A plan to identify the body of knowledge of software engineers

Steering Committee for the Establishment of Software Engineering as a Profession

Software Engineering Institute, Friday December 10, 1993

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1.0 Recommendation

1.1 The body of knowledge will be defined piece by piece, through surveys.

1.2 Structures to define body of knowledge

1.2.1 Categories of components of knowledge (Static knowledge or dynamic knowledge; things we do):

Generic	Specific to SE
mathematics	software analysis
science	software architectures
engineering science (analytic tools)	computer systems
engineering design (life cycle)	software process (things you do as an engineer)

1.2.2 Levels of knowledge (Educational objectives in cognitive domains; how well do we do things):

Knowledge (lowest then moving higher)

Comprehension

Application

Analysis

Synthesis

Evaluation (highest)

1.3 First identify and classify components of knowledge under static/dynamics knowledge (primary). Then use level of knowledge (secondary)

Define list of main categories (e.g., analysis, architecture, systems, process). Define terms in list. Provide examples

Identify components of knowledge under each listed category. Limit to a small number of components. Provide definition for each component.

1.4 Surveys might differ across domains. For example, within Software Architectures there are many domains. Superdomains also exist, e.g. Embedded systems, Support for human activities

1.5 Survey #1 is to identify components i.e. things all Software Engineers "should know" under various categories (static/dynamic knowledge)

These are 2 questions: know at entry level? Know at expert level?

Preliminary survey can ask people to review/prioritize and add additional components. This preliminary survey is just for debugging the real survey and will be limited to a small group (30 ~ 40 participants) to allow confirming survey results with participants.

Set aside components that fall below some threshold (votes).

1.6 Survey #2 is to identify level of knowledge required for components identified and classified by survey #1.

Before large ballot, do a test involving a few hundreds of participants that agree to work with us. Should also ask for comments. Could also do small sampling many times before doing the larger sampling.

After revision, if necessary, conduct mass balloting. Probably thousands of participants.

Primarily we are concentrating on industry, but any other organizations can provide input.

Try to do surveys with different populations from different areas.

1.7 Later surveys?

Pick up set-aside components and classify by "domains"

Ask the question what SE should know now or in 10 years (ideal)

2.0 Expected result from survey 1

Result from Survey 1 is a table with a list of component above a cut. These are topics that all software engineers should know when they first start working or after a few years of experience. Topics are clustered under major categories (type of knowledge)

Table 1:

Components of Knowledge		Apprentice (Entry Level)	Journeyman/Master (Expert 5 years+)
Software Analysis topics:			
	topic 1	x	
	topic 2		x
	.....	x	
Software Architecture topics:			
	topic 1	x	
	topic 2	x	
	.....		x
Computer Systems topics:			
	topic 1		x
	topic 2		x
	.....	x	
Software Process topics:			
	topic 1	x	
	topic 2		x
	.....		x

3.0 Expected result from survey 2

Result from Survey 2 is an augmented table with the components identified in the first survey but now asking for the level of knowledge required at entry or after a few years of experience. The levels of knowledge are Knowledge (K), Comprehension (C), Application (Ap), Analysis (An), Synthesis (S), and Evaluation (E)

Table 2:

Components of Knowledge		Apprentice (Entry Level)						Journeyman/Master (Expert 5 years+)					
Software Analysis topics:		K	C	Ap	An	S	E	K	C	Ap	An	S	E
	topic 1	x								x			
	topic 2				x								x
	.....		x										x
Software Architecture topics:													
	topic 1												
	topic 2												
	.....												
Computer Systems topics:													
	topic 1												
	topic 2												
	.....												
Software Process topics:													
	topic 1												
	topic 2												
	.....												

4.0 Sketch of survey #1

4.1 Theme: "Identify what Software Engineers should know today, not at some future time"

4.2 Contents

Category: Analysis

Topic 1 title and definition

Topic 2 title and definition

.....

? (Leave blank for suggested additional topics during test version)

Category: Architecture

Topics.....

Category: Systems

Topics.....

Category: Process

Topics.....

4.3 Audience is a small representative sample of companies and domains. About 40-50 people for test version, hundredths for real version. Survey addressed to specific point of contact (not "occupant")

5.0 Sketch of survey #2

5.1 Theme: "How well should Software Engineers know these topics today, not at some future time."

5.2 Contents

Category: Analysis

Topic 1

Topic 2

.....

Category: Architecture

Topics.....

Category: Systems

Topics.....

Category: Process

Topics..... (e.g. Software Configuration Management)

5.3 Audience

Target to a wide audience of hundredths for test version, thousands for real version

Controlled groups

survey individuals

survey companies

large companies

small companies

5.4 Sample Topic for Survey #2

Levels of knowledge for Software Configuration Management (SCM) topic

The Software Engineer shall be able to define SCM.

The Software Engineer shall be able to execute a SCM plan.

The Software Engineer shall be able to create a SCM plan.

The Software Engineer shall be able to participate in CCB.

The Software Engineer shall be familiar with the use of at least one source of code control system.

6.0 Resources and Schedule

6.1 Resources:

Clerical - SEI

Editorial - SEI + Task Force + Steering Committee + Interested volunteers

Survey Design/Analysis - IBM (Pat)

6.2 Schedule

6.2.1 Identify survey designers by (1/15/94?)

6.2.2 Complete literature search (candidate list of components and categories) by 2/15/94

6.2.3 Identify group to test survey #1 (30 to 40 participants) by 2/15/94

6.2.4 Draft survey #1 (components of knowledge) by 3/15/94

6.2.5 Survey designers start work on survey #2 (format, audience, etc.) by 3/15/94

6.2.6 Conduct test survey #1 between 3/15/94 and 5/1/94

6.2.7 Conduct revised survey #1 (hundredths) between 5/1/94 and 6/15/94

6.2.8 Draft survey #2 (levels of knowledge) by 8/1/94

6.2.9 Conduct test survey #2 (hundredths) between 10/1/94 and 12/1/94

6.2.10 Ballot survey #2 (thousands) by 1/1/95

7.0 Addendum

The following changes were suggested to the plan after the first draft was circulated for comments by the participants at the December 10 meeting. Since not all participants have had a chance to comment on the changes they are not yet incorporated in the body of the report.

7.1 Separate the Journeyman/Master levels of expertise. Define a Journeyman as a software engineer with 5+ years of experience and a Master as a software engineer with 10+ years of experience. During the meeting these two categories were lumped together ("expert") for the survey each will have a separate column.

7.2 Refine survey #1 to ask "when does the software engineer first learns the topic". The original question was ambiguous because an "X" under Apprentice would imply "X" under the other two levels of experience. In Survey #1 there should be at most 1 "X" per topic row. Survey #2 is different because it asks for level of knowledged at various levels of experience i.e., there could be multiple "X" in a topic row (e.g., Comprehension as Apprentice, Analysis as Journeyman, Evaluation as Master)

7.3 The schedule sketched at the meeting had errors. Some necessary tasks were not included. A revised schedule is shown in the following Gantt chart.

Industry Task Force Milestone Chart

Task Descriptions	Jan 94	Feb 94	Mar 94	Apr 94	May 94	Jun 94	Jul 94	Aug 94	Sep 94	Oct 94	Nov 94	Dec 94	Jan 95
Preliminary activities (1) Identify survey designers - 1/15/94 (2) Complete candidate list of components and categories - 2/15/94	(1)	(2)											
Survey #1 (1) Identify group to test survey #1 (30 to 40 participants) - 2/15/94 (2) Draft survey #1 (components of knowledge) and mail - 3/15/94 (3) Collect test survey #1 - 5/1/94 (4) Complete analysis of test survey #1, revise and mail (hundredths) - 6/15/94 (5) Collect survey #1 - 8/1/94? (6) Complete analysis of survey #1 - 9/15/94		(1)	(2)		(3)	(4)		(5)	(6)				

Task Descriptions	Jan 94	Feb 94	Mar 94	Apr 94	May 94	Jun 94	Jul 94	Aug 94	Sep 94
Survey #2 (1) Survey designers start work on survey #2 (format, audience, etc.) - 3/15/94 (2) Draft survey #2 (levels of knowledge) and mail - 9/15/94 3) Collect survey #2 (hundredths of participants) - 11/1/94 4) Complete analysis of survey #2, revise, and ballot (thousandsof participants) - 1/1/95			 (1)						 (2)