The Future is Already Here – It’s Just Not Distributed Evenly

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“The Future is Already Here – It’s Just Not Distributed Evenly”

William Gibson

(author of Neuromancer)
There is a major misconception in society concerning the role of research: knowledge does **NOT** flow from universities to industry, but rather it is a circular process *starting in industry*

Both universities and companies are in trouble and risk being **disrupted** in the coming decade

Novel industry/academia **collaborative engagement models** are required for both to survive the accelerating rate of innovation
Overview

• Vem är jag? Wie ben ik? Who am I?
• Trends in Software: Need for Speed
• Common Misconceptions about Research
• Challenges for Academia and Industry
• Software Center: A Novel Engagement Model
• Conclusion
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Nature of Product Innovation is Shifting

• More than 80% of R&D is related to software according to Ericsson
  – The world’s 5th largest software company

• 70% of all innovation is related to software according to AB Volvo

• 80-90% of all innovation in a car is related to electronics (HW & SW) according to Volvo Cars

https://hbr.org/2015/06/does-hardware-even-matter-anymore
Towards Products As Services

This requires continuous deployment throughout the lifetime of the product
Innovation Approaches

Customer driven innovation

Technology driven innovation

Strategy driven innovation

This requires continuous experimentation with customers
You should wake up every morning terrified with your sheets drenched in sweat, but not because you're afraid of our competitors. Be afraid of our customers, because those are the folks who have the money. Our competitors are never going to send us money.

- Jeff Bezos
10x every ~7 years
Volvo XC 90

Downloadable SW Size

- 750 MB in IHU
  - Speech and Maps not included.
- Compared to V60:
  - Reduced ICM
  - RSE not included
- 74 MB in ICM+IAM
  - Maps not included

Project:
- S80/1998
- XC90/2002
- S80/2006
- V70/2007
- XC60/2008
- V60/2011
- V40/2012
- SPA/2014
Data Generated in the World

- Location-tagged payments made in the U.S. annually: 65 billion
- E-mails sent per day: 154 billion
- U.S. adults whose location is known via their mobile phone: 87%

Digital Information Created Each Year, Globally

- 2,000% expected increase in global data by 2020
- 3 Megabytes: Video and photos stored by Facebook, per user
- 75%

50 Terabytes of data are created every second
Emerging companies highlight importance of user contribution and social connectedness

Value Creation Shifts

Trend: Need for Speed

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1M users</td>
<td>~6 years</td>
<td>30 months</td>
<td>10 months</td>
<td>?</td>
</tr>
<tr>
<td>50M users</td>
<td>N/A</td>
<td>~80 months</td>
<td>~44 months</td>
<td>~ 1 month</td>
</tr>
</tbody>
</table>

Level of User Contribution
Need for Speed in R&D – An Example

• Company X: R&D is 10% of revenue, e.g. 100M$ for a 1B$ product
• New product development cycle: 12 months

• Alternative 1: improve efficiency of development with 10%
  • 10 M$ reduction in development cost
• Alternative 2: reduce development cycle with 10%
  • 100M$ add to top line revenue (product starts to sell 1.2 months earlier)

No efficiency improvement will outperform cycle time reduction
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It Starts With Basic Research?

• **Belief:** New knowledge is created in basic research. Then it moves to applied research, advanced engineering and engineering.

• **Reality:** New knowledge is created in innovative companies. Research generalizes the knowledge and creates accessibility.

• **Examples:**
  – Agile development practices
  – Hadoop data processing and NoSQL databases
  – All new programming languages in the last 20 years
Our Research is Mono-Disciplinary?

- **Belief**: New innovations originate from within the research community. We lead the community and know best.
- **Reality**: Ideas and innovations almost always originate from outside the research community.
- **Examples**:
  - A/B testing originates in marketing
  - Technical debt metaphor is taken from economics
  - State diagrams originate in communications theory
Work With Government; Stay Away From Industry

- **Belief:** Governments have the long-term perspective and will offer academic freedom. Industry is short-term focused and just wants free/cheap labor.

- **Reality:** With proper governance, industry will set medium & long term direction for research. Governments are always behind.

- **Examples:**
  - Over the last 20 years ALL major innovations in software originated in industry
  - Silicon Valley and US west coast companies are way ahead of academic research in key areas such as big data, deep learning, VR and AR, etc.
  - Swedish companies are ahead in areas such as safety, security, systems integration, etc.
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On Education ...

When a subject becomes totally obsolete we make it a required course.

Peter F. Drucker
(the man who invented management)

If you think education is expensive, try ignorance.

Derek Bok
(former president of Harvard University)
Universities Are Disrupted

Disrupting Class
How Disruptive Innovation Will Change the Way the World Learns

Clayton M. Christensen
Bestselling Author of THE INNOVATOR’S DILEMMA

Michael B. Horn & Curtis W. Johnson
Research

More than 1,500,000 papers in 2013!

Wanna stay on top of things?

Read more than 4000 papers PER DAY

365 days per year!!!

http://www.quora.com/How-many-academic-papers-are-published-each-year
Research Results

• Over the last 20 years, **ALL** major innovations in software originated in industry
  – Programming languages, operating systems, web technology, mobile technology, etc.

• Innovation happens when you are trying to solve a really hard, real problem

• Academics tend to be the “chickens” and not the “pigs”
52% of the Fortune 500 firms since 2000 are gone.
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**Software Center: A Novel Engagement Model**

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Software Center

**Mission:** Improve the software engineering capability of the Nordic Software-Intensive industry with an order of magnitude

**Theme:** Fast, continuous deployment of customer value

**Success:**
- Academic excellence
- Industrial impact
Some Online Companies
A New Collaboration Model

Software Center aims to develop a strategic partnership with partner companies to significantly accelerate their adoption of novel approaches to software engineering.

- Research is performed in 6-month sprints
- Long term goal; short term value
- System-level, holistic perspective, including business, architecture, ways of working and organizational aspects
Theme Structure

Application Domain Themes

- Autonomous Systems
- Internet of Things
- System of Systems

Technology Themes

- Continuous Delivery
- Continuous Architecture
- Metrics
- Customer Data and Ecosystems

Shared public/partner funding

Predominantly partner funding
How are we doing?

- Stairway to Heaven
- CIVIT model
- CAFFEA model
- HYPEX model
- Metrics-based visualization
- Etc.

Active use by the Software Center companies!
Stairway to Heaven: Speed

Traditional Development

R&D Organization All Agile

Continuous Integration

Continuous Deployment

R&D as an Innovation System

Sales & mrkt

Prod. mgmt.

Cust. Sup.

Cust. sup.

Release

Release

V&V

V&V

V&V

V&D teams

V&D teams

V&D teams

V&D teams
Dependencies

Unawareness

Duplication - reuse

Temporal properties - behavior

Repeated wrapping

Contagious ATD

Quality issues

Big deliveries involving many developers

Hidden ATD

Non-identified non-functional requirements

Dependencies

Unawareness

Adaptation of existing code

New code

Big deliveries involving many developers

Testing

Bug fixing

Finding hidden problems

Hidden ATD

Non-identified non-functional requirements

Duplicated activities

Extra-activities

PHENOMENA (EFFECTS)

CAUSES

CLASSES OF ATD

Debt

Non-uniformity - Policies

Lack of familiarity and experience

Understanding

Confusion

Time pressure

Non-completed refactoring effort

Wrong estimation of effort

Stairway to Heaven: Data

<table>
<thead>
<tr>
<th></th>
<th>Collection</th>
<th>Analysis</th>
<th>Reporting</th>
<th>Decision making</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad-hoc</td>
<td>manual</td>
<td>manual</td>
<td>manual</td>
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<td>Collection</td>
<td>automated</td>
<td>manual</td>
<td>manual</td>
<td>manual</td>
</tr>
<tr>
<td>Automation</td>
<td>automated</td>
<td>automated</td>
<td>automated</td>
<td>supported</td>
</tr>
<tr>
<td>Data innovation</td>
<td>dynamic</td>
<td>dynamic</td>
<td>dynamic</td>
<td>supported</td>
</tr>
<tr>
<td>Evidence-based company</td>
<td>dynamic</td>
<td>dynamic</td>
<td>dynamic</td>
<td>automated</td>
</tr>
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</table>
“Featuritis”

Features / Functions Used in a Typical System

- Often / Always Used: 20%
- Rarely / Never Used: 64%
- Sometimes Used: 16%
- Rarely Used: 19%
- Never Used: 45%

Standish Group Study Reported at XP2002 by Jim Johnson, Chairman
Our Research ...
The HYPEX Model

Business strategy and goals

Strategic product goal

Feature: expected behavior \( (B_{exp}) \)

Gap analysis

- \( B_{exp} \)
- no gap \( (B_{act} = B_{exp}) \)
- relevant gap \( (B_{act} \neq B_{exp}) \)

Develop hypotheses

- implement MVF
- actual behavior \( (B_{act}) \)
- relevant gap \( (B_{act} \neq B_{exp}) \)

Experimentation

- implement alternative MVF
- extend MVF
- abandon

Product

Feature backlog

generate

select
Stairway to Heaven: Ecosystems

<table>
<thead>
<tr>
<th>Levels</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internally focused</td>
<td>do everything in-house unless it is really impossible</td>
</tr>
<tr>
<td>Ad-hoc ecosystem engagement</td>
<td>individuals take ad-hoc decisions to engage with ecosystem partners, but local optimization</td>
</tr>
<tr>
<td>Tactical ecosystem engagement</td>
<td>ecosystem engagement is centralized, but driven by tactical (rather than strategic) considerations</td>
</tr>
<tr>
<td>Strategic single ecosystem management</td>
<td>one of the ecosystem types is managed strategically</td>
</tr>
<tr>
<td>Strategic multi-ecosystem management</td>
<td>all three types (I, D, C) are managed strategically</td>
</tr>
</tbody>
</table>
What % of R&D for Commodity?
Innovation ecosystem

- **Who**: Customers, 3rd party developers, suppliers
- **What**: Development of new functionality
- **Why**: Share/minimize innovation costs/risks
- **When**: High market uncertainty
- **How**: Open innovation, co-opetition, partnerships
- **Mechanisms**: Product platforming, idea competitions, customer involvement, collaborative design, innovation networks etc.

Differentiating ecosystem

- **Who**: Keystone player
- **What**: Optimization and extension of existing functionality
- **Why**: Turn innovations into core product offerings, keep internal control over value-adding functionality, optimize for maximum customer value
- **When**: When innovative functionality have proven valuable for customers
- **How**: Innovation transfer, R&D management, monetizing strategies
- **Mechanisms**: Data-driven development, patents, contracts, licenses etc.

Commoditizing ecosystem

- **Who**: Suppliers, competitors, developers
- **What**: Reduce efforts related to old, non value-adding functionality
- **Why**: Share/minimize maintenance costs
- **When**: Functionality that has become so integral to the product that it no longer offers customer value
- **How**: OSS, COTS, inner source, standardization, shared supplier
- **Mechanisms**: Open platforms and API’s, connecting services etc.
TeLESM: Three Layer Ecosystem Strategy Model

Innovation ecosystem
- Internal
  - Me-Myself-I Strategy
  - Be-My-Friend Strategy
- Collaborative
  - Customer Co-Creation Strategy
  - Supplier Co-Creation Strategy
  - Peer Co-Creation Strategy
  - Expert Co-Creation Strategy
- External
  - Copy-Cat Strategy
  - Cherry-Picking Strategy
  - Orchestration Strategy
  - Supplier Strategy
  - Preferred Partner Strategy
  - Acquisition Strategy

Differentiating ecosystem
- Internal
  - Increase Control Strategy
  - Incremental Change Strategy
  - Radical Change Strategy
- Collaborative
- External

Commoditizing ecosystem
- Internal
  - Rationalized in-sourcing
  - Push-Out Strategy
- Collaborative
  - OSS Creation Strategy
  - Partnership Strategy
  - OEM partnerships
- External
  - COTS Adoption Strategy
  - OSS Integration Strategy
  - Outsourcing
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