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Research Challenges and Opportunities

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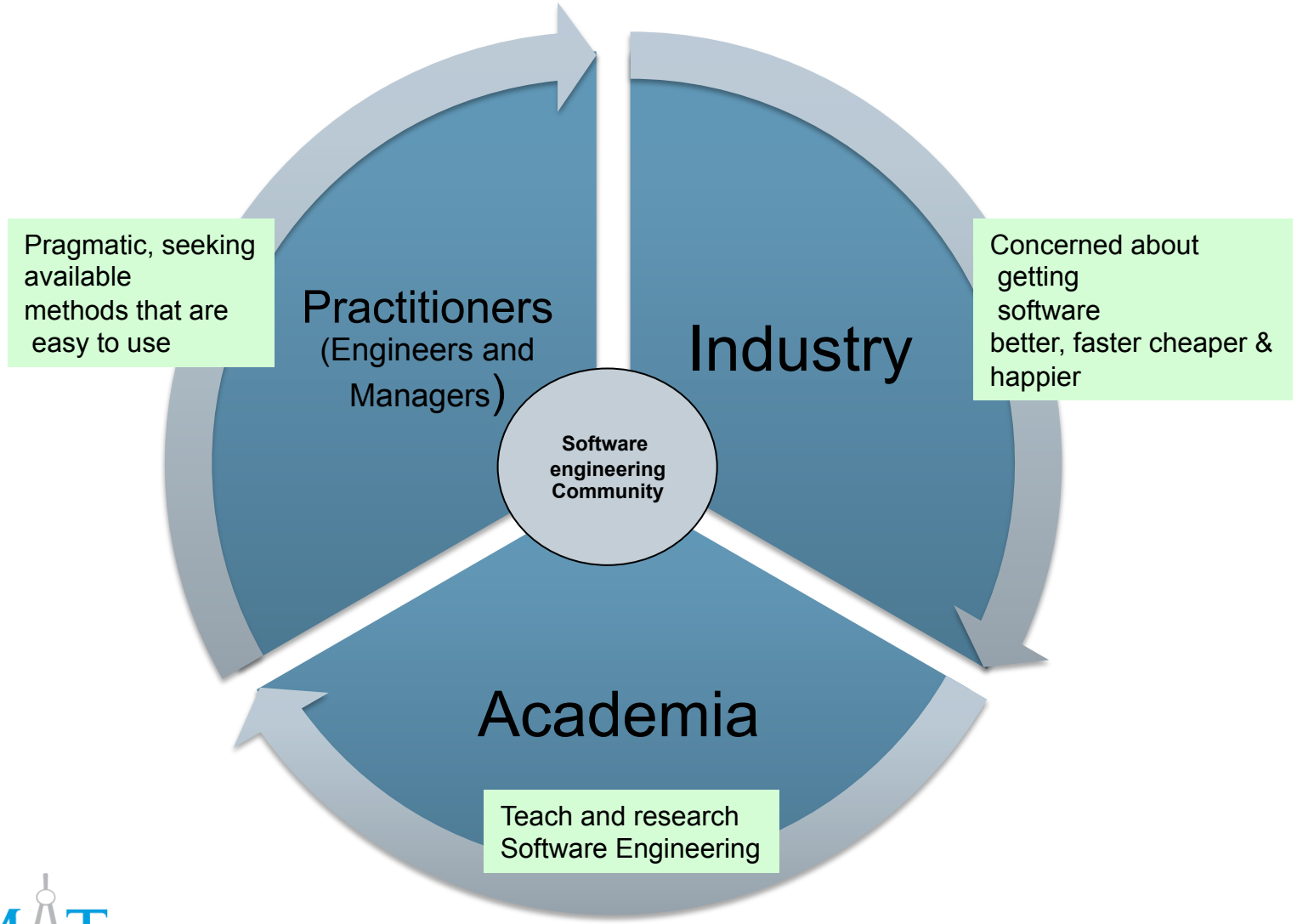
Software engineering community



Academia roles

- Academia has an unique position in the adoption and promotion of SEMAT
- Essentially, academia plays three roles that are interrelated
  - Education (basic software engineering, research oriented work)
  - Research (basic and applied), and
  - Serving the community
- In addition, academia can
  - Aid to foster the adoption of SEMAT result
  - Provide feedback to SEMAT practices
  - Work with industry in tandem to understand what industry needs, and use that as input for research

The benefits

- Standardization and reference for teaching of and research in Software Engineering principles, artifacts, practices & methods
- Fostering shared understanding, empirical assessment and creation of new concepts and related topics in Software Engineering
- Shared means: between teachers and students, among students and among researchers, between researchers and practitioners and among researchers from different disciplines

Research general issues –1

- Development of empirical assessment methods to compare software engineering practices and methods – using principles from experience-based, evidence-based and empirical software engineering
- The SEMAT fosters the advancement of formal foundations of software engineering, provide fundamental understanding of software engineering concepts
- Provision of an research infrastructure serving as a test-bed and fast deployment of new ideas

Research general issues –2

- Use Essence language and produce kernels for related/ other/extended domains: systems engineering, hardware engineering, service engineering any engineering, - business modeling, service innovation, creative work, adaptive case management, ….
- Evaluate and extend Essence for use in global distributed teams, i.e. networked enterprises – is something more required ?
- Extended tool support for enactment – integration with social media and collaboration tools

Topic example 1: Empirical assessment – in university setting

- Empirically assess SEMAT practices and methods in a controlled experimental environment, i.e., classroom setting in universities
- Although there are some advantages of using industrial projects, there are also many limitations set by the industrial context and beyond the control of the assessment procedure
- In contrast, academic experimenters have much fine control on the experimental parameters, and
- It is possible to achieve some degree of reproducibility and statistical significance
- Some disadvantages include
  - The issue of generalization to realistic situations (scalability), and
  - That students are not necessarily representative of professional software engineers
- Nevertheless, academia can provide valuable feedback to SEMAT and industry

Topic example 2: Empirical assessment – in industrial setting

- Conduct empirical study on assessing different methods on real software developments in industry
- Apply Essence Alphas to industrial development project, generate general framework for selected features for an organization, then deploy and validate it by using one product line
- Providing feedback to Essence and refining it with industry need

Supporting Project Management practices

- Project management based on Essence compared to traditional project management
- Different project management practices examples include: Scrum, Kanban, waterfall-based
- Essence has implicit support for measurement of progress through use of alpha states
- One possibility to consider/evaluate is to extend existing project management practices with the use of Essence alphas

Comparison of different methods

- Compare different methods with and without a kernel with practices on top of the kernel
- Traditionally methods were not described using a common base. They used different vocabulary, which made it extremely hard to compare
- Comparisons were very superficial and subjective
- Practices slice up the method and comparisons can be made up practice by practice, instead of compare method with method
  - For instance, comparing use cases with user stories, sprinting with iterating
- Study and try to find out the efficacy of comparing methods with or without a kernel

The constitution of a “good” kernel

- What constitutes a good kernel in different domains (software systems, systems including hardware, businesses, methods)?
- How “universal” is universal?
- How to empirically evaluate and validate the collection of Alphas (kernel) are really the “essence” of a particular domain, not too little and not too much?
- What constitutes good alphas states in different domains
- Are there some rules and some patterns to follow when come to identifying the kernel in different domains
- These patterns may be the same over different domains, but there may also be similar
- How to define the quality attributes of the kernel, such as usefulness, consistency, completeness, extensibilities etc.

The constitution of a “good” Alpha state

- What constitutes good alphas states in different domains
- How to evaluate the quality attributes of identified states, e.g., their effectiveness, completeness, consistency, extensibility etc
- Do the states of alphas differ for different application domains?
- In other words, for different domains, do we need to define different set of states of the alphas?

Kernel language usability study

- Graphical syntax is another area of research
- Need to provide great user experiences to our developers

Scalability Issues

- Applicability on a large scale software development where each development is a composition of many small systems
- For example, system of systems
- Traditional systems engineering seeks to optimize an individual system (i.e., the product)
- SoS seeks to optimize network of various interacting legacy and new systems brought together to satisfy multiple objectives of the program

Apple Essence to industry project

- Apply Essence Alphas to industrial development project, generate general framework for selected features for an organization, then deploy and validate it by using one product.

Use case analysis of SEMAT

- In the initial phase of SEMAT, use cases for a universal language of software engineering practices and methods have been identified, such as "comparison of methods", "teaching methods and practices" or "adaptation of practices”
- With the first proposal at hand, it's now time to assess the outcome of SEMAT with respect to these use cases
- Need to conduct a deep and detailed analysis of both the use cases and the SEMAT proposal in order to judge the completeness and quality of the proposal.

Moving forward

- Distinguish teaching and research
- Forms SEMAT chapters, SIGs in different regions
- Host a series of workshops co-located with major software engineering conferences (academic and industry)
  - e.g., ICSE, RSC, FSE
- Create template for standard software engineering curricula
- Publications, presentations, advertise and distribute Semat content
  - In conference proceedings
  - Academic journals
  - LNCS (Lecture Notes in Computer Science by Springer)
  - Technical magazines: *Dr. Dobb's*, *CrossTalk* (The Journal of Defense Software Engineering)
- Give seminars in colloquium, invited talks, keynotes
- Develop projects in basic and applied research to show the usefulness of SEMAT for the research community