Speed, Data and Ecosystems: Exelling in a Software-Driven World

Jan Bosch
Director Software Center
www.software-center.se
Professor of Software Engineering
Chalmers University of Technology
Gothenburg, Sweden.
www.janbosch.com

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Three Key Take-Aways

• For society as a whole, thanks to technology in general and digitalization specifically, life has never been better. For companies, the risk of disruption is the greatest ever.

• To avoid disruption, companies have to become world-class in three areas: speed, data and ecosystems

• Universities and the knowledge ecosystem around them have a fiduciary responsibility to help companies accelerate their pace of transformation.
Overview

- Trends in Society and Industry
- Stairway to Heaven
  - Speed
  - Data
  - Ecosystems
- Accelerating Transformation: Software Center
- Conclusion
The World Has Never Been Better!

- There is (much!) less poverty:
  - Extreme poverty (less than $1.25/day) dropped from 40% to 14% of the world population (721 million people!)

- We’re living longer!
  - Global life expectancy has gone from 47 in 1950 to 70 in 2011 (50% improvement!)

- There are much fewer war deaths:
  - Number of war deaths dropped from 300 per 100,000 people (WWII) to less than 1 currently

- There’s less racism, sexism, and other forms of discrimination in the world:
  - 20 percent decline in observable gender inequalities from 1995 to 2011.

Role of Digital Technology

• Mobile & smart phones
  – Virtually EVERYONE in the world has one

• Internet access
  – 3.174 billion people (44%)

• Optimization through data availability
  – 2.5 billion gigabytes (GB) of data was generated every day in 2012

• Everything is/will soon be connected
  – 50 billion connected devices in 2020
Fortune 500

52% of the Fortune 500 firms since 2000 are gone
Disruption Is The New Normal

• Jim Collins (Built to last): Companies last, on average, 30 15 10 years on the Fortune 500 list. And that time period is decreasing
• More than 2000 companies have appeared on the Fortune 500 list and most are gone from it
• Main cause: Companies fail to innovate and to build new core capabilities

Digitalization Is The New Disruptor!
Digitalization is the use of digital technologies to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business.

- Gartner
Digitalization

The Strategic Building Blocks of Digital Transformation

- **Digital customer experience**
  - Digitally enhanced products
  - Data-driven services
  - Digital services
  - Software products

- **Digitization of core business**
  - Sales, channels, and marketing
  - Research and development
  - Manufacturing and supply chain management
  - HR, finance, and support

- **Digital capabilities**
  - Agile organization, IT, and development
  - Systems and technology platforms
  - Analytics and data integration
  - Digital partner ecosystem

**Digital transformation accelerators**

- Start-up incubation, venture capital, and prototyping
- Lighthouses and bold M&A moves
- Digital redesign process by process
- Digital program and change management

Source: BCG analysis.
Software Changes Everything

- Air Pollution
  Control of CO₂, emissions of factories, pollution emitted by cars and toxic gases generated in farms.

- Forest Fire Detection
  Monitoring of combustion gases and preemptive fire conditions to define alert zones.

- Wine Quality Enhancing
  Monitoring soil moisture and trunk diameter in vineyards to control the amount of sugar in grapes and grapevine health.

- Offspring Care
  Control of growing conditions of the offspring in animal farms to ensure its survival and health.

- Sportsmen Care
  Vital signs monitoring in high performance centers and fields.

- Structural Health
  Monitoring of vibrations and material conditions in buildings, bridges and historical monuments.

- Smartphones Detection
  Detect iPhone and Android devices and in general, any device which works with WiFi or Bluetooth interfaces.

- Perimeter Access Control
  Access control to restricted areas and detection of people in non-authorized areas.

- Radiation Levels
  Distributed measurement of radiation levels in nuclear power stations surroundings to generate leakage alerts.

- Electromagnetic Levels
  Measurement of the energy radiated by cell stations and WiFi routers.

- Traffic Congestion
  Monitoring of vehicles and pedestrian affluence to optimize driving and walking routes.

- Smart Roads
  Warning messages and diversions according to climate conditions and unexpected events like accidents or traffic jams.

- Smart Lighting
  Intelligent and weather adaptive lighting in street lights.

- Intelligent Shopping
  Getting advice in the point of sale according to customer habits, preferences, presence of allergic components for them or expiration dates.

- Noise Urban Maps
  Sound monitoring in bar areas and critical zones in real time.

- Water Leakages
  Detection of liquid presence outside tanks and pressure variations along pipes.

- Waste Management
  Detection of rubbish levels in containers to optimize the trash collection routes.

- Vehicle Auto-diagnosis
  Information collection from Canbus to send real time alarms to emergencies or provide advice to drivers.

- Item Location
  Search of individual items in big surfaces like warehouses or harbours.

- Water Quality
  Study of water suitability in rivers and the sea for fauna and eligibility for drinkable use.

- Golf Courses
  Selective irrigation in dry zones to reduce the water resources required in the green.
Towards Product as a Service

This requires continuous deployment throughout the lifetime of the product
Software Size

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
Data Generated in the World

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

Digital Information Created Each Year, Globally

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

50 Terabytes of data are created every second
Every Minute of the Day

- Pinterest users pin 3,472 images.
- Vine users share 8,333 videos.
- Skype users connect for 23,300 hours.
- Yelp users post 26,380 reviews.
- Apple users download 48,000 apps.
- Pandora users listen to 61,141 hours of music.
- Amazon makes $83,000 in online sales.
- Instagram users post 216,000 new photos.
- Twitter users tweet 277,000 times.
- Facebook users share 2,460,000 pieces of content.
- Tinder users swipe 416,667 times.
- Whatsapp users share 347,222 photos.

Google receives over 4,000,000 search queries.

YouTube users upload 72 hours of new video.

Email users send 204,000,000 messages.

The global internet population grew 14.3% from 2011-2013 and now represents 2.4 billion people.
Emerging companies highlight importance of user contribution and social connectedness.

**Trend: Need for Speed**

### Value Creation Shifts

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<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>
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</table>
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Stairway to Heaven 2.0
Stairway to Heaven: Speed

Traditional Development
R&D Organization All Agile
Continuous Integration
Continuous Deployment
R&D as an Innovation System

R&D teams
R&D teams
R&D teams
R&D teams
R&D teams

V&V
V&V
V&V
V&V
V&V

Cust. Sup.
Cust. sup.
Release
Release
Sales & mrkt
Prod. mgmt.
Stairway to Heaven: Data

<table>
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<tr>
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<th>Collection</th>
<th>Analysis</th>
<th>Reporting</th>
<th>Decision making</th>
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<td>manual</td>
<td>manual</td>
<td>manual</td>
<td>manual</td>
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<tr>
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<td>manual</td>
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<tr>
<td>Automation</td>
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<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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“Featuritis”

Features / Functions Used in a Typical System

- **Often / Always Used:** 20%
- **Rarely / Never Used:** 64%
- **Sometimes:** 16%
- **Rarely:** 19%
- **Always:** 7%
- **Never:** 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 ($B_{exp}$)
- actual behavior ($B_{act}$)

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

- Develop hypotheses
- Experimentation
  - implement MVF
  - implement alternative MVF
  - extend MVF
  - abandon
Data-Driven Continuous Evolution of Autonomous Systems

- Human hypothesis testing
- Automated experimentation
- Predefined adjustment

- Staged deployment
- Friendly customer deployment
- Company internal deployment
- Test bed
- Simulation
- Continuous integration
- Deployment environments

Smart system
### Levels

<table>
<thead>
<tr>
<th>Levels</th>
<th>Description</th>
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<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>
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</table>
3LPM: Three Layer Product Model

What % of R&D for Commodity?
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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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
Success: Industrial impact
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
- WASP
- IOTAP

Predominantly partner funding
How Are We Doing?

The Software Center is significantly accelerating the adoption of novel approaches to software engineering at my company.

<table>
<thead>
<tr>
<th>Response</th>
<th>Value</th>
<th>Percentage</th>
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<tbody>
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<td>0%</td>
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<tr>
<td></td>
<td>2</td>
<td>3%</td>
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<tr>
<td>neutral</td>
<td>3</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>14%</td>
</tr>
<tr>
<td>strongly agree</td>
<td>5</td>
<td>41%</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>7%</td>
</tr>
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“In the future, all companies will be software companies”

George F. Colony (CEO Forrester Research)
Conclusion

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• To avoid disruption, companies have to become world-class in three areas: speed, data and ecosystems

• Universities and the knowledge ecosystem around them have a fiduciary responsibility to help companies accelerate their pace of transformation.
Not My Job?! 

Strong LEADERSHIP needed from YOU