The 4+1 View Model of Industry–Academia Collaboration – Experiences

PER RUNESON @ TAIC PART 2015
It takes two to tango

Testing:
Academic &
Industrial
Conference

Practice
and
Research
Techniques
Industry-academia anti-patterns

1. academia always behind
2. research then transfer
3. research on demand
4. the blame game
The 4+1 Model

[RUNESON & MINÖR, 2014]
The 4+1 View Model of Architecture

The 4+1 View Model organizes a description of software architecture using five concurrent views, each of which addresses a specific set of concerns. Architects capture their design decisions in four views and use the fifth view to illustrate and validate them.

End users
- functionality

Programmers
- software management

Logical view
- development view

Scenarios
- Process view
- Physical view

System integrators
- performance
- scalability
- throughput

System engineers
- system topology
- delivery
- installation
- telecommunication

The 4+1 View Model is used to organize the description of the architecture of a software-intensive system.
4+1 model of industry-academia collaboration

1. Time view (when)
2. Space view (where)
3. Activity view (how)
4. Domain view (what)

+ 1 use case view – collaboration scenario
Knowledge cycles

- Career: 40 years
- Paradigm shift: 20 years
- Research program: 10 years
- Education program: 5 years
- Company operations: 1 year
- Knowledge
Time horizons

Table 1: Typical time horizons in industry–academia collaboration (years)

<table>
<thead>
<tr>
<th>Area</th>
<th>Industry</th>
<th>Academia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracts</td>
<td>1 – 3</td>
<td>3 – 5</td>
</tr>
<tr>
<td>Goals</td>
<td>1/4 – 3</td>
<td>3 – 5</td>
</tr>
<tr>
<td>Results</td>
<td>0 – 3</td>
<td>3 – 10</td>
</tr>
<tr>
<td>Organization</td>
<td>1 – 3</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Work practice</td>
<td>0 – 1/2</td>
<td>0 – 3</td>
</tr>
</tbody>
</table>
Doomed to fail?

SubMedina @SubMedina · 8 tim
LOL’ing so hard. RT @ainsinpeng At a tech startup talk. This is what the about working w academics

Visa översättning

Working with academics

• Annoying
• Terrible time management
• Have different goals
• Usually don’t have money

Martin Glinz: why academia and industry did not succeed to work together. @WC_REFSQ

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RETIWEETS FAVORITER
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18:19 - 25 mar 2015
Time view (when)

Time frame

<table>
<thead>
<tr>
<th>Now</th>
<th>Best practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soon</td>
<td>Next practice</td>
</tr>
<tr>
<td>3-5 years</td>
<td>Applied research</td>
</tr>
<tr>
<td>5+ years</td>
<td>Basic research</td>
</tr>
</tbody>
</table>
Time practicalities

Researchers make commitments far ahead of time for e.g. conference organization and teaching, while industry staff re-plan their commitments on daily, or even hourly basis, for higher management.

[Runeson 2012]
Space distances
Space view (where)
Traveling

Why does space matter?
Collaboration involves meetings = traveling:

**Local** – almost no traveling time

**Regional** – traveling time of 1-2 hours, i.e. a meeting takes at least half a day

**National** – traveling of 2+ hours, i.e. any meeting takes a full day

**International** – traveling takes more than one day
There are other distances...

- Geographical
- Organizational
- Psychological
- Cognitive
- Adherence
- Semantic
- Navigational
- Temporal

[Bjarnason et al 2015]
Organizational issues

Long term view

Time to spend

Commit
Top mgmt

Manage
Devlpmnt
Research

Conduct
Practition
Practition
Research
## Domain view (What)

<table>
<thead>
<tr>
<th>Automotive</th>
<th>Industrial Automation</th>
<th>Telecom Mobile</th>
<th>Defense</th>
<th>Public</th>
<th>Medical</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Management</td>
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<tr>
<td>Software Engineering</td>
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<tr>
<td>Software Technology</td>
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</tbody>
</table>
Industry: Silos —> Cross domain

CC Miroslav Petrasko @ flickr
Activity view (how)

Activities

<table>
<thead>
<tr>
<th>Networking</th>
<th>Catalyzing</th>
<th>Executing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Society/Financing</td>
<td>Knowledge Provider</td>
<td>Service Provider</td>
</tr>
<tr>
<td>Product Provider</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Actors
Industry-academia win-win

Case study ... investigate one instance ... of a contemporary software engineering phenomenon within its real-life context, especially when the boundary between phenomenon and context cannot be clearly specified
Example: Industrial Excellence Center on Embedded Applications Software Engineering

**When**
- Time frame
  - Now
  - Soon
  - 3-5 years
  - 5+ years

**Where**
- Best practice
- Next practice
- Applied research
- Basic research

**What**
- Automotive
- Industrial Automation
- Telecom
- Mobile
- Defence
- Public
- Medical
- Other
- Management
- Engineering
- Technology

**How**
- Networking
- Catalyzing
- Executing

- Society/Financing
- Knowledge provider
- Service Provider
- Product Provider
"Buth what...it is good for"

Engineer at Advanced Computing Systems Division of IBM, 1968

- Negotiating new collaboration
  - Setting expectations right
- Analyzing ongoing collaboration
  - Understanding success & failure
- Identifying missing collaboration
  - Improving for the future
What did we learn?

**Time** – the need for long term relations, the acceptance of different time scales

**Space** – physical distance plays a role also in the digital world

**Activity** – the collaboration may include several kinds of activity for mutual benefit

**Domain** – industries in different domains may learn from each other, catalyzed by academic research


