The Emerging Consensus on the Software Engineering Body of Knowledge

Pierre Bourque

R. Dupuis, A. Abran, J. W. Moore, L. Tripp

QAAM/QAI Conference

Baltimore

October 22, 2003

Corporate Support by:

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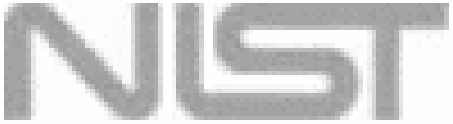

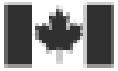

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Project managed by:

Université du Québec
École de technologie supérieure

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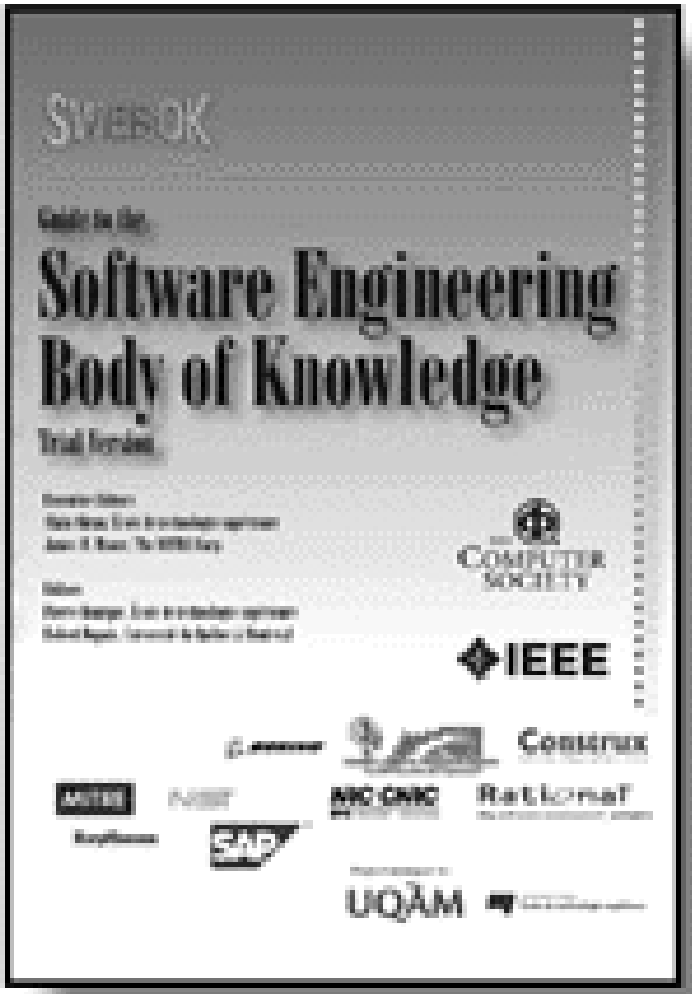
Trial version

Can be downloaded from www.swebok.org free of charge



Now Available in Japanese

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Guide to the Software Engineering Body of Knowledge (SWEBOK)

- Began as a collaboration among IEEE CS, ACM and the Université du Québec à Montréal
- International participation from industry, professional societies, standards bodies, academia, authors
- By the time the project is finished many hundreds of individuals will have touched it
- Release of Trial Version in 2001
- Currently completing the third phase of this three-phase project leading to the 2004 Version

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List of Knowledge Areas

- Software Requirements
- Software Design
- Software Construction
- Software Testing
- Software Maintenance
- Software Configuration Management
- Software Quality
- Software Engineering Tools & Methods
- Software Engineering Process
- Software Engineering Management

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Presentation Objectives

- Give an overview of the emerging international consensus on the “core body of knowledge” of software engineering
- Explain how you can leverage the SWEBOK Guide within your organization

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Presentation Plan

- **Project background**
- Project scope, objectives, audience and plan
- Contents of the Guide
- How you can leverage the Guide within your organization
- Conclusions

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What is Software Engineering?

- IEEE 610.12:
  - "(1) The application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software.
  - (2) The study of approaches as in (1)."

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Recognized Profession?

- Starr*:
  - Knowledge and competence validated by the community of peers
  - Consensually validated knowledge rests on rational, scientific grounds
  - Judgment and advice oriented toward a set of substantive values

* P. Starr, *The Social Transformation of American Medicine*: BasicBooks, 1982.

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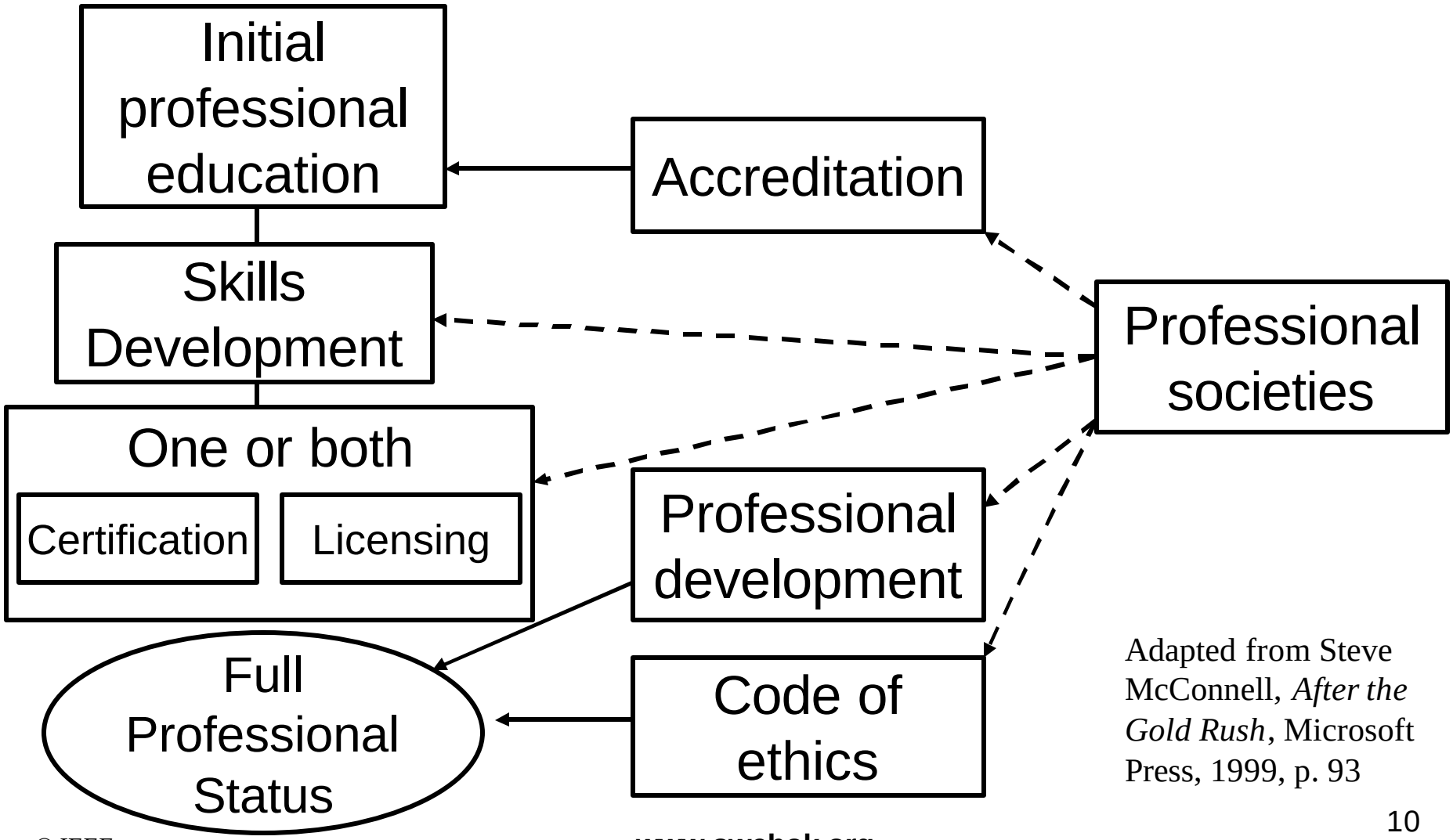
Professional Development



Adapted from Steve McConnell, *After the Gold Rush*, Microsoft Press, 1999, p. 93

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Presentation Plan

- Project background
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Project Objectives

- Characterize the contents of the Software Engineering Body of Knowledge
- Provide a topical access to the Software Engineering Body of Knowledge
- Promote a consistent view of software engineering worldwide

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Project Objectives

- Clarify the place of, and set the boundary of, software engineering with respect to other disciplines (computer science, project management, computer engineering, mathematics, etc.)
- Provide a foundation for curriculum development and individual certification and licensing material

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Intended Audience

- Public and private organizations
- Practicing software engineers
- Makers of public policy
- Professional societies
- Software engineering students
- Educators and trainers

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What Are we Not Trying to Accomplish?

- Not a curriculum development effort!
- Not an all-inclusive description of the sum of knowledge in the field
- Not all categories of knowledge

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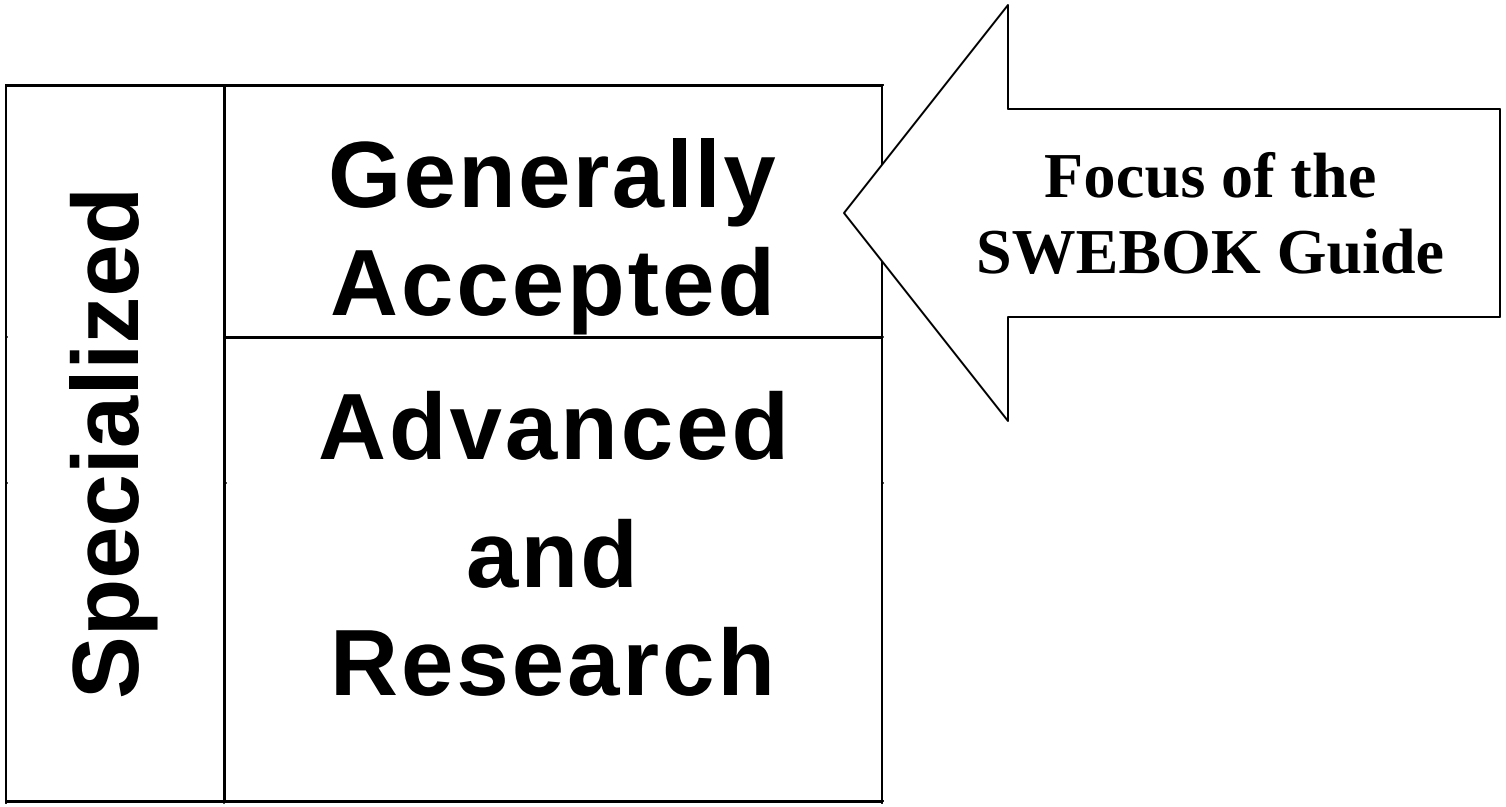
Categories of Knowledge in the SWEBOK



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Generally Accepted

- «Applicable to most projects, most of the time, and widespread consensus about their value and usefulness»
  - Project Management Institute - PMI

- Bachelor + 4 years of experience

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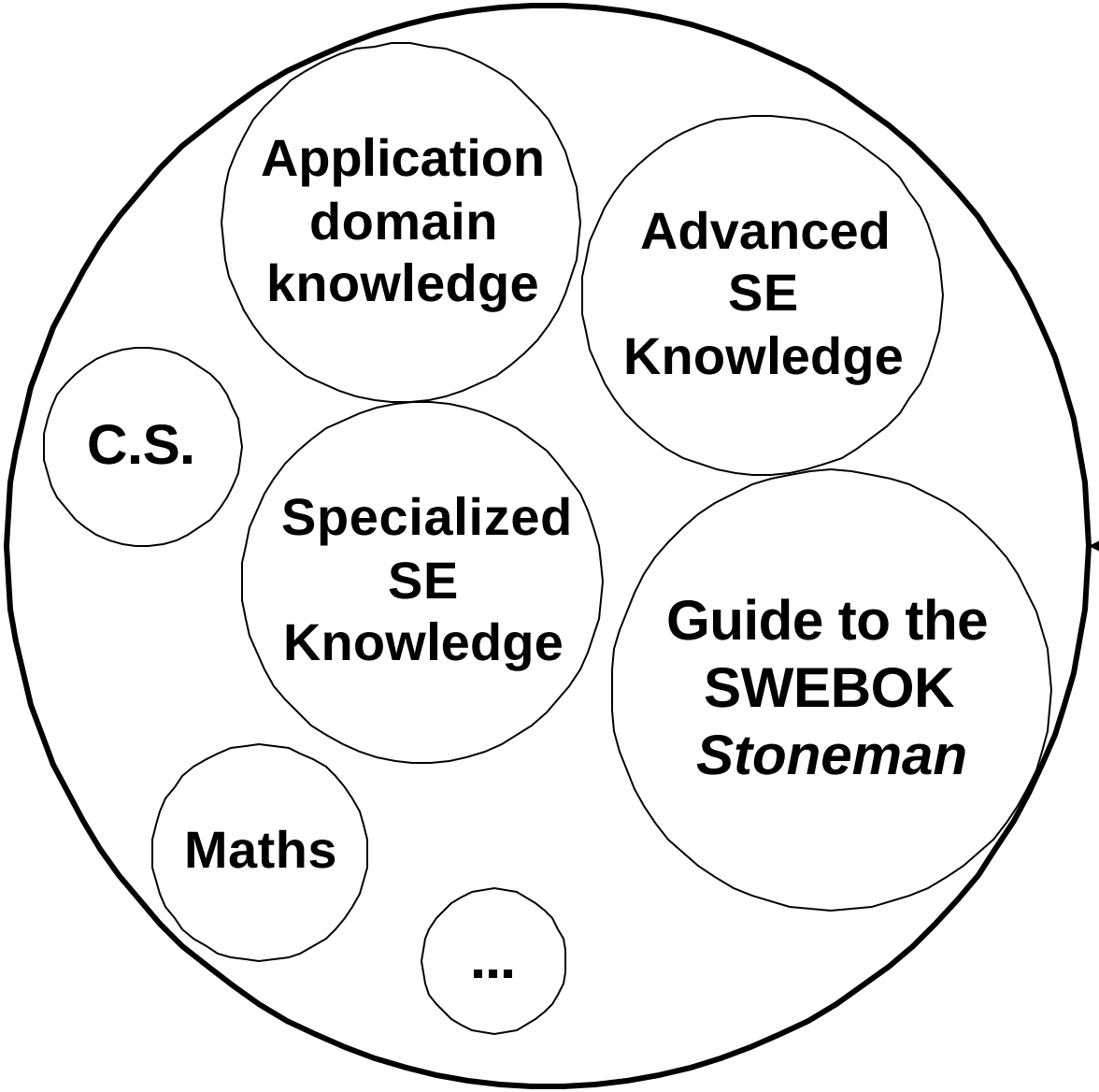

Knowledge of a Software Engineer

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Three Underlying Principles of the Project

- ***Transparency***: the development process is itself published and fully documented
- ***Consensus-building***: the development process is designed to build, over time, consensus in industry, among professional societies and standards-setting bodies and in academia
- Available ***free*** on the web

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Project Team

- Editorial team
- Industrial Advisory Board
- Knowledge Area Specialists
- Reviewers

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Editorial Team

- Project “Champion”:
  - Leonard Tripp, 1999 President, IEEE Computer Society
  - President, Professional Practices Committee
- Executive Editors:
  - Alain Abran, ETS
  - James W. Moore, The MITRE Corp.
- Editors:
  - Pierre Bourque, ETS
  - Robert Dupuis, UQAM

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Roles of the Industrial Advisory Board

- Provide input to ensure relevance to various audiences
- Review and approve strategy and deliverables
- Oversee development process
- Assist in promoting the Guide to the Software Engineering Body of Knowledge
- Lend credibility to the project

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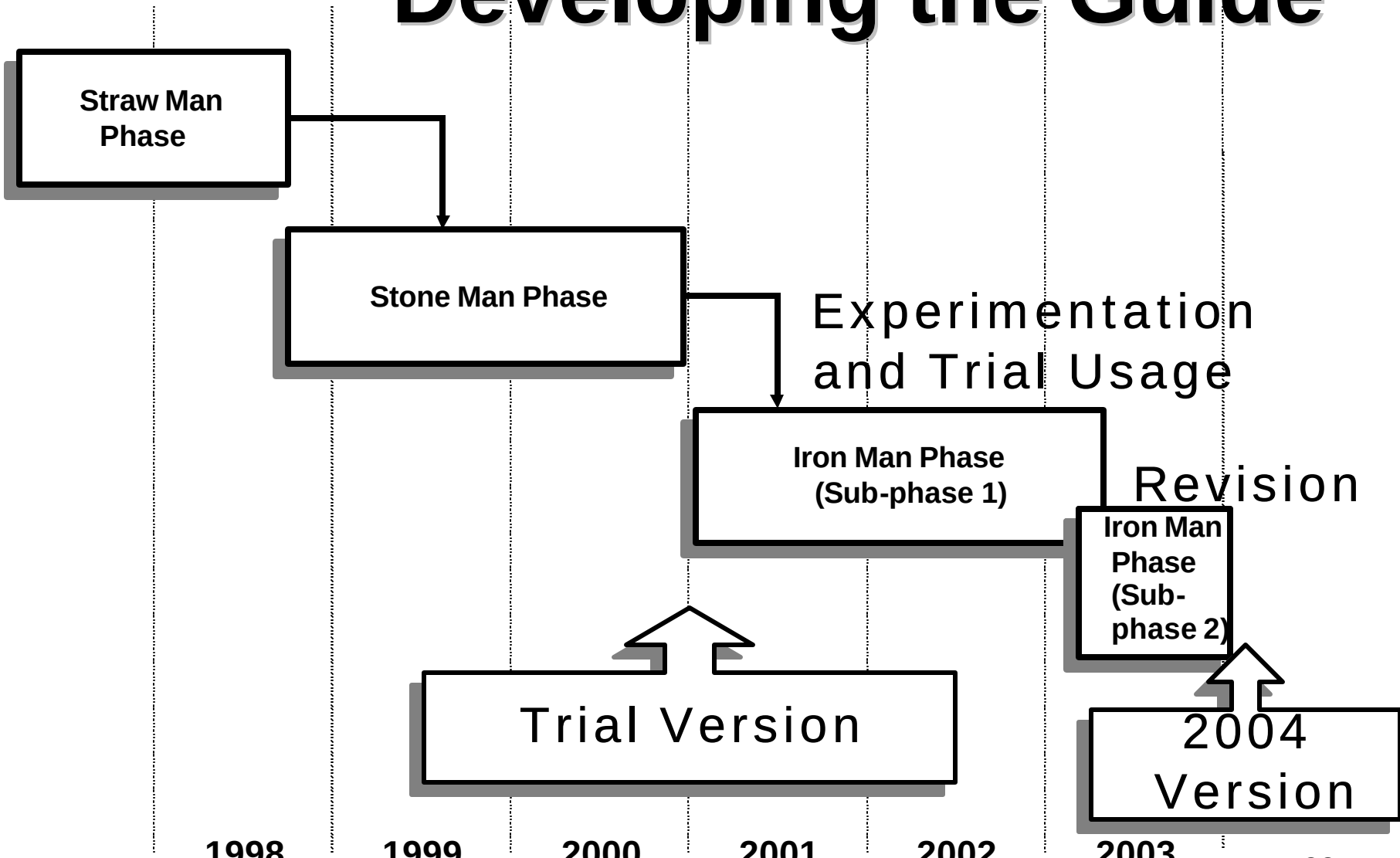
A Three-Phase Approach for Developing the Guide



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Formal resolutions

- Industrial Advisory Board (2001)
- CS Board of Governors (2001)
  - *"The Board of Governors of the IEEE Computer Society accepts the Guide to the Software Engineering Body of Knowledge (Trial Version) as fulfilling its development requirements and is ready for field trials for a period of two years"*
- *ISO Technical Report (2004)*

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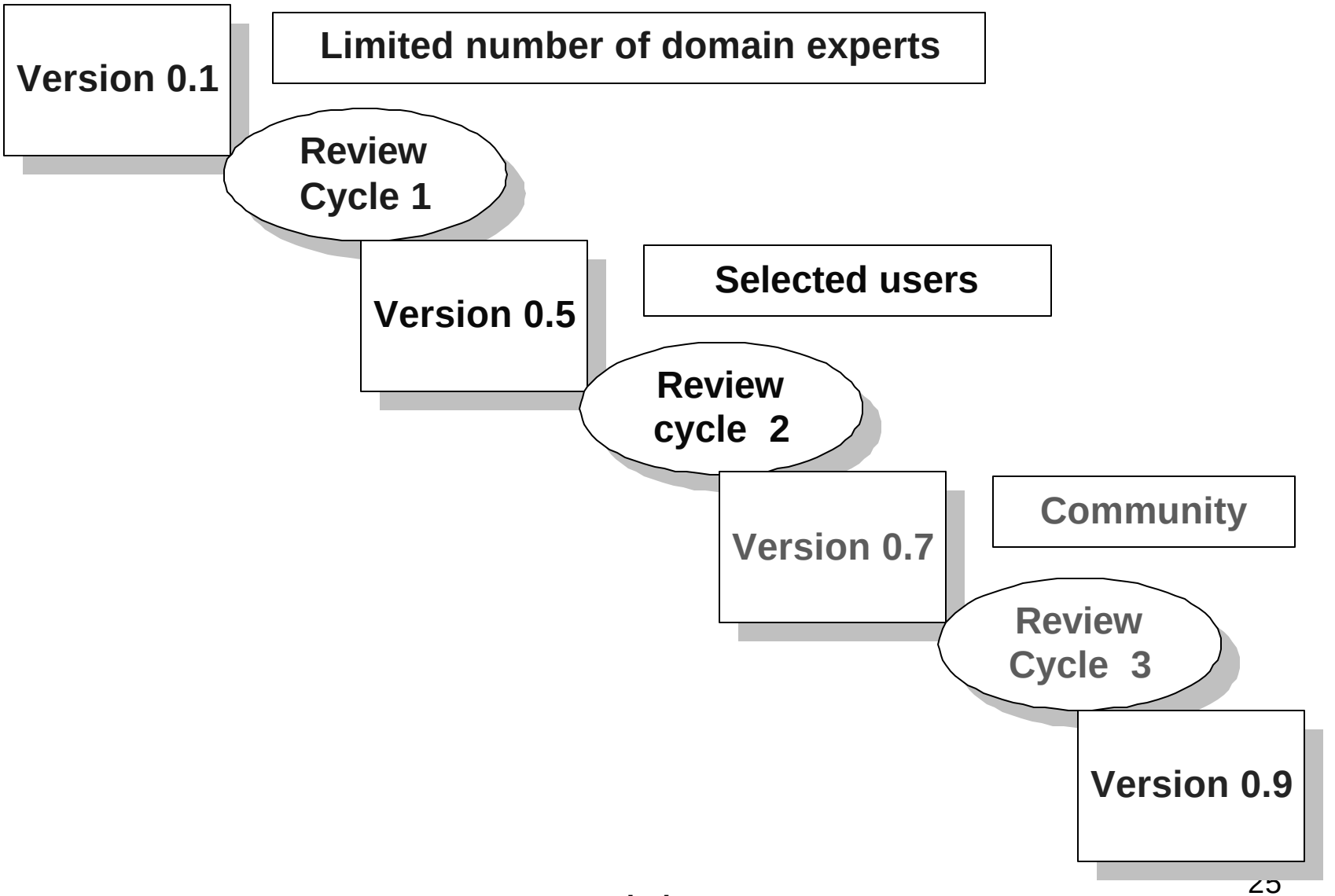
Phase 2: Stone Man Review Process



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Stone Man Review Process

- Transparency and consensus-building
  - All intermediate versions of documents are published and archived on **www.swebok.org**
  - All comments are made public as well as the identity of the reviewers
  - Detailed comment disposition reports are produced for Review Cycle 2 and 3

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Data on reviewers

- Version 0,1: 33
- Version 0,5: 195
- Version 0,7: 378
  - + ISO reviews from 5 countries

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Geographic Distribution of Reviewers

- USA: 55%
- Europe: 18%
  - 90 reviewers from 25 countries
- Canada: 10%
- Australia: 5%
- Asia: 5%
- Latin America: 4%

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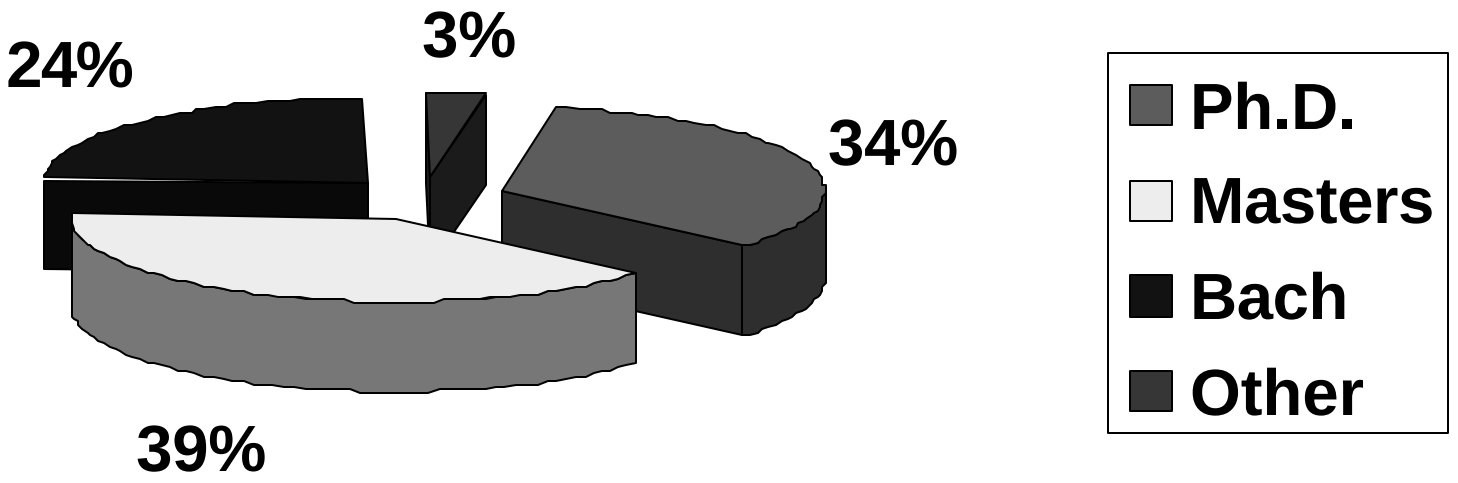
Education level of reviewers (Version 0,7)



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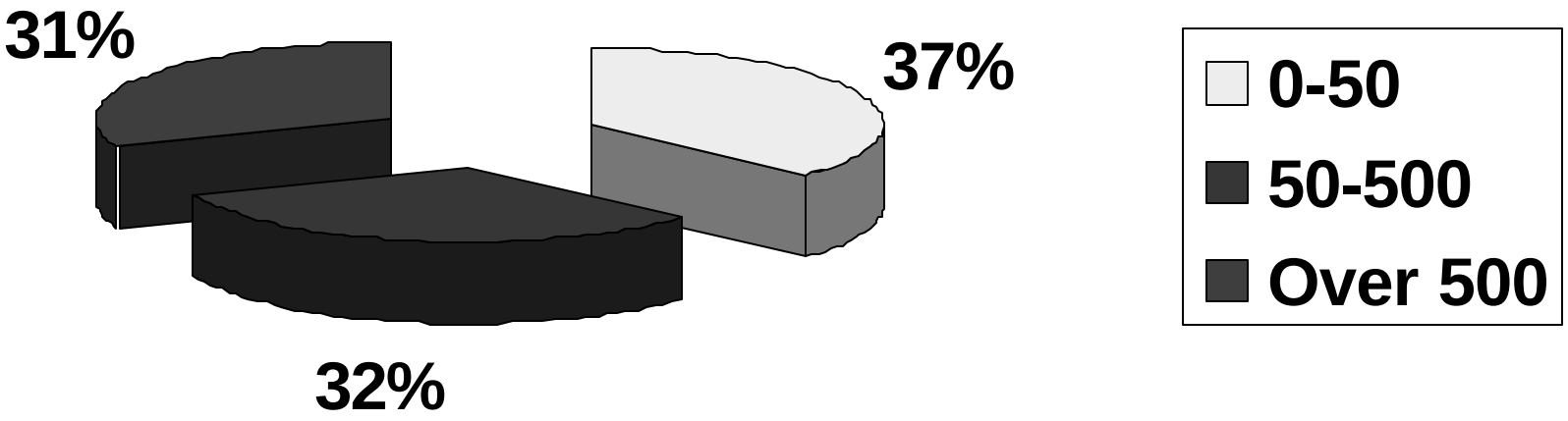
Number of employees at reviewer location (Version 0,7)



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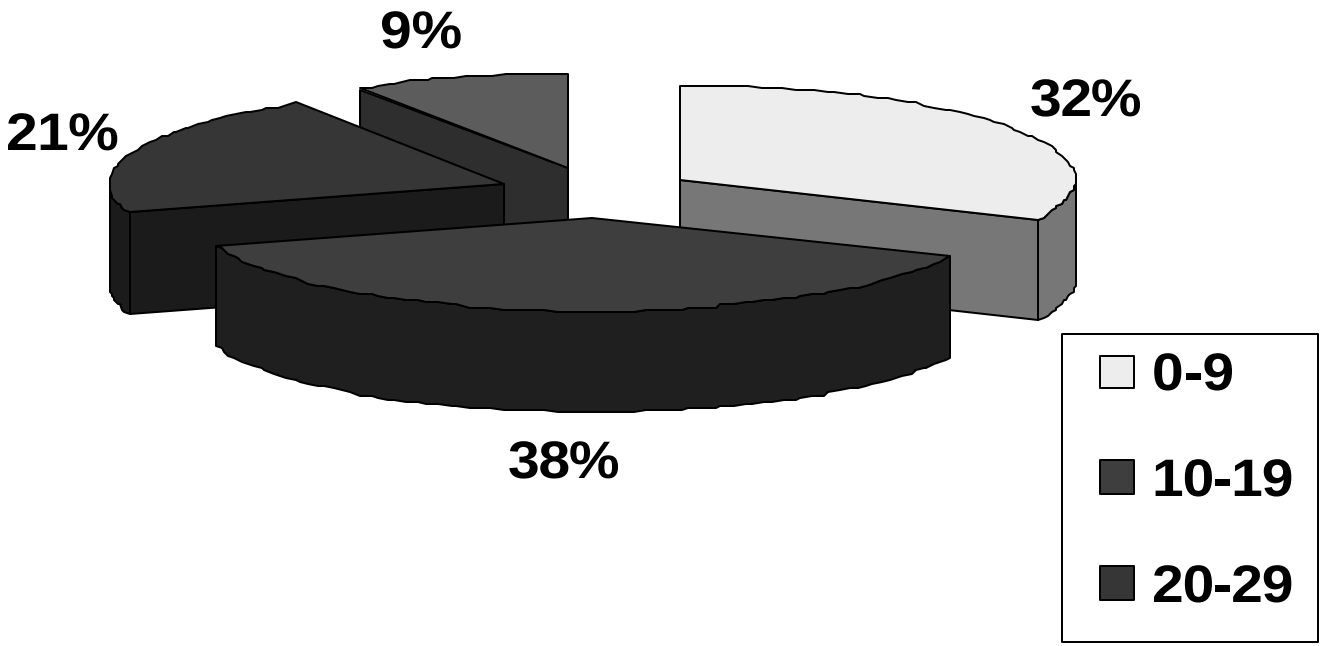
Number of years of practical experience (Version 0,7)



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Project Overview Presentation Plan

- Project background
- Project scope, objectives, audience and plan
- **Contents of the Guide**
- How you can leverage the Guide within your organization
- Conclusion

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Stone Man Deliverables:

- **Consensus** on a list of Knowledge Areas
- **Consensus** on a list of **topics and relevant reference materials** for each Knowledge Area
- **Consensus** on a list of Related Disciplines

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List of Knowledge Areas

- Software Requirements
- Software Design
- Software Construction
- Software Testing
- Software Maintenance
- Software Configuration Management
- Software Eng. Management
- Software Eng. Tools & Methods
- Software Engineering Process
- Software Quality

Related Disciplines

- Computer Science (CC2001)
- Mathematics (CC2001)
- Project Management (PMBOK)
- Computer Engineering
- Cognitive Sciences and Human Factors
- Systems Engineering
- Management and Management Science

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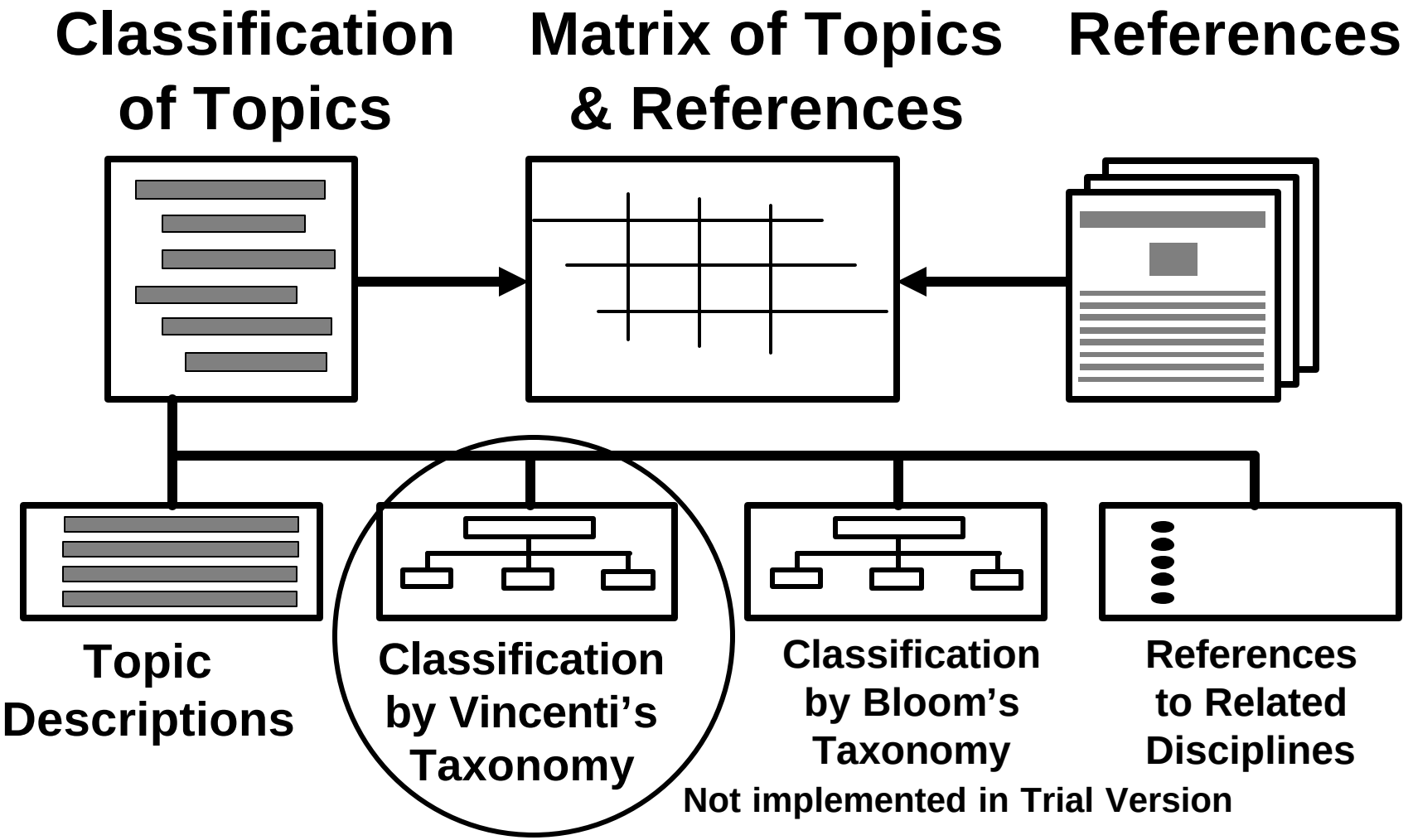
Knowledge Area Description



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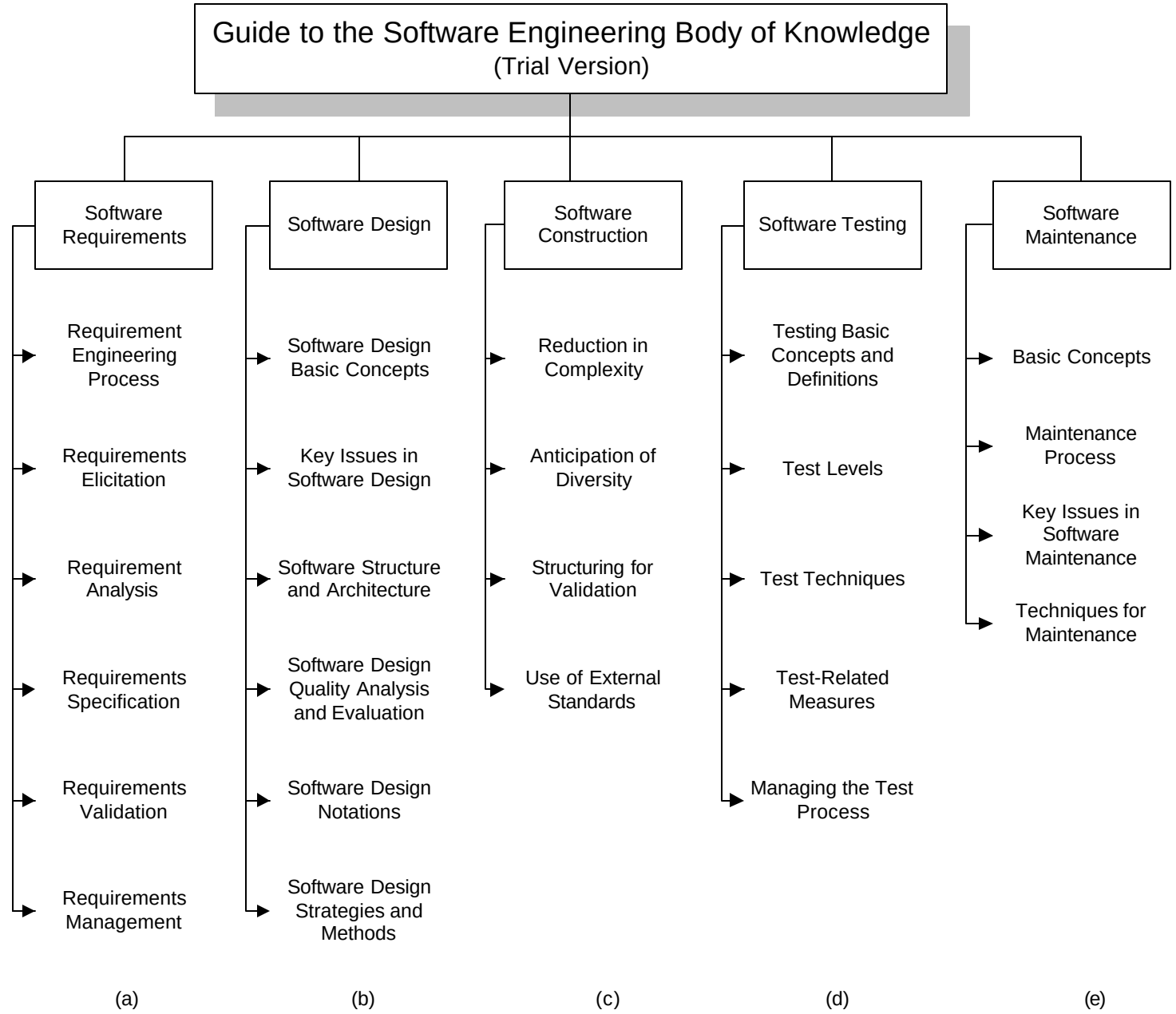
Guide to the Software Engineering Body of Knowledge
(Trial Version)
Software Requirements
Software Design
Software Construction
Software Testing
Software Maintenance
Requirement Engineering Process
Requirements Elicitation
Requirement Analysis
Requirements Specification
Requirements Validation
Requirements Management
Software Design Basic Concepts
Key Issues in Software Design
Software Structure and Architecture
Software Design Quality Analysis and Evaluation
Software Design Notations
Software Design Strategies and Methods
Reduction in Complexity
Anticipation of Diversity
Structuring for Validation
Use of External Standards
Testing Basic Concepts and Definitions
Test Levels
Test Techniques
Test-Related Measures
Managing the Test Process
Basic Concepts
Maintenance Process
Key Issues in Software Maintenance
Techniques for Maintenance
(a)
(b)
(c)
(d)
(e)

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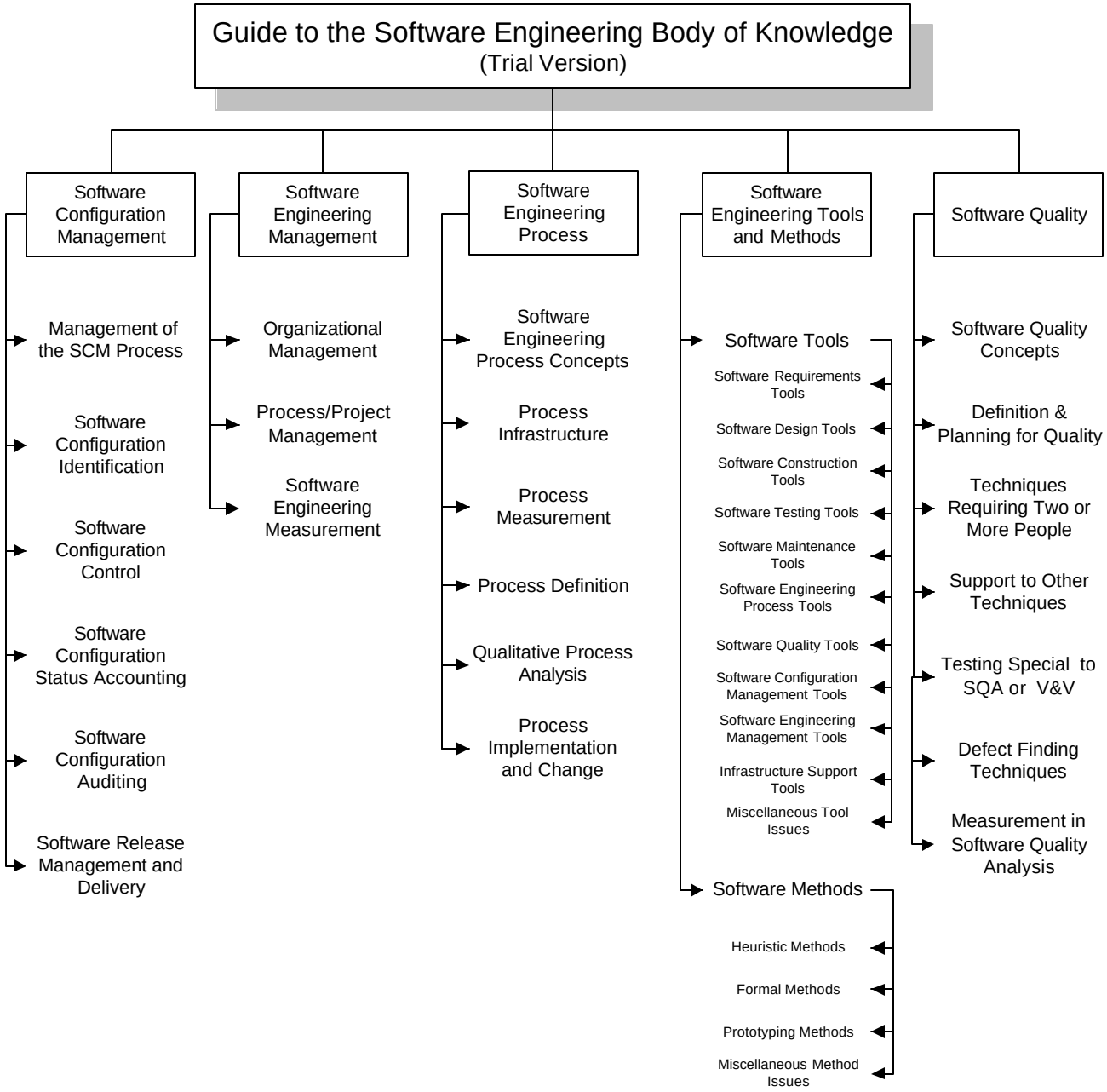

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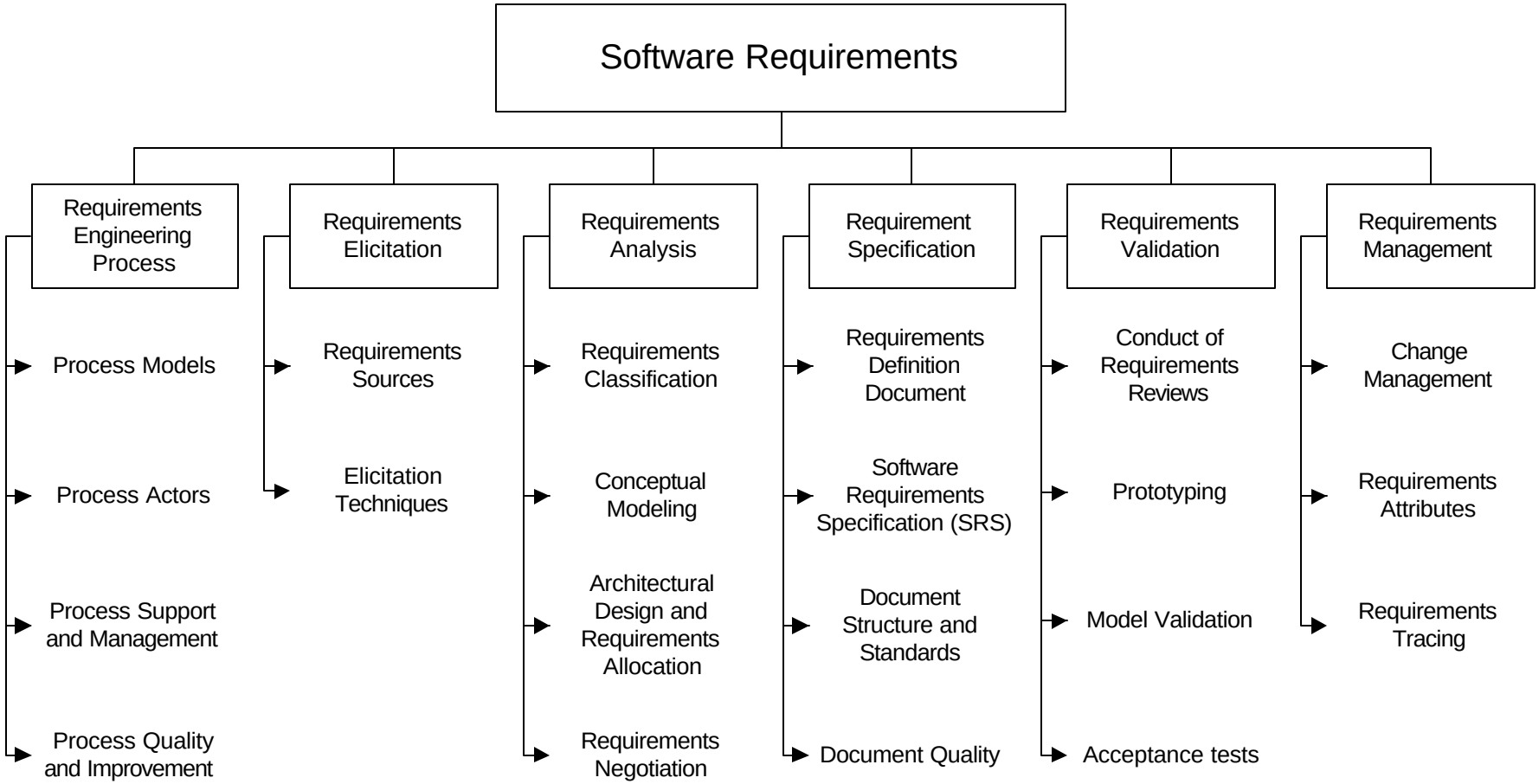
Software Requirements



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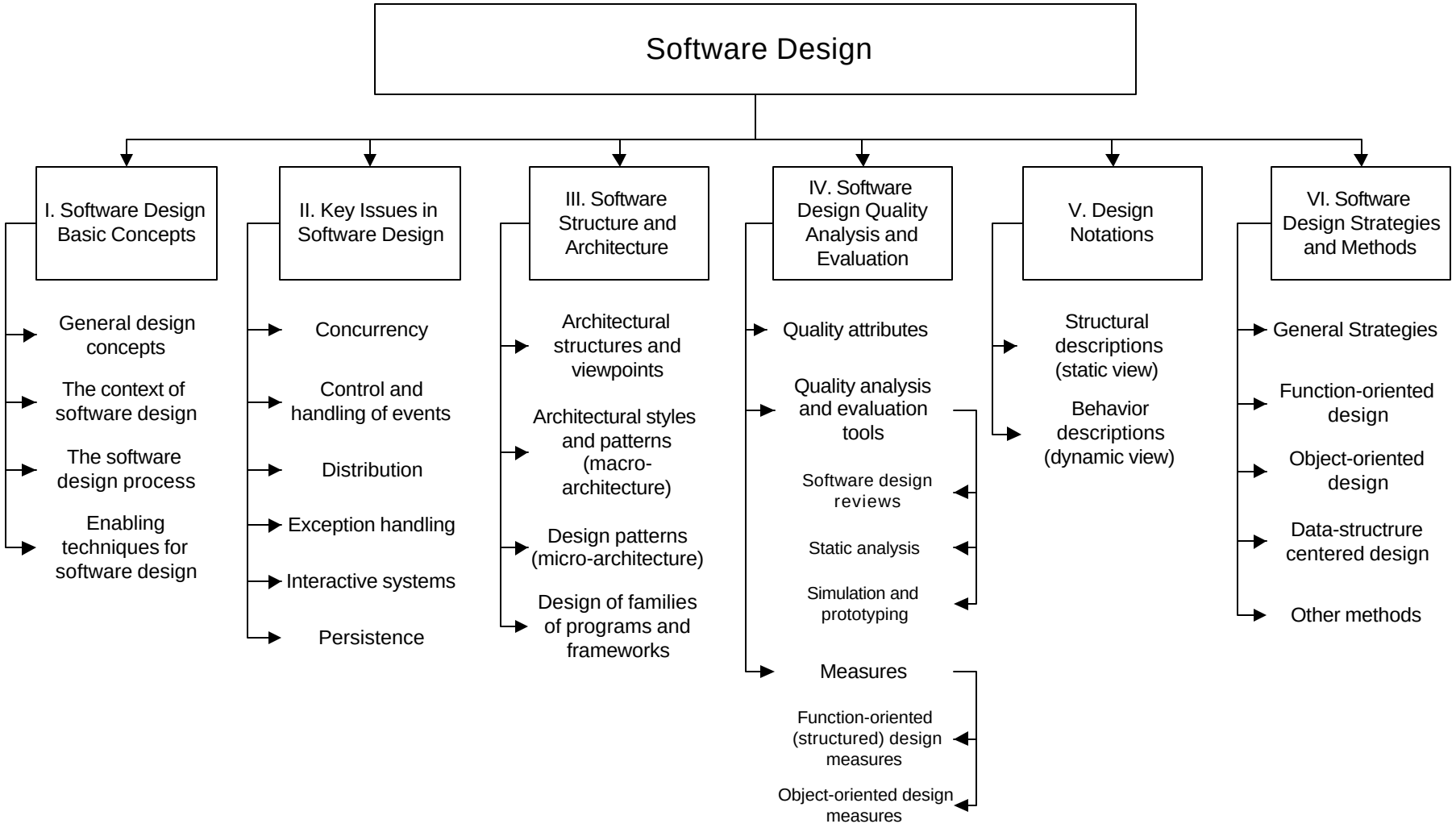
Software Design



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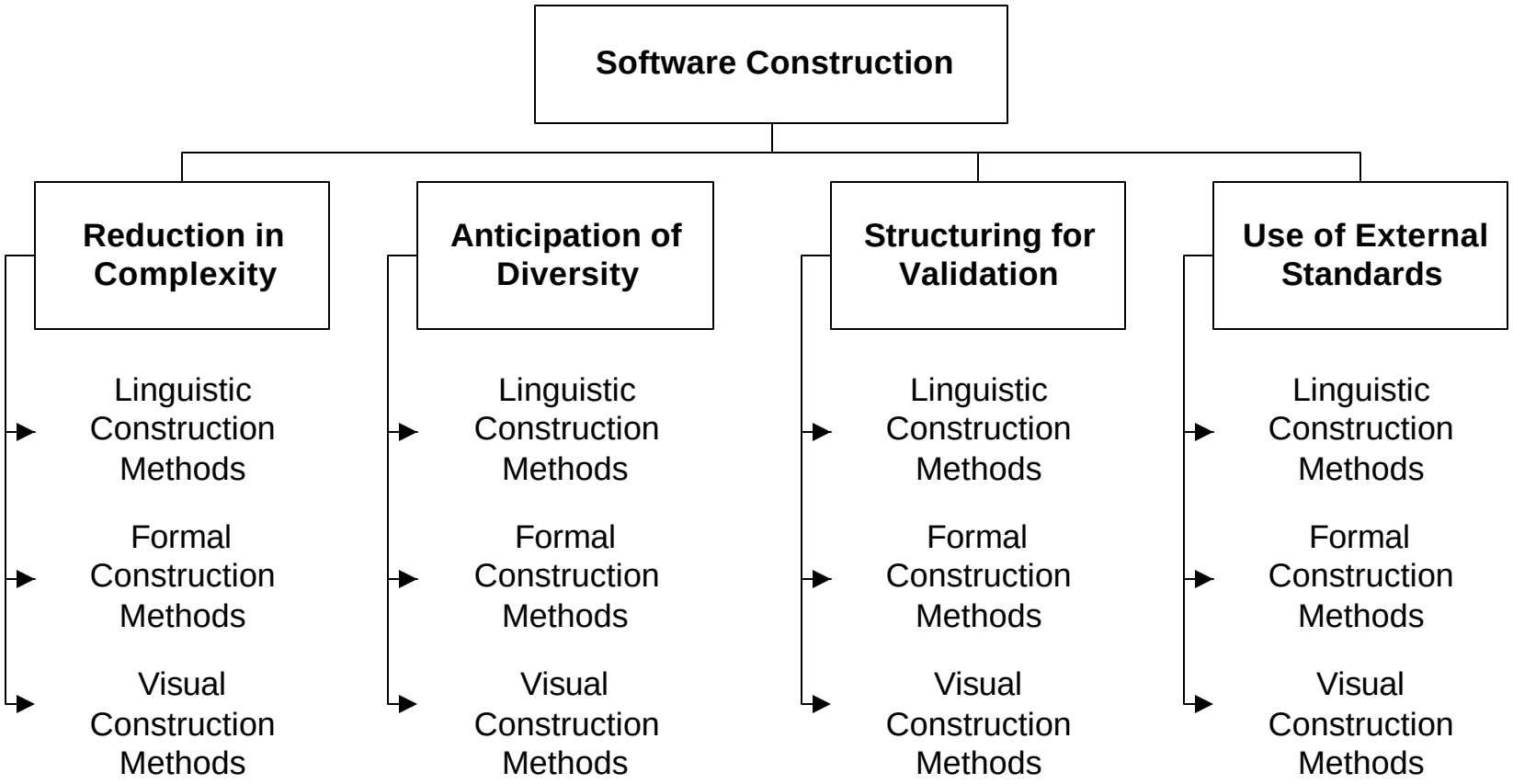
Software Construction



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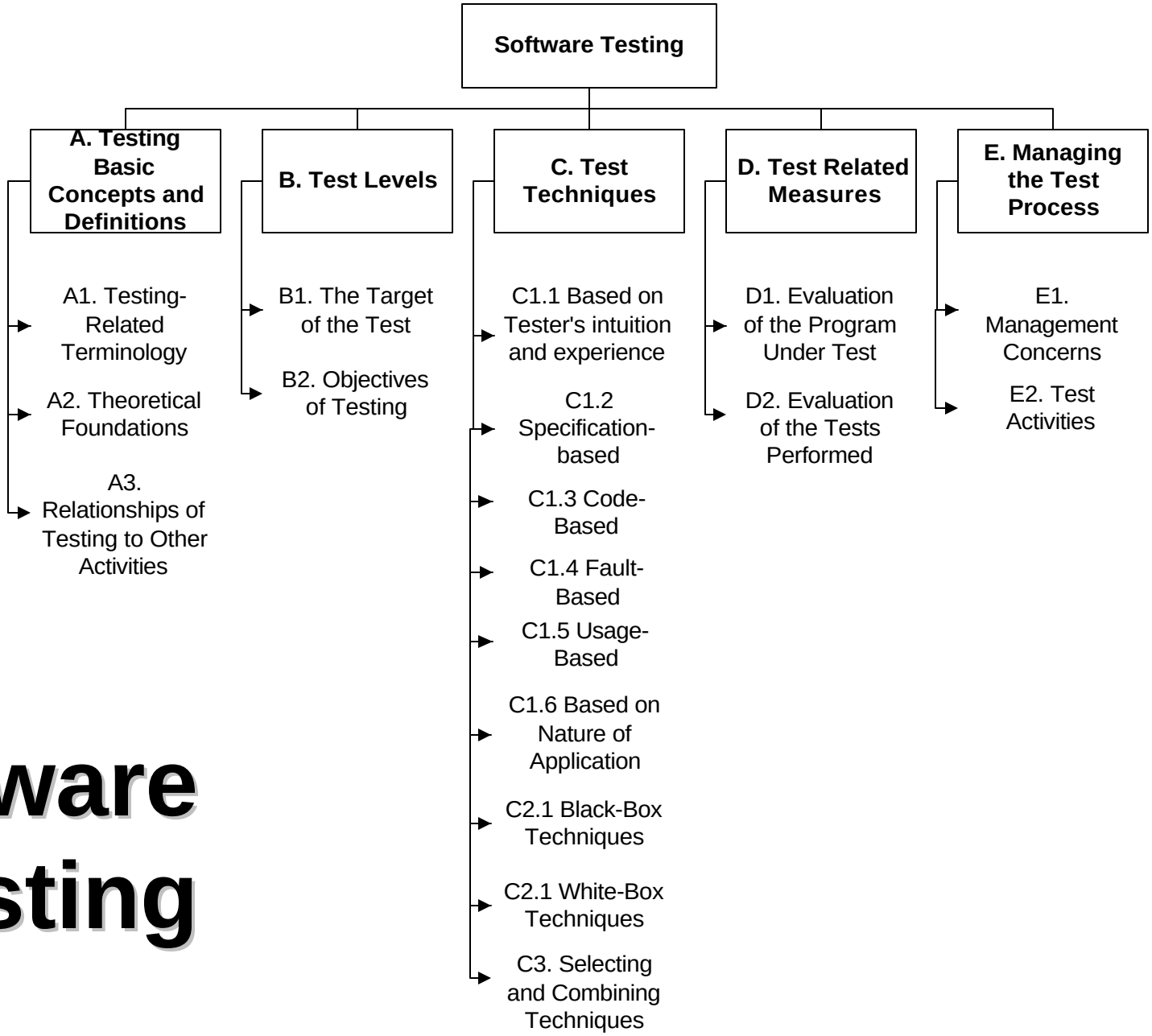

Software Testing

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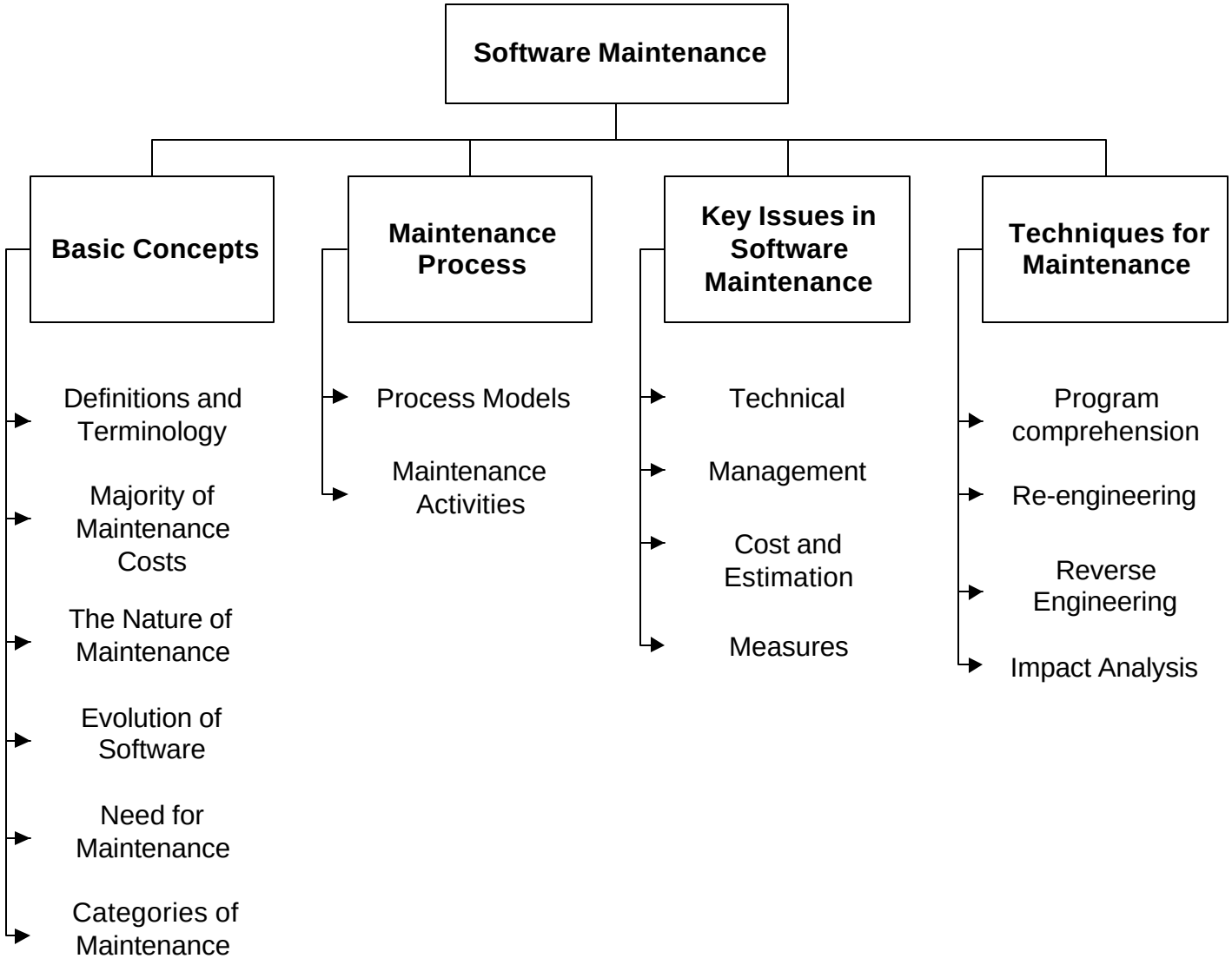
Software Maintenance



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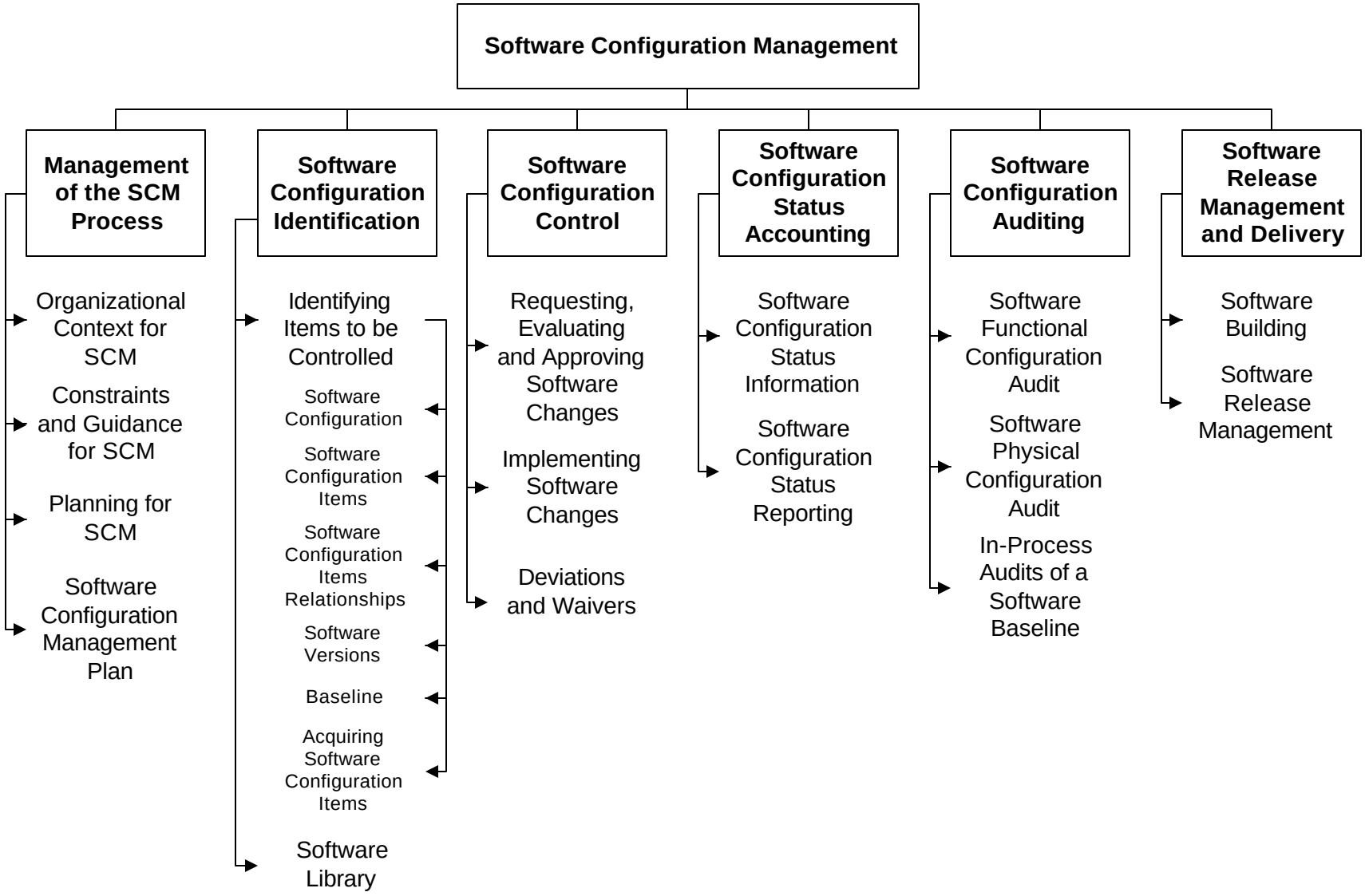
Software Configuration Management



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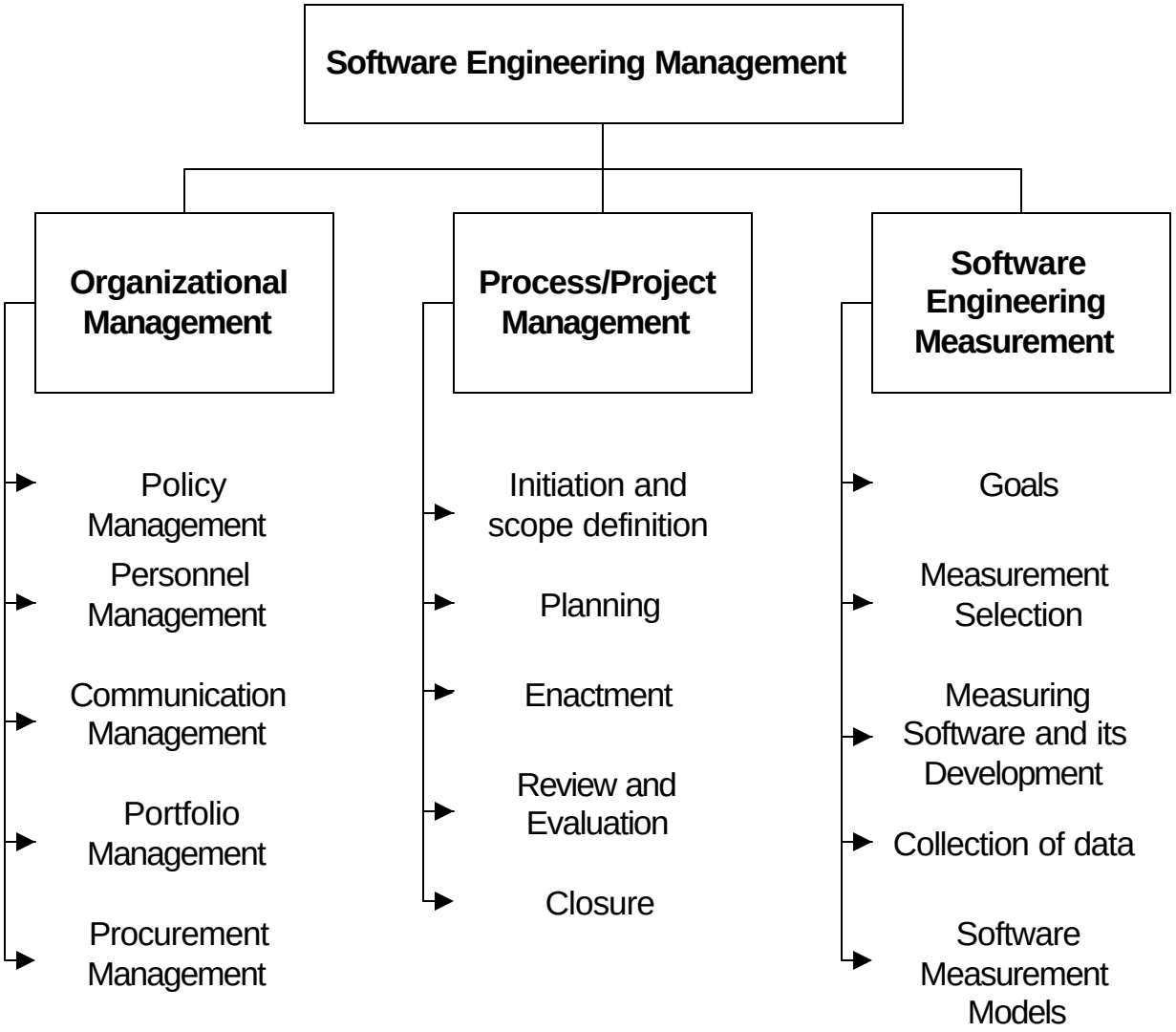
Software Engineering Management



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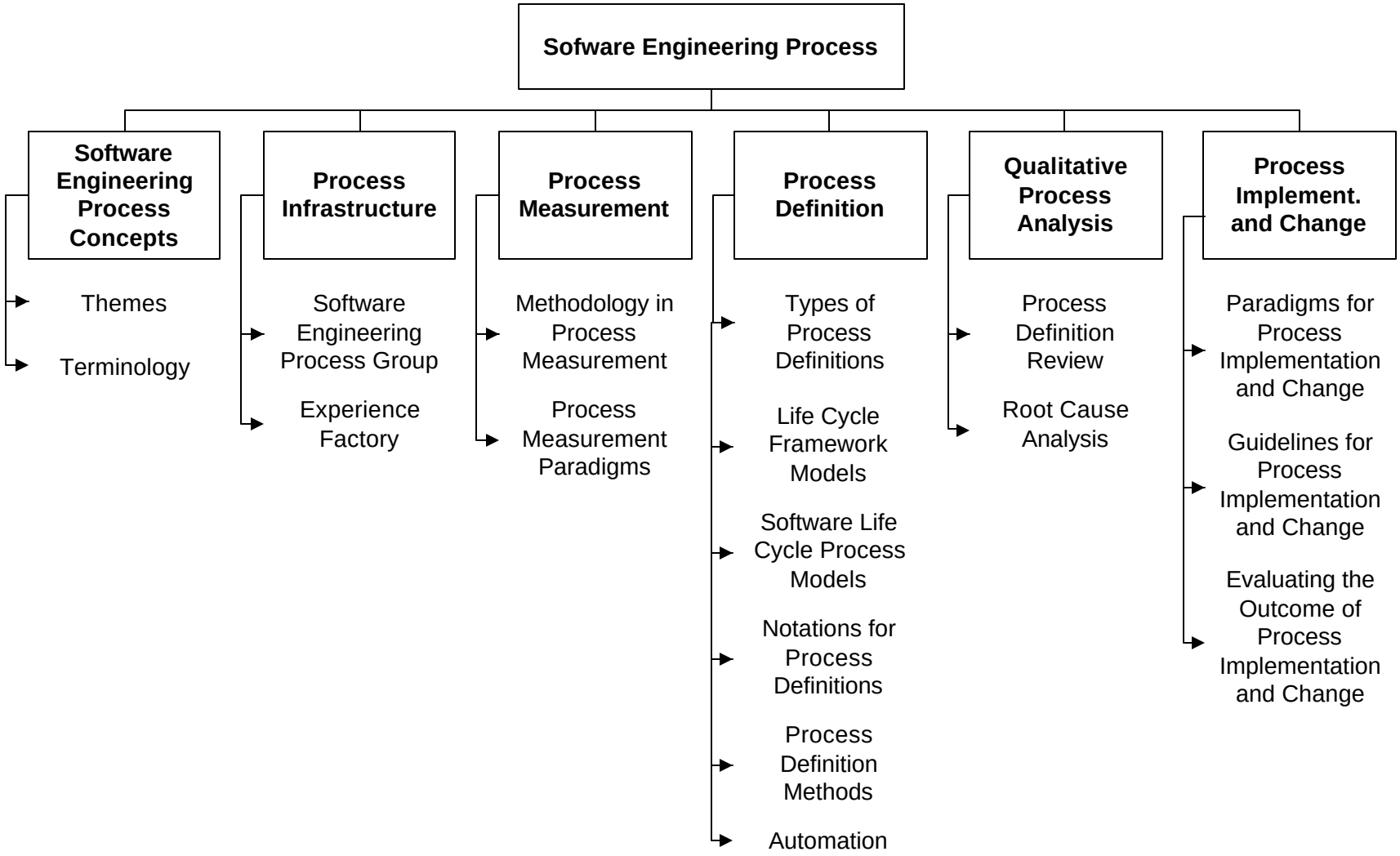
Software Engineering Process



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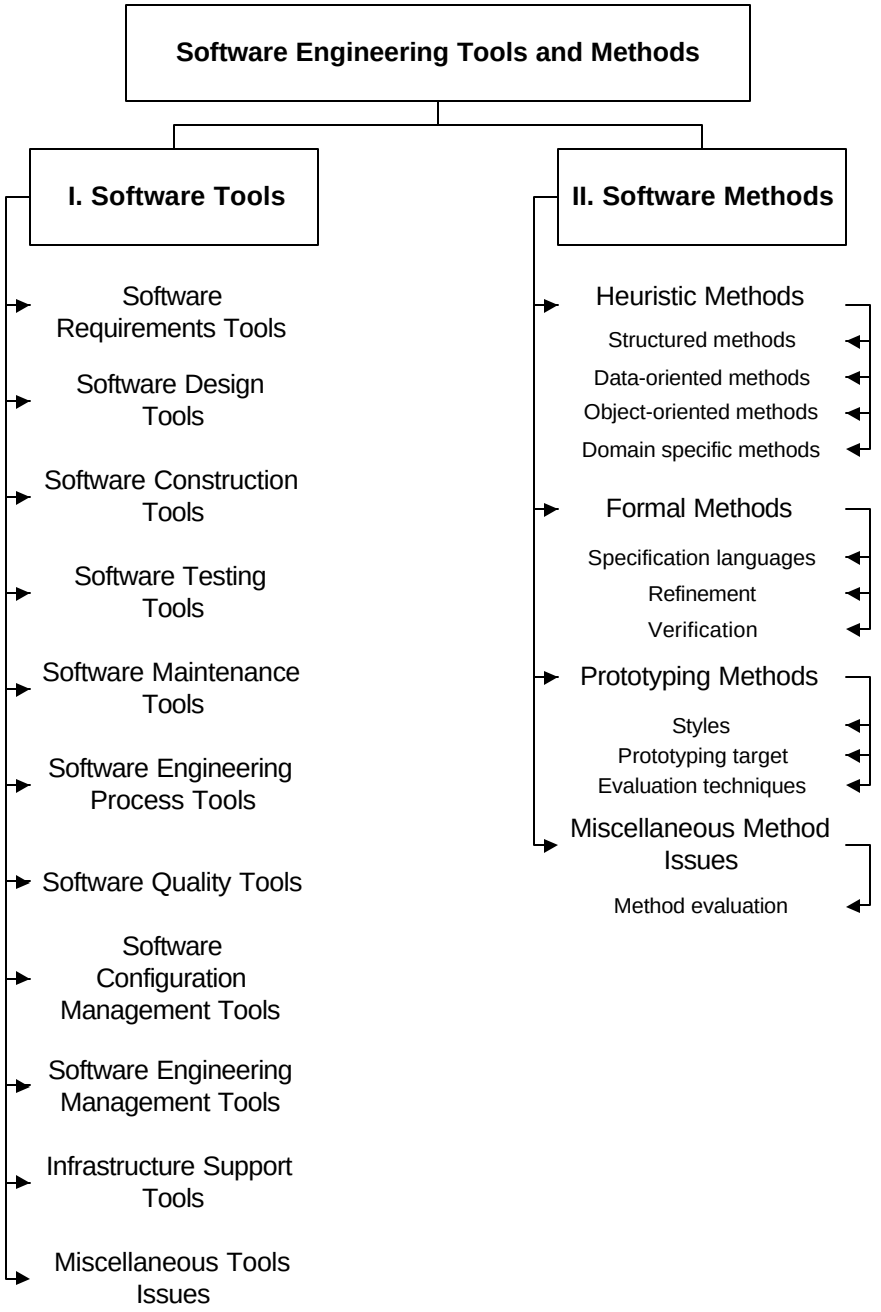
Software Engineering Tools and Methods



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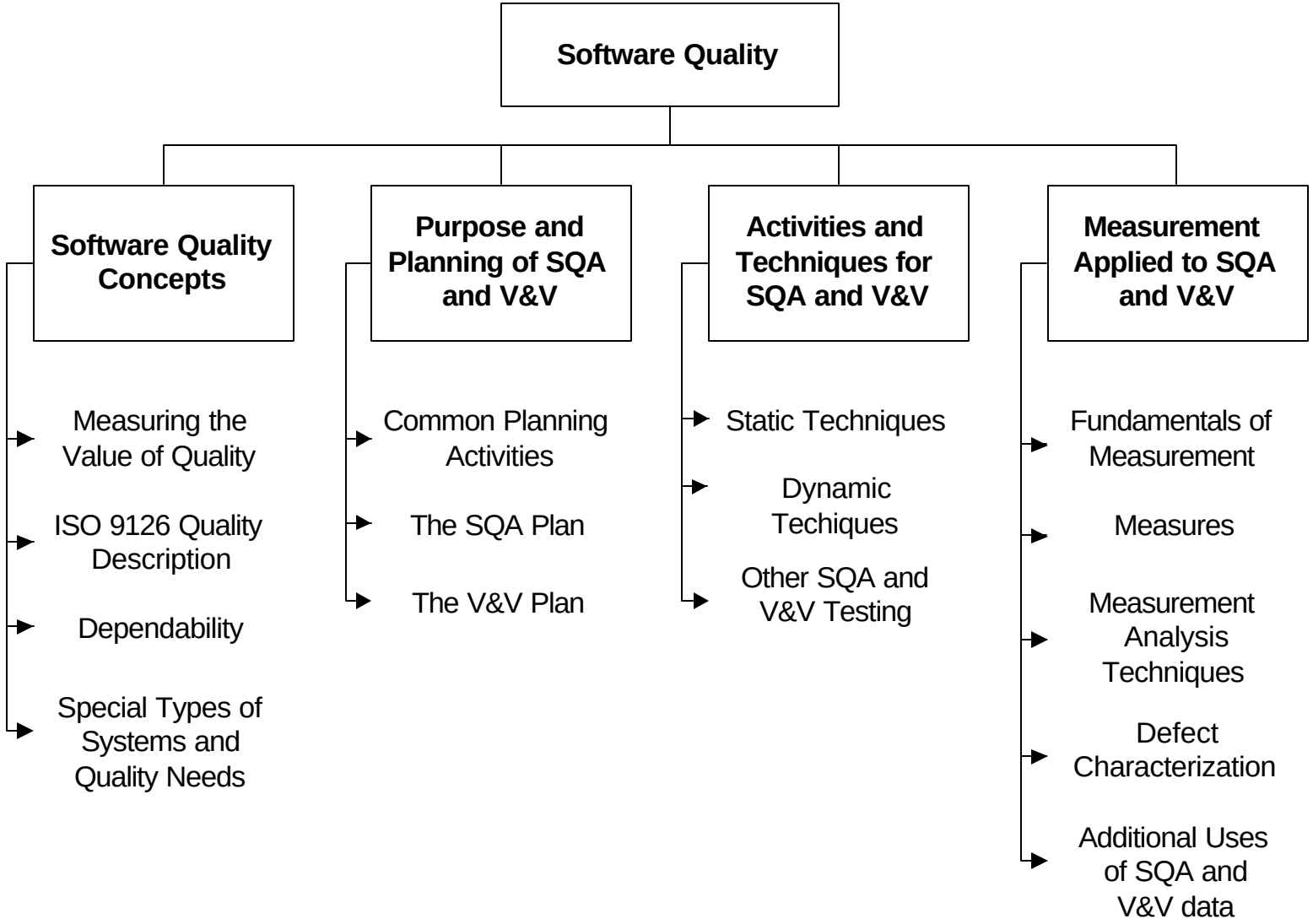
Software Quality



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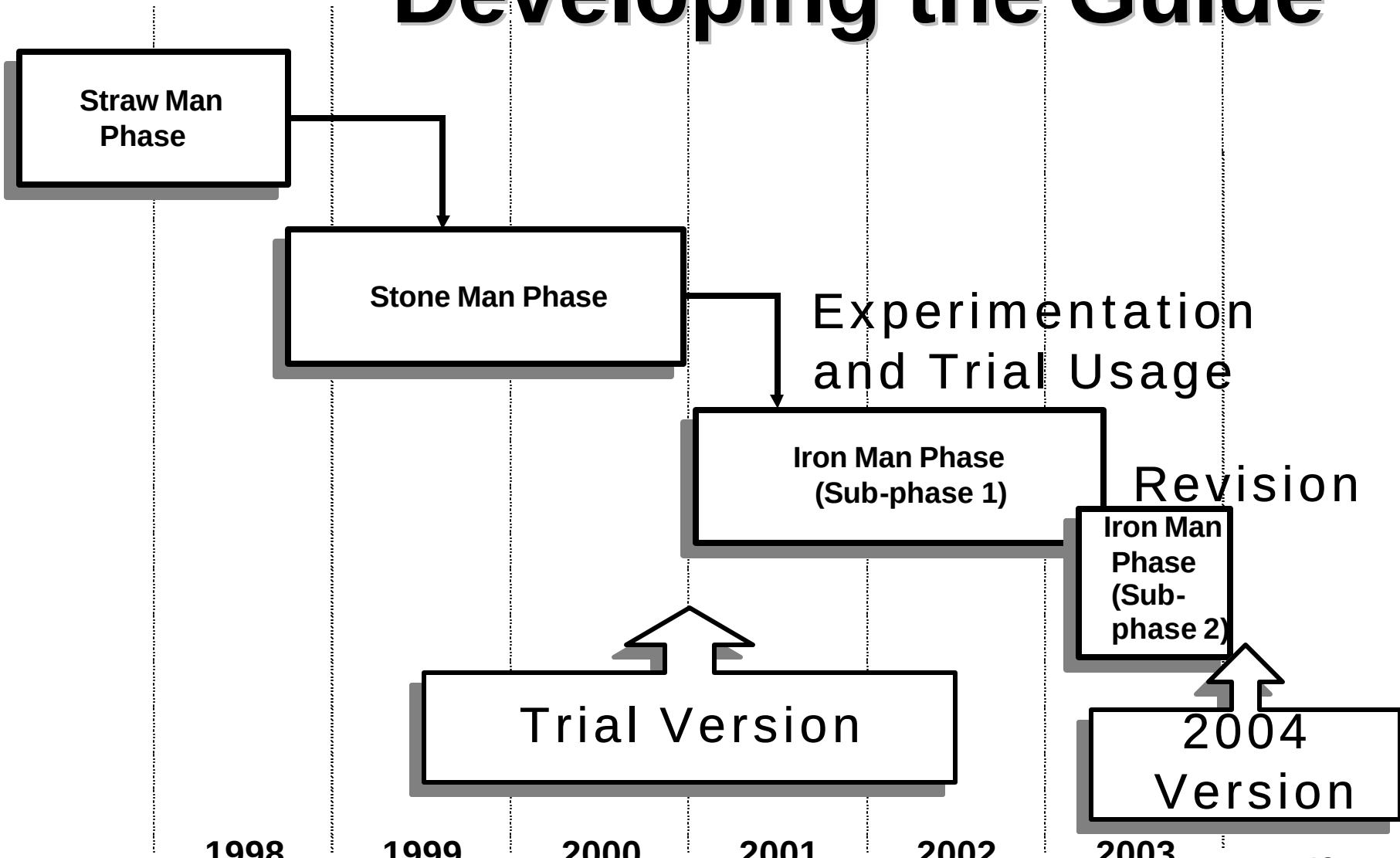
A Three-Phase Approach for Developing the Guide



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Presentation Plan

- Project background
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- Contents of the Guide
- How you can leverage the Guide within your organization
- Conclusions

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Current Usage of the Guide

- As of June 2003 = 2,680 SWEBOK references
- About 65% of references to SWEBOK occur in education/training (#2, practice, 18%)

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Applications of the Guide

- Industry & Government
  - job description
    - Bombardier Transportation
  - hiring
  - staffing of projects
  - career planning
  - contracting

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Applications of the Guide

- Professional development
  - internal training, corporate universities
  - course design
  - self-assessment
  - individual training

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Example Usage in Professional Development: Construx

- Software Development Company
- Steve McConnell
- Ladder:
  - Levels of performance/knowledge in SE
  - Knowledge acquisition based on SWEBOK Knowledge Areas
  - Reading and other activities permit you climb the ladder

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How SWEBOK Was Used

Next six slides from a presentation done at the Conference on Software Engineering Education snd Training, Cincinnati, March 2002.

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Security Industry Automation Corporation

- Build/Operate NYSE/AMEX trading systems
- High volume, transaction processing systems that demand the highest levels of reliability.
- Financial markets depend on these systems
- SIAC must provide reliability assurances

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Using SWEBOK to Align SIAC Needs with the Body of Knowledge

	Specialties aligned with SWEBOK Knowledge Areas				
	Software Requirements Engineering	Software Design Engineering	Software Construction	Software Test Engineering	Software Engineering Management
Employee 1	x				
Employee 2		x	x		
Employee 3		x			x
Employee 4				x	x

- **Opportunity to plan expeditiously**
- Intuitive acceptance of the structure
- Individual and organization planning were supported

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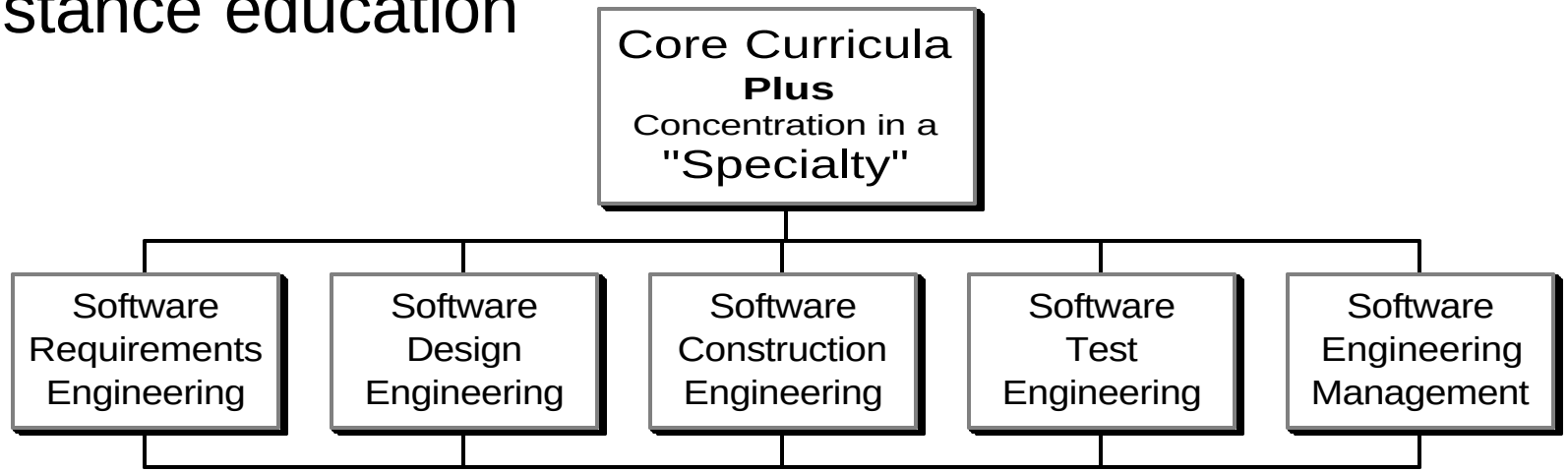
SIAC Desired Course Structure

- Executive style on-site classes, supplemented by distance education



Program	Description
Core Curricula	3-graduate courses in the "foundation knowledge"
Software Requirements Engineering	2-graduate courses supporting the area of concentration -- per "specialty"
Software Design Engineering	
Software Construction Engineering	
Software Test Engineering	

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NTU Program

- National Technological University broadcasts courses from about 3 dozen universities over satellite to hundreds of industrial companies
- Software engineering program started about 1995, based on SEI model curriculum
- Same challenges as SMU, plus
  - keep up with distance education technologies
  - form a cogent program out of many universities

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Using SWEBOK to Examine the NTU Software Engineering Program

- The problem here was that courses come from many universities, and there needs to be a model by which to correlate their content and determine equivalencies, overlaps, etc.

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Things that were Learned - NTU

- The SWEBOK categories made an excellent system for categorizing courses
  - And will be used for course numbering in the future
- Holes and overlaps in course coverage were considerably more apparent
- The SWEBOK provides a “neutral” basis for discussion when universities disagree about what should be covered

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Example Usages in Education

- Course Design/Assessment:
  - Arizona State, etc.
- Program Design/Assessment:
  - University of Iceland
  - Southern Methodist University
  - Stevens Institute of Technology
  - National Technological University
  - École de technologie supérieure
  - Monash University

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Known Usage in Education

- Accreditation Criteria
  - Japan
  - Canada
- Numerous mentions in conference material
- References in PhD dissertations
- References in SE education related sites

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Applications of the Guide

- Licensing & Certification
  - licensing exam questions
  - study material
  - in software engineering and other IT fields
  - could be on subsets of Knowledge Areas

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Identifying Opportunities in Your Organization

- How could the Guide be used in your organization ?
- What other applications do you see in your organization ?

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Concluding Remarks

- Consensus on the core body of knowledge is key in all disciplines and pivotal for the evolution toward a professional status

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