On the Diminishing Prospects for an Engineering Discipline of Requirements

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Agenda

• What do I mean by “requirements,” and what do I mean by “engineering”?
• Why does it matter?
• Why are prospects diminishing?
• Suppose you believe the argument – what should we do differently?
Requirements

• Part of the development process – interacting with stakeholders and producing representations that are used by implementers as the description for the intended functionality of a system under development

• So,
  – If I build something for myself, for example, without the intermediate requirements step, I don’t consider that my intentions were “requirements”

• Requirements always has the flavor of a translation from the stakeholders’ domain(s) to the developers’ domain(s)
What Is Engineering?

- Creating cost-effective solutions
  - Engineering is not just about solving problems; it is about solving problems with economical use of all resources.

- to practical problems
  - Engineering deals with practical problems whose solutions matter to people outside the engineering domain—the customers.

- by applying scientific knowledge
  - Engineering solves problems in a particular way: by applying science, mathematics, and design analysis.

- to building things
  - Engineering emphasizes the solutions, which are usually tangible artifacts.

- in the service of mankind.
  - Engineering not only serves the immediate customer, but it also develops technology and expertise that will support the society.
What is Engineering?

• “The creative application of scientific principles to design or develop . . .”
  – American Engineers' Council for Professional Development

• “. . . applying technical, scientific and mathematical knowledge to design and implement . . .”
  – Wikipedia

• “Engineering is the practical application of science and math to solve problems . . .”
  – School of Electrical and Computer Engineering, Georgia Tech

• “the practical application of science to commerce or industry”
  – Princeton Wordnet
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• Engineering is a London-based fortnightly magazine
• Engineering - one of the four temperaments defined by David Keirsey’s Myers-Briggs
• Engineering – Role assigned to playable characters in the Final Fantasy series of role-playing games by Square Enix
• Engineering is a Tamil language film slated to be released in 1999
Why Does it Matter?

- Aspirations and expectations that can’t – and maybe shouldn’t – be fulfilled
- Hides alternatives or forces them into the background
- Locks in one way – maybe not the best way – of factoring expertise
Why Are Prospects Diminishing?

• Two factors combine to create the problem:
  • Software
    – Software is in everything
    – Software enables/encourages complexity
  • More of life is lived in and through computers
Individual work applications
Networks
Communication
Group applications
Talking to friends
Texting
Sharing photos
Purchasing and listening to music
On and on . . .
Shopping
Mating
Gossip, Pictures, Updates
And not just the young . . .
And not just men . . .
Tweeting
Team-oriented collaborative virtual mass murder
Not just the web . . .
Ultra-Fast Trading

- Millions of shares in milliseconds
- Distribute orders to many exchanges
- Proprietary software
- Will generate $8b in revenue this year

- Software engineers > $10M
- Sergey Aleynikov arrested last week for stealing code
- Prosecutor claimed code could be used to “unfairly manipulate” markets
Where Are We Headed?

• More and more of life is
  – lived in and through computers
  – in contexts created, controlled, and manipulated by computers . . . .
Trends Shaping Technology Design

- Living in a computational landscape
- Side effects are often more important than intended effects
- Designed systems and social systems co-evolve
- How we organize to develop systems
Asking a Different Question

• Rather than ask
  – “How can I specify the system that my stakeholders need?”

• Maybe we should ask
  – “How can I set up the socio-technical system that will allow users, consultants, businesses, and everyone else to cooperatively build what all my stakeholders need?”
  – “Even though those needs are currently unknowable and evolving . . .”
Research Directions

• How to design and deploy platforms for others to build on
  – Individual users (e.g., end-user programming)
  – Domain experts (e.g., statistics packages)
  – Commercial firms (e.g., open source ecologies)
Four Eclipse Slides
Eclipse Plug-in Architecture
Eclipse Business Opportunities

• Sell plugins: Eclipse Plugin Central
• Sell complementary hardware or software
• Sell customization, consulting, training services
• Use platform (RCP) for other products

• In all cases, strong network externalities
Eclipse Governance - 1

• Centralized functions
  – IP due diligence
  – Rules and process
  – Selecting, coaching, enforcing
  – Recruiting and marketing

• Decentralized functions
  – Deciding what (if anything) to build for the platform
  – Deciding if and how to contribute to Foundation
    • Committees
    • Marketing, etc.
  – Deciding on business model, how to pursue it
    • Services
    • Products
Eclipse Governance - 2

- Overall governance
  - Board of directors
- Foundation Councils
  - Requirements
  - Planning
  - Architecture
Coordination in Eclipse

• Overall, cooperative effort

• At level of subproject
  – One company does nearly all the work
  – Sometimes companies take turns on a particular subproject
  – IBM maintains and enhances the platform
Collaboration in CDT

IBM Leaves/QNX Lead

WindRiver Joins/IBM Lead

WindRiver Leads

Fractional Commits for tools.cdt
Who Builds the Platform?

Fractional Commits for eclipse.platform

- Top 3 Firms
- IBM
- EmbarcaderoTechnol
- individual
- unknown
- QNXSoftwareSystem
- SAS
- WindRiver
- IntelCorporation
Do commercial developers drive away volunteers (by firm)?

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Developers at community focused firms have a significant attractive power while developers at product focused firms have no relation.
How to Train People for This?

• Computation, Organizations, & Society
  – PhD program in School of Computer Science at CMU

• Curriculum combines
  – Computer science
  – Machine learning/statistics
  – Network analysis/simulation
  – Policy

• Very successful to date
Summary of the Argument

• Systems that need “social smarts” are becoming increasingly prevalent
• Many key issues in determining the functionality of these systems are not amenable to traditional engineering approaches
• Therefore we need something *in addition* to traditional engineering approaches
• Alternatively, we could expand our notion of engineering to encompass new approaches
Questions?

Did you just say their field shouldn't exist?