
- Systems Engineering.

These are the related disciplines in SWEBOK



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SWECOM Cognitive Skills

- Cognitive skills apply across all skill areas, skills, and activities of SWECOM; they include but are not limited to:
 - reasoning skills
 - analytical skills
 - problem-solving skills
 - innovation skills



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SWECOM Behavioral Attributes and Skills

- Include but are not limited to:
 - aptitude
 - enthusiasm
 - initiative
 - work ethic
 - willingness
 - trustworthiness
 - cultural sensitivity
 - communication skills
 - team participation skills
 - technical leadership skills



Skill Areas, Skills, and Activities

- A skill area is a way of naming and grouping related skills
 - e.g., requirements engineering
- A skill is a way of naming and grouping related activities within a skill area
 - e.g., requirements elicitation, analysis, or specification
- Activities are units of work that constitute a skill
 - e.g., elicitation: interviews, prototyping, observation



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SWECOM Technical Skill Areas

SWECOM technical skill areas are categorized as:

- 5 life cycle skill areas
 - include skills and activities for project phases
- 8 cross-cutting skill areas
 - each applies to one or more (perhaps all) life cycle skill areas



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Two Caveats

- The order of listing skill areas, skills, and activities does not imply a life cycle sequencing of phases
- Activities are **not** job roles
 - but can be grouped into job roles
 - for specific organizations
 - and specific projects



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Life Cycle Skill Areas

- Software Requirements
- Software Design
- Software Construction
- Software Testing
- Software Sustainment



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Cross-Cutting Skill Areas

- Software Process and Life Cycle Models
- Software Systems Engineering
- Software Quality
- Software Security
- Software Safety
- Software Configuration Management
- Software Measurement
- Human-Computer Interaction



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Some Examples of Skills and Activities

Skill Area: Software Requirements

- Skills: elicitation, analysis, specification, verification, management
- Elicitation activities:
 - Identifies stakeholders for elicitation of requirements
 - Engages stakeholders in elicitation of requirements
 - Uses appropriate methods to capture requirements
 - Negotiates conflicts among stakeholders during elicitation activities



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Some Examples of Skills and Activities (2)

Skill Area: Software Process and Life Cycle Models

- Skills:
 - implementation of software life cycle models
 - process definition and tailoring
 - process implementation and management
 - process assessment and improvement



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Some Examples of Skills and Activities (3)

Skill Area: Software Process and Life Cycle Models

- Skill: implementation of software life cycle models
 - Activities:
 - ✓ determine one or more organization-wide life cycle models for a project (e.g., waterfall, spiral, V-model, incremental, agile)
 - ✓ select a team software process (e.g., functional, integrated)
 - ✓ carry out process activities specified in a life-cycle process model script
 - ✓ lead a small team in executing some portion of a life-cycle process model (e.g., software design)



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SWECOM Competency Levels

- SWECOM includes five competency levels for software engineering technical activities:
 - technician
 - entry level practitioner
 - practitioner
 - technical leader
 - senior software engineer
- Some activities do not have corresponding competency levels



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Characterization of Competency Levels

- *Technician*: an individual who is competent to follow instructions while performing an activity
- *Entry Level Practitioner*: an individual who is competent to assist in performing an activity or to perform activities with some supervision
- *Practitioner*: an individual who is competent to perform an activity with little or no supervision
- *Technical Leader*: an individual who is competent to lead and direct participants in the performance of the activities in one or more skills or skill areas
- *Senior software engineer*: an individual who is competent to create new, and modify existing processes, procedures, methods, and tools for performing activities, groups of activities within one or more skills, and skills within skill areas



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Characterization of Competency Levels (2)

- An individual may have different competency levels for different activities
- To be competent in a skill, at a given competency level, requires competency in all activities in that skill at the given competency level
- To be competent in a skill area, at a given competency level, requires competency in all skills in that skill area at the given competency level



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SWECOM Use Cases

- Appendix C of SWECOM includes use cases to illustrate how the following individuals might use SWECOM
 - HR and managers to screen job applicants
 - HR and managers to develop strategies and plans
 - to counsel new job-hires
 - individuals to assess competencies and prepare self-improvement plans
 - managers to evaluate and counsel individuals on improvement planning
 - curriculum designers to develop a competency-based training program or academic curriculum



A Manager's Gap Analysis Worksheet

Date: [xxx]

Organizational Unit: [xxx]

Completed by: [names and titles of those completing the worksheet]

Note: **Have**, **Need**, and **Gap** are indicated by number of individuals and competency level (e.g., 3@Entry Level, 2@Practitioner Level)

Competencies (from Tables A & B of the SECOM Skill Areas)

Skills: **Have** **Need** **Gap**

Software Requirements Skills

Software Requirements Elicitation

Software Requirements Analysis

Software Requirements Specification

Software Requirements Verification

Software Requirement Management

Software Design Skills

Software Design Fundamentals

Software Design Strategies and Methods

Software Architectural Design

Software Design Quality Analysis and Evaluation



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Some Discussion Questions

- Have you used or been exposed to competency models in the past?
 - which ones?
 - how were they used?
- In what ways might you or your organization use SWECOM?
- What is missing from SWECOM?
- Other issues, comments, concerns?



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Public Review Cycle is Open!

- SWECOM is currently available for public review

<https://computer.centraldesktop.com/swecomreview/>

- Team will adjudicate public review comments
 - and revise SWECOM accordingly
- Closing date for reviews is **April 20, 2014**
- Publication date is planned for June 2014

Please consider participating in the SWECOM public review