Panel discussion on

TOP CHALLENGING ISSUES
FOR SOFTWARE DEVELOPMENT

Roy Oberhauser
Aalen University
Importance of SW Development

- Society increasingly depends on software
  - SW impacts us all, thus SW development issues too
  - Value has shifted to software and data

- Impacts of development issues
  - Direct costs of defects and catastrophes
  - Indirect costs in lack of satisfaction and capabilities

- New trends/situations bring their own challenges:
  - GSD, Crowdsourcing, Cloud Computing, DevOps, etc.
  - Security: malware, hacking, cyber-espionage and -warfare
  - Reuse via composability and resulting issues

Yet in some cases these may be running into some common underlying challenges too...
Challenging Issues for SW Development

- Technical Issues
  - Brooks’ Essential Difficulties [Br86]
    - Complexity, Conformity, Changeability, Invisibility
  - Requirements refinement [Br86]
    - “Deciding precisely what to build is hardest part of the conceptual work: establishing the detailed technical requirements, including all the interfaces to people…”
  - UI design [Bro3]
    - An art, not systematic or an engineering discipline
  - Productivity via reuse: compositionality (avoid building)
Challenging Issues for SW Development

- Technical Issues
- Process Issues
  - Agile vs. plan-driven approaches
    - Agile Manifesto with explicit emphasis on:
      - Explicit values, ownership, trust, working SW
    - CHAOS Report 2012 on Waterfall vs. Agile [CH12]:
      - Success 14 vs. 42%; Failed 29 vs. 9%;
      - But half are still Challenged in either case (57 vs. 49%)
  - Technical debt - long-term?
  - Team self-organization and role ambiguity
    - Maintaining conceptual integrity across multiple minds?
  - Forking “binges”; lack of documentation
Challenging Issues for SW Development

- Technical Issues
- Process Issues
- People-related Issues
  - Human issues: fallibility, communication issues, social skills, psychological effects
  - Adequate competency, training, and education
    - Dynamic technological landscape
  - Handling & valuing developers: Peopleware [DeLi87]
Challenging Issues for SW Development

- Technical Issues
- Process Issues
- People Issues
- Project Issues
  - SW estimation [Bro3]
    - Predictable schedule and predictable amount of work
Challenging Issues for SW Development

- Technical Issues
- Process Issues
- People Issues
- Project Issues
- Quality and other Holistic Issues
  - Less tolerance for errors?
  - Beyond single-point-of-failures, chain events
Software development is really about:

Multiple fallible humans collaborating via some lossful natural language to precisely program essentially invisible systems based on unclear and imperfect specifications, thereby creating highly complex defect-prone systems without definitive schedule or work predictability, on which society (gratefully and wishfully) relies...

In Summary
References


Stephen Clyde? Who’s he?

- **Person**: Role (0..*) plays Role and has Interest (0..*).
- **Person**: me: Problem Solver likes working with Software System (0..*) and uses Conceptual Modeling.
- **Object**: Complex?
- **Software System**: Object
- **Conceptual Modeling**: Object
- **Role**: Object
- **Interest**: Object

Diagram: [Object-oriented diagram showing relationships between roles, interests, software systems, and problem-solving.]

Interactions:
- Role plays Role with Person (0..*).
- Person has Interest (0..*).
- Person likes working with Software System (0..*).
- Person uses Conceptual Modeling.
Transitions and States?

@circa.1973

Acquiring skills

has idea & customer

Start Business

Pursuing Education

@circa.1993

Developing Software

Researching & Learning

Teaching Soft. Eng.

success

failure

has question
Responsibilities and Collaborations?

In the 1980’s

Problem Solver

CRC-Card-like model
[Cunningham, Beck, Wirfs-Brock, etc.]

<table>
<thead>
<tr>
<th>Average Software Engineer</th>
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<tbody>
<tr>
<td><strong>Responsible for …</strong></td>
<td><strong>Collaborates with …</strong></td>
</tr>
<tr>
<td>• Programming (coding) core application logic</td>
<td>• Managers</td>
</tr>
<tr>
<td>• Detailed design</td>
<td>• Customers</td>
</tr>
<tr>
<td>• Some levels and types of design</td>
<td>• End users</td>
</tr>
<tr>
<td>• Some testing</td>
<td>• Testers</td>
</tr>
<tr>
<td>• Some integration</td>
<td>• Graphic artists</td>
</tr>
<tr>
<td>• A little analysis of application problems and domains</td>
<td>• Documenters</td>
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<td>• and more</td>
<td>• and more</td>
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Responsibilities and Collaborations?

Today

Problem Solver

Average Software Engineer

<table>
<thead>
<tr>
<th>Responsible for …</th>
<th>Collaborates with …</th>
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<tbody>
<tr>
<td>• Programming the “glue” between frameworks, SDK’s, and existing components</td>
<td></td>
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<tr>
<td>• All kinds of integration</td>
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<tr>
<td>• All kinds of testing</td>
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<tr>
<td>• All levels and kinds of design</td>
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<tr>
<td>• Analysis of application problems and domains</td>
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<td>• Most of the development process</td>
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<td>• and more</td>
<td>• More Managers</td>
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<td></td>
<td>• Sophisticated Customers &amp; End Users</td>
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<td></td>
<td>• Quality Assurance</td>
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<td></td>
<td>• Security Officers</td>
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<tr>
<td></td>
<td>• Graphic artists</td>
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What’s change and what hasn’t?

- **Essence** → more complexity
- **Tools** → lots of improvements, still focus primarily on reducing accidents
- **Accidental complexity** → different, but more frequent and subtle
- **Principles** → some advancements and more evidence, but still lacking maturity
- **The need for great designers** → the need for great analysts, designers, integrators, testers, etc.
Top Challenging Issues for Software Development

Governance issues

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The software lifecycle “in the large”

A P.A. or company
Including business people and business analysts

Here needs, money, priorities are known

A company acting as software procurer and integrator

Here needs are mapped onto software requirements

A company acting as software developer

Here bids are specified, on the basis of software requirements

Here actual software is developed
The goals at the different levels

- Satisfying business needs
- Managing the budget and the software portfolio,
- Translating business needs into software requirements
- Roughly estimating costs to assess requirements viability and supply costs
- Translating software requirements into bid-oriented specifications (including functionality, quality, cost, etc.)
- Software development (of the required quality, within budget and in time)
The problems

- Communication “impedance mismatch”
  - How can analysts understand business people (or PA administrators)? and vice versa …
  - How can analysts and technical people communicate with no misunderstandings?

- Dealing with invisibility
  - What are the actual needs?
  - What are the requirements?
  - What are the specifications of the software solution?

- What is the cost and value
  - Of satisfying needs?
  - Of implementing requirements?
  - Of developing software?
A step towards a solution

- A common language, to express
  - business processes
  - Software requirements
  - Software specs, architecture, design

- The common language should support measurement. Objective quantitative measures support
  - Cost estimation models
  - Value models
  - Evaluation of progress
Virtuous communication flows

Model based cost estimates
Actual costs and progress referred to model items

Reqs models and measures

Refined cost estimates
Actual costs and progress referred to model items

Specs models
Global Software Development (GSD) Challenges

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What is Global Software Development (GSD)

- Software work undertaken at geographically separated locations across national boundaries in a coordinated fashion involving real time (synchronous) and asynchronous interaction.

- **Communication** for information exchange.
- **Coordination** of teams and activities (adhering to goals and policies)
Types of GSD Organizations

- Organizations shift all or part of their software development to other countries (referred to as offshoring). Independent client companies who outsource their software development to a vendor or software supplier.

- Multinational organizations distribute their software development activities across multiple subsidiary sites, located in different countries, e.g., Cisco, IBM, Alcatel-Lucent, Siemens, etc.
Extens of Global Software Development

- More than 90% of Fortune 500 companies use external resources for IT services delivery [2010]

- 31% of IT spending by companies in 2010 was on external services

- Cisco, IBM, Alcatel-Lucent, British Telecom, and General Electric have moved parts of their software development to countries like Ireland and India
Why Global Software Development?

- Solving local IT skills shortage
- Threat of opportunism, security and trust concerns, training, cultural issues
- Hidden, unexpected, and long term costs
- Cost Savings
- Follow the sun development
- Geopolitical risks, coordination problems
- Improvements in time-to-market efficiency
- Legal issues
- New markets
- Remain focused on core competencies
- Improved quality?
- Competitive advantage
- Loss of control
### Issues and Challenges

- **Strategic issues**: when, to whom and how, task allocation.
- **Communication issues**: distance, time zone difference, infrastructure support, distinct backgrounds, lack of informal communication.
- **Requirements dynamism**: user requirements are dynamic.
- **Cultural issues**: individualism vs. collectivism, emotional vs. neutral, attitude to time, attitude to governments, etc.
- **Geographical dispersion**: coordination complexity, vendor support, access to experts, software practices that need face-to-face communications.
- **Technical issues**: information and artifact sharing, software architecture.
- **Knowledge management**: slow communication, poor documentation, management of repositories, etc.
Addressing GSD issues

- Global software development process capabilities:
  - **Rigor and Standardization**: may offset some of the negative effects of team dispersions
  - **Agility and Customizability**: may help teams cope with user requirements dynamism. Such processes can lower cost and shorten time in responding to user change requests.

- **Work allocations**:
  - Transfer by development stage, transfer by functionalities, product line approach

- **Organizational models**: local managers at each site (with common visions).

- **Cultures** must be understood and respected. They could not be easily changed!

- **Other solutions**:
  - Share your experience...
Thank You
How to handle Human Diversity at the Web?

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You can’t just punch in “Let there be Light” without writing the code underlying the user interface functions!

J. P. Rini (1997)

So, what’s the problem? Web users are just like humans... and there are many different areas concerned with what we called:

“The Human Side of the Web”
Web Accessibility promotes "A Web for All" by removing barriers based on standards and guidelines that help Web sites or products meet basic requirements...

User-Centered Design (UCD) works on the strategy of positioning users' needs at the center of a Web design... (also known as Usability Engineering)

It seems that we already have good proposals, so again: what's the problem?

"The Web is more of a Social creation than a Technical one..."

Human-Computer Interaction (HCI) involves the study, planning and design of the interaction between people (users) and computers...

Web Usability promotes "A Web site or product easy to Use" by targeting to users who use that Web site or product to study the user’s attitude towards it...
Web Accessibility
"A Web for All"
puts the focus on technical aspects

possible?
what about the human interaction aspect?

So, let's take a second look to some of these areas we mentioned before, and their proposals...

... more than 7 billion people around the world
As predicted by the National Geographic Magazine - Special Series: 7 Billion (2011)

Web Usability
"A Web site or product easy to Use"
puts early focus on identifying users and tasks

what about considering people who have disabilities?
content and frequency of tests?
representative users?
Web Accessibility
"A Web for All"
puts the focus on technical aspects

Web Usability
"A Web site or product easy to Use"
puts early focus on identifying users and tasks

"An Usable Accessibility"

… and how’s the Client’s test going?
good! just a couple issues…

Hi, please could you guide me to the checkout?
Sure… It’s just over there!
I bet he’s pointing…
... researchers and practitioners have to leave their sandboxes and work their fields with a broader view!

For sure this is a very fast decade and it’s a fact that we need technology to survive, but mostly it’s a SOCIAL DECADE where

"It’s really about the Web User experience"

Mike Paciello of The Paciello Group (2009)

... involves HUMAN logics!!!
... there is no doubt that we need to improve recipes, ergo, effective and practical solutions to better handle the human nature of our Web users.

Thanks for your attention!

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