



Software Center



# Speed, Data, Ecosystems and Empowerment: The Future of Software Engineering

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# The World Has Never Been Better!

- There is (much!) less **poverty**
  - Extreme poverty (less than \$1.25/day) dropped from 29% to 9% of the world population in 30 years
- 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

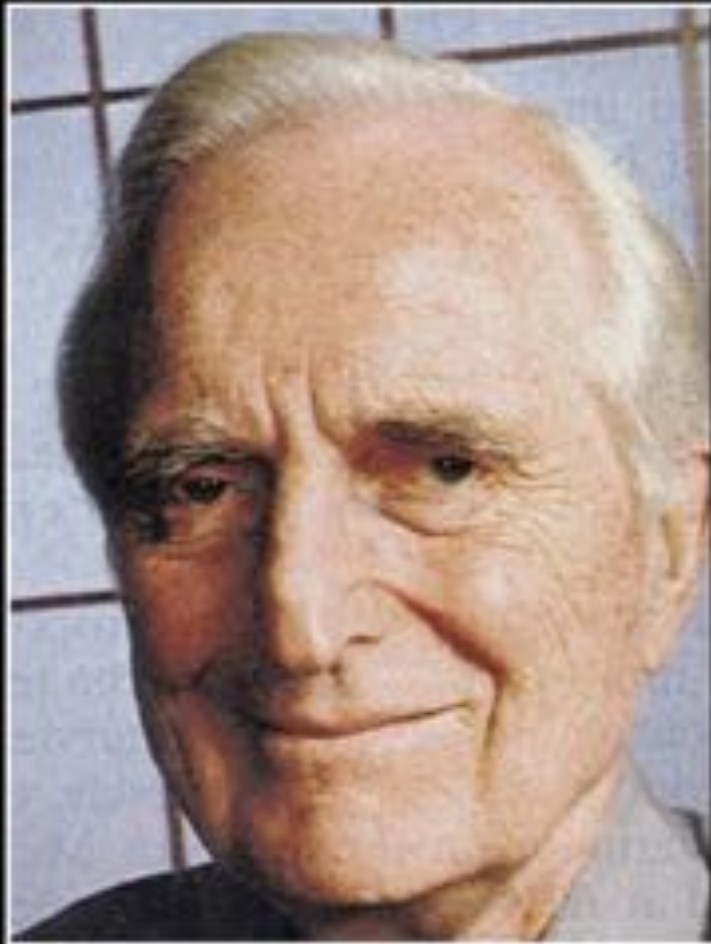
- Mobile & smart phones
  - Virtually EVERYONE in the world has one
- Internet access
  - 3.174 billion people (44%)
- Optimization through data availability
  - 2.5 billion gigabytes (GB) of data was generated every day in 2012
- Everything is/will soon be connected
  - 50 billion connected devices 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
- Main cause: Companies fail to innovate and to build new core capabilities

**Digitalization Is The New Disruptor!**



# Digitalization

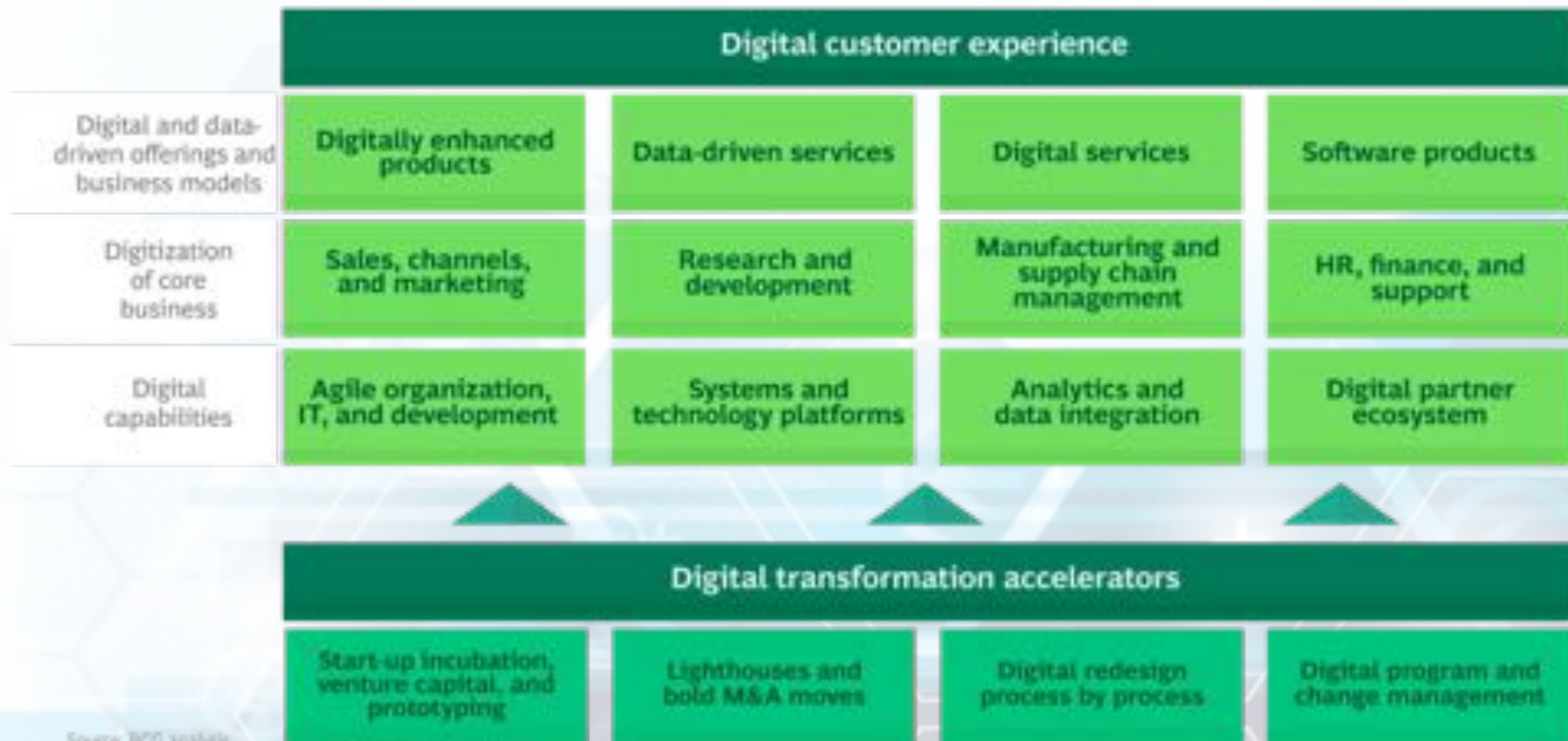


**Digitalization** is the use of digital technologies to change a **business model** and provide **new revenue and value-producing opportunities**; it is the process of moving to a **digital business**.

- Gartner

# Digitalization

## The Strategic Building Blocks of Digital Transformation



Source: BCG analysis.



# Three Key Take-Aways

- Companies are increasingly **disrupted** and these days **digitalization** is the root cause
- The pathology of **change resistance** in companies shows several recurring patterns
- To survive, companies need to adopt a ***digital business operating system***

# Overview

- Vem är jag? Wie ben ik? Who am I?
- Trends in Industry
- Towards a New Business Operating System
  - Speed
  - Data
  - Ecosystems
  - Empowerment
- Conclusion



Academic Research



Software Center



Software Center



Consultancy



Startups



Remente



Automated Quality Testing of User Scenarios

Industry Innovation



ASSIA

Industry Operations





# Software Center

**Mission:** Improve the *digitalization* capability of the European Software-Intensive industry with an order of magnitude

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

**Success:** Academic excellence

**Success:** Industrial impact



CHALMERS



MALMÖ UNIVERSITY



MÄLARDALEN UNIVERSITY  
SWEDEN



# Research Themes

## Application Domain Themes

Shared  
public/partner  
funding

Autonomous  
Systems

**WASP**

Internet  
of  
Things

**IOTAP**

System  
of  
Systems

Predominantly  
partner  
funding

Continuous  
Delivery

Continuous  
Architecture

Metrics

Customer  
Data and  
Ecosystems

## Technology Themes

# Some Online Companies





# About Sweden

- Third largest country in EU (450,295 KM2) (about 4.7% of China)
- ~ 10 Million people (<1% of China)
- Incredibly strong industry base: Volvo, Ericsson, Sony Ericsson Mobile Communications AB, Saab Defense, Electrolux, Volvo Cars, Sandvik, Scania, Atlas Copco, ABB and SKF
- Also: Hennes & Mauritz, IKEA, Nordea, Preem, Securitas and Nordstjernan

# About Sweden

**SWEDISH HITS**



**IN THE SPOTLIGHT**

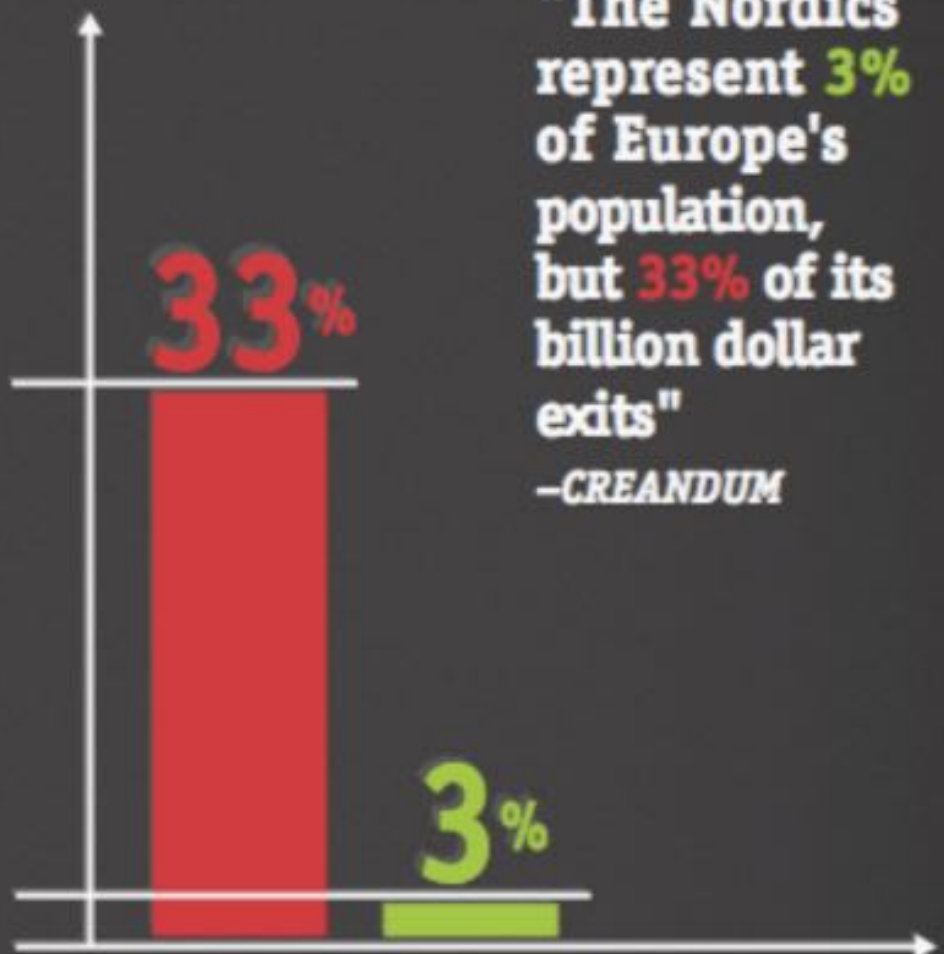
Bloglovin iZettle KnC Miner  
Lifesum MAG interactive Magine  
Sinch(Rebtel) Stardoll TicTail  
Wrapp Widespace Tobii Truecaller  
Soundcloud Videoplaza Yubico

... and many more!

**NEXT TO WATCH**

13th Lab, Bannerflow, BehavioSec, Campanja, Detectify, Epidemic sound, Fishbrain, Funded-ByMe, Hansoft, Instabridge, Load Impact, Lookback, Narrative, People People, Poppermost Productions, RelationDesk, Safello, Teenage Engineering, Unomaly, Vamos, Virtusize, Vint, Volumental...and many more!

**IPO's, M&A's**



**"The Nordics represent 3% of Europe's population, but 33% of its billion dollar exits"**

**—CREANDUM**

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# Gartner 2017 Technology Hype Cycle



Note: PaaS = platform as a service; UAVs = unmanned aerial vehicles

# Wildly combinatorial streams of digital transformation

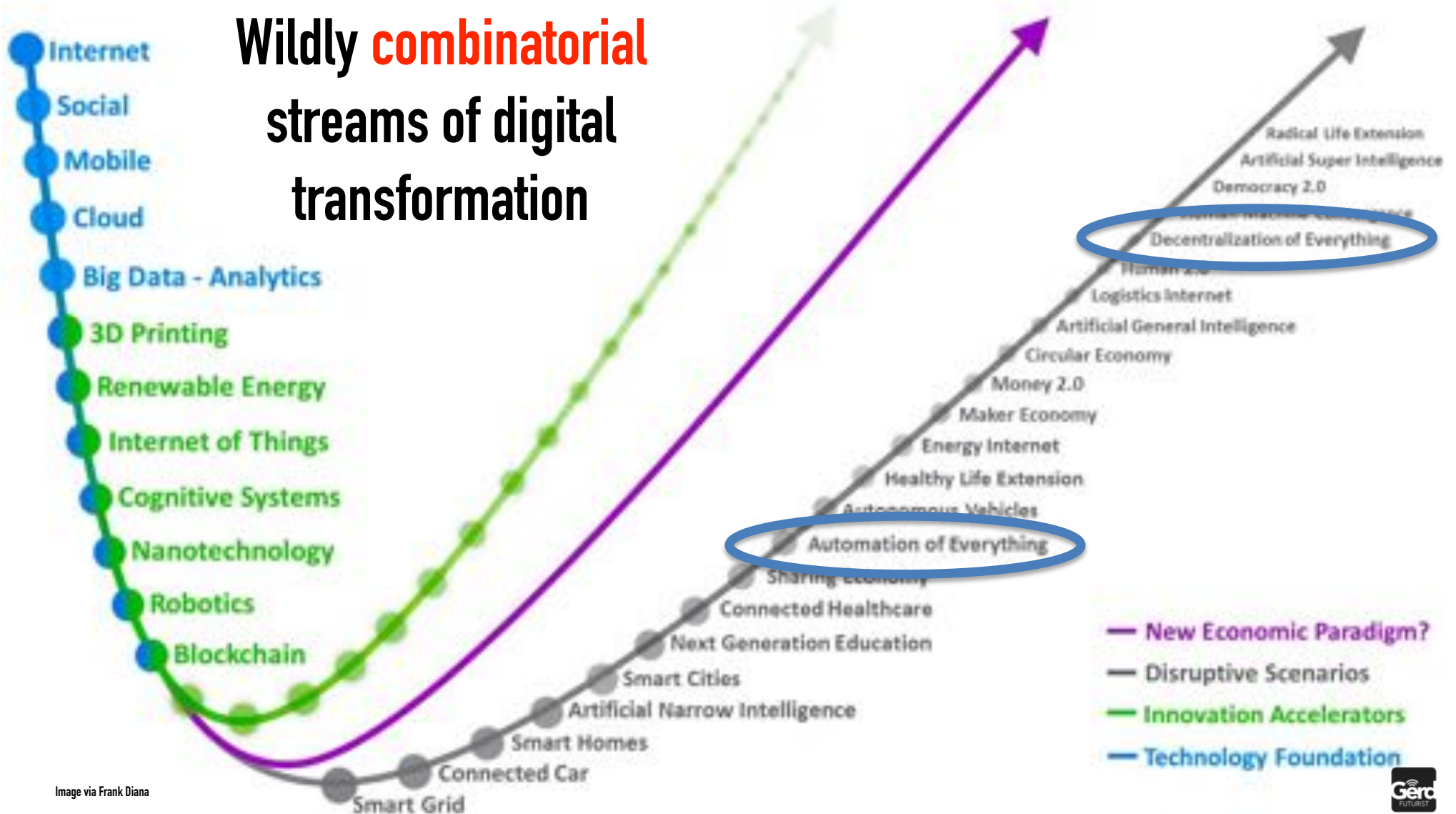


Image via Frank Diana

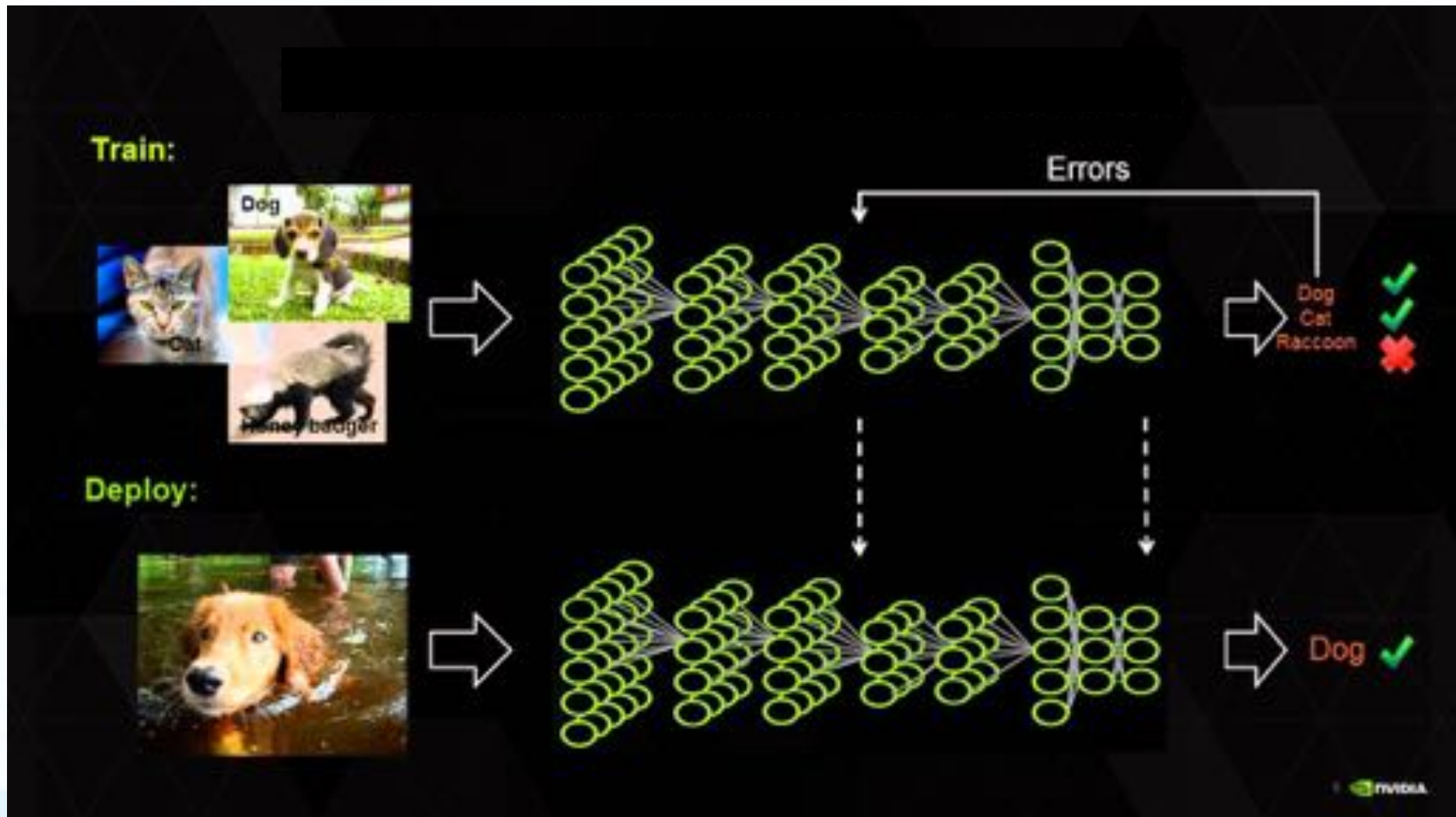


# INTELLIGENCE

"We want Google  
to be the third  
half of your brain."  
Sergey Brin

Automation

# Deep Learning





# Software Drives Everything



Self-Driving Cars



Robots

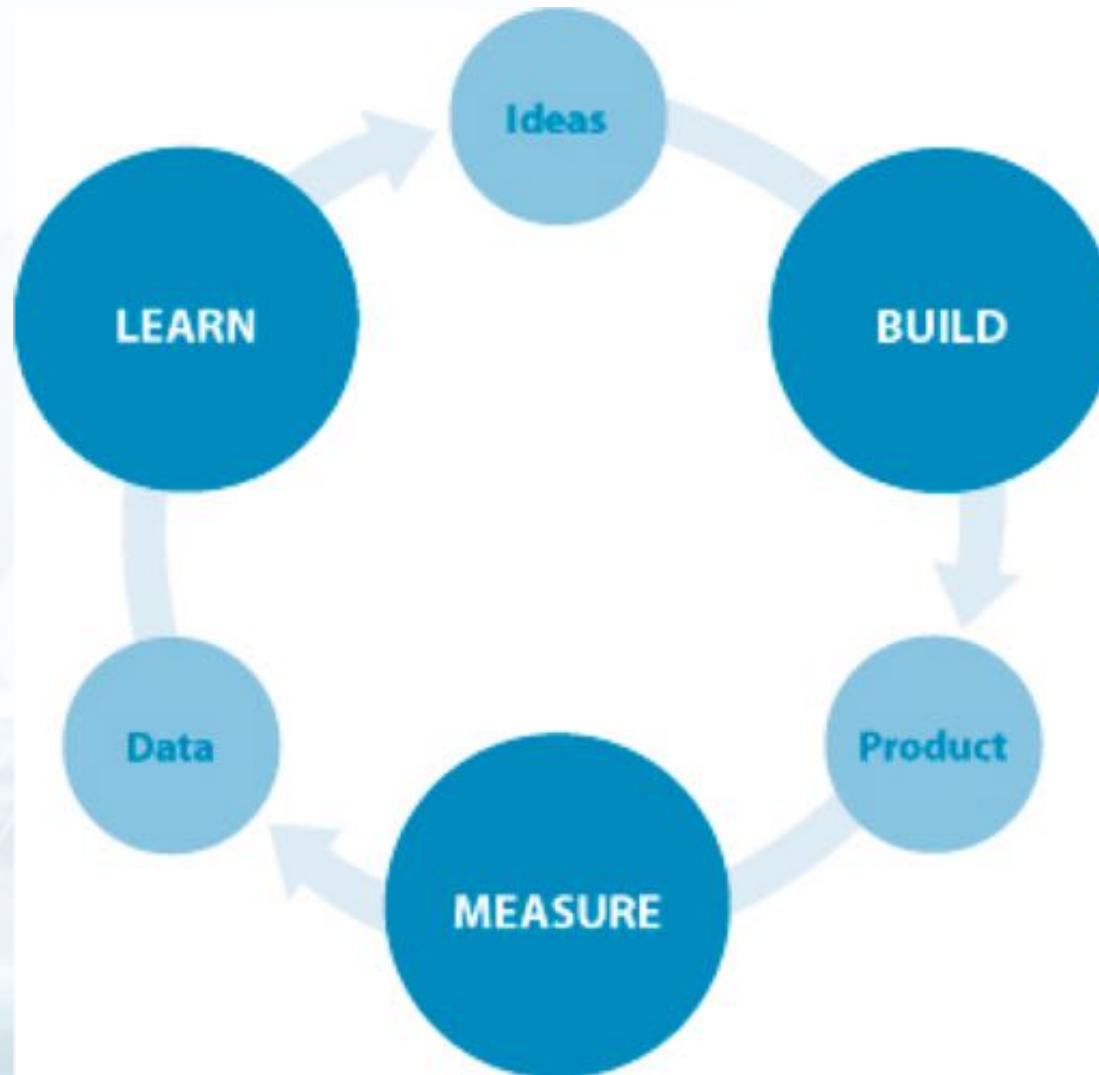


Gripen Drone



3D Cement Printing

# The Cycle of Innovation



# Length of Innovation Cycle



Car Platform: 10-15 years



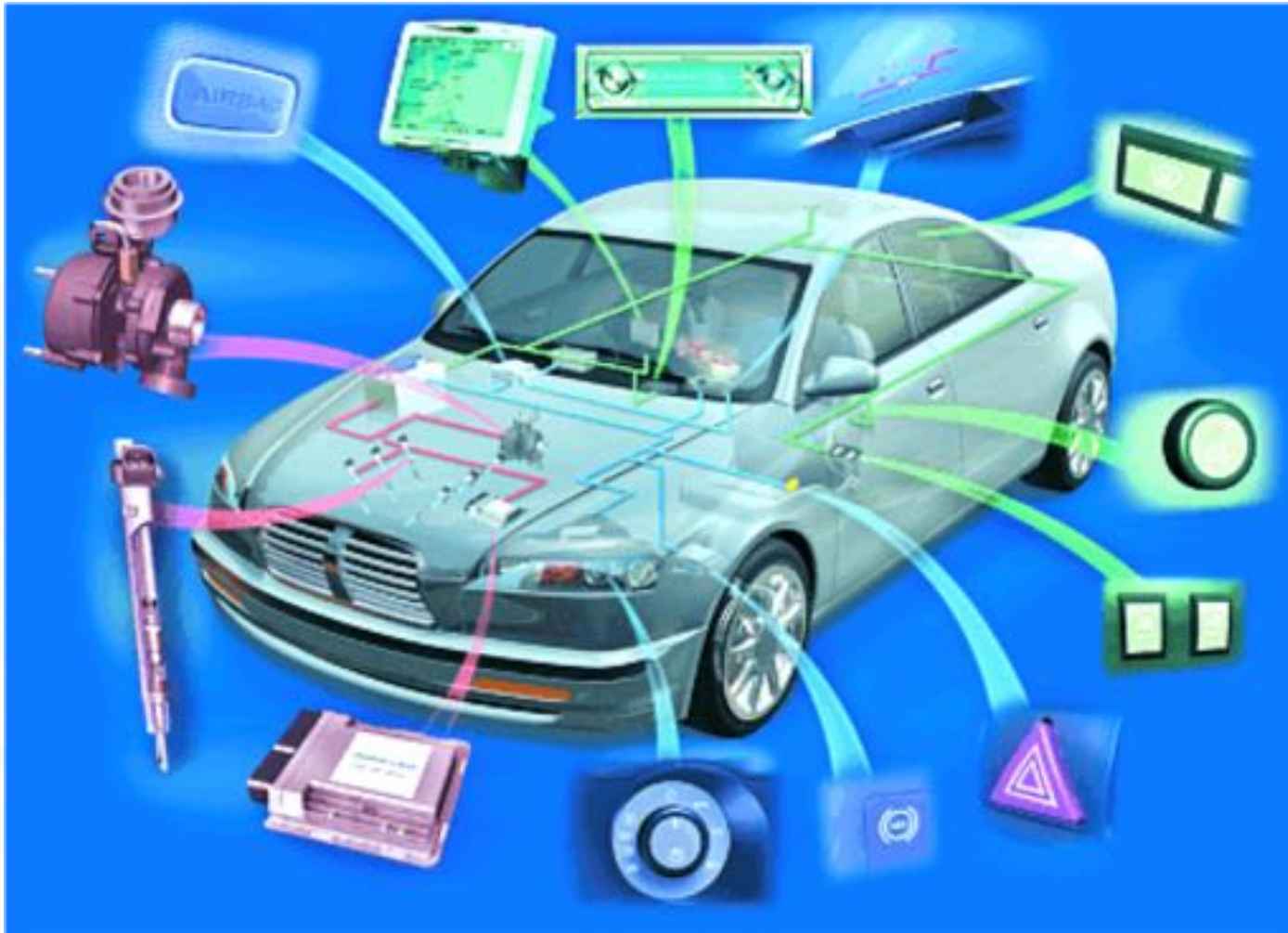
# Length of Innovation Cycle



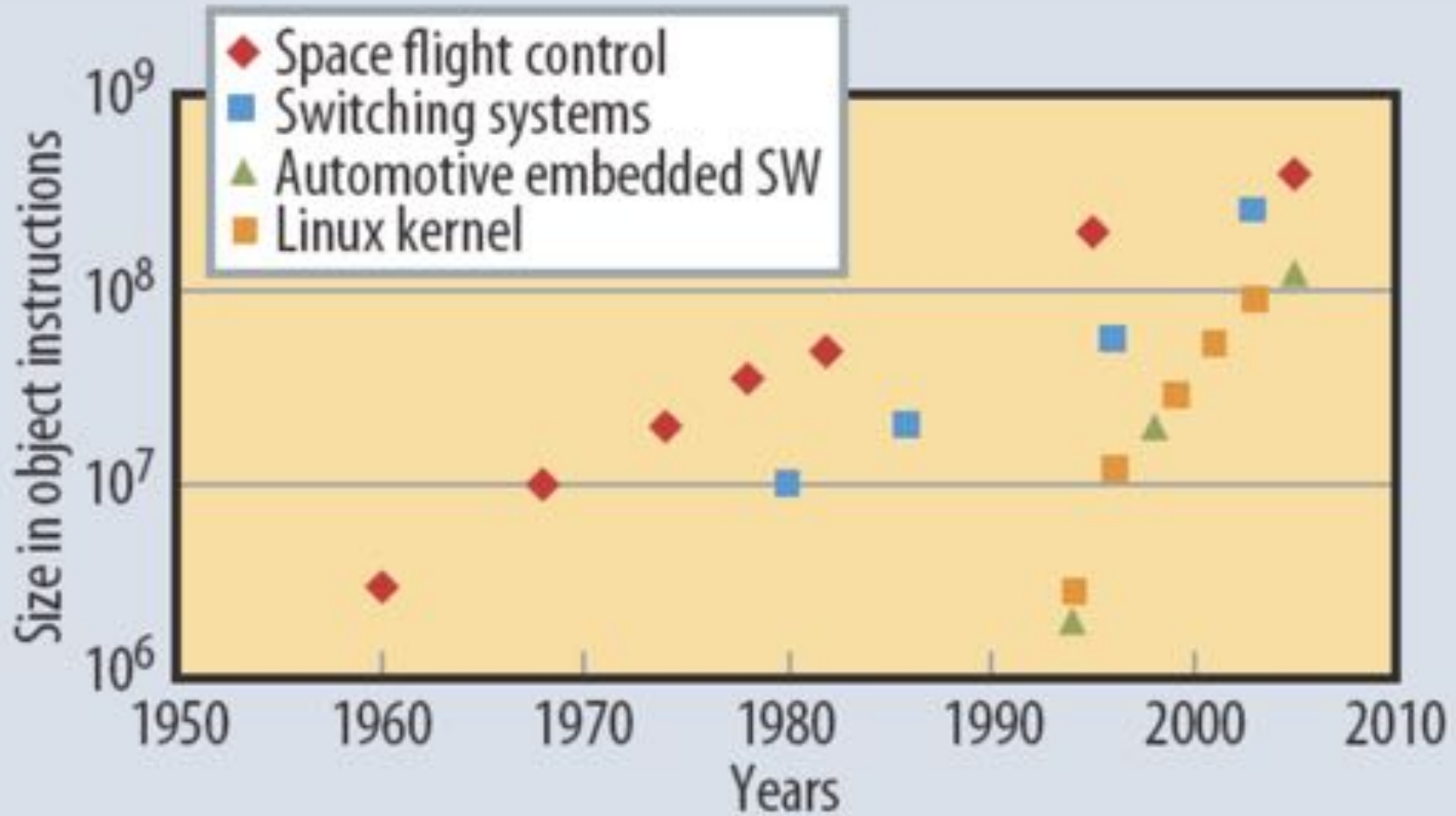
Car: 3-4 years



# Length of Innovation Cycle

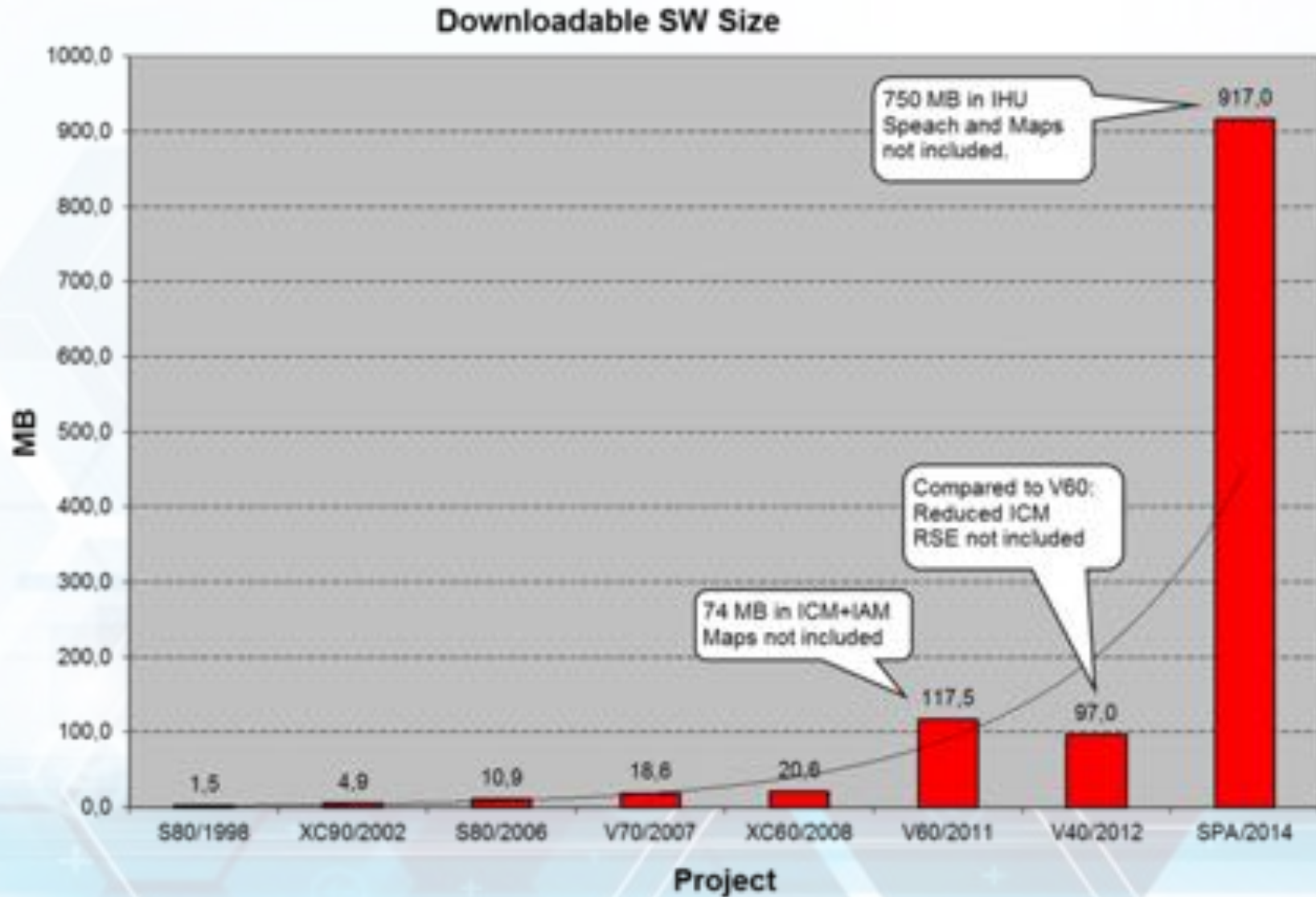


Car Software: 1-5 days



**10x every ~7 years**

# Volvo XC 90



# Data Generated in the World

 **65 billion**  
Location-tagged payments  
made in the U.S. annually

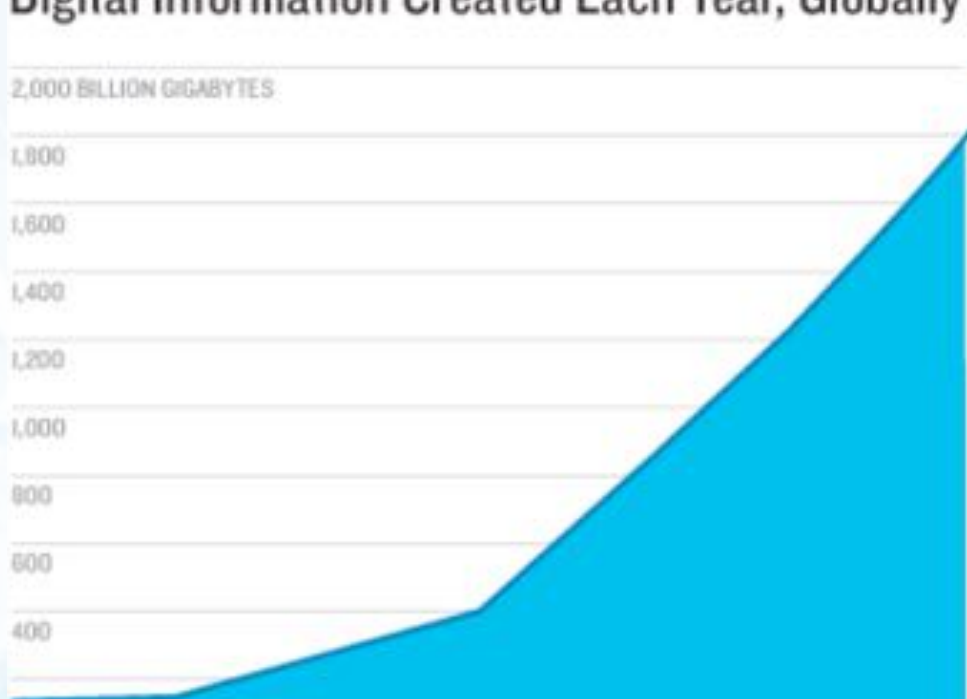
**154 billion**  
  
E-mails sent per day

 **87%**  
U.S. adults whose location is  
known via their mobile phone

## Digital Information Created Each Year, Globally

2,000 BILLION GIGABYTES

1,800  
1,600  
1,400  
1,200  
1,000  
800  
600  
400



**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



# 2018 *This Is What Happens In An Internet Minute*



# Trend: Need for Speed

## Value Creation Shifts

Emerging companies highlight importance of user contribution and social connectedness



Level of User Contribution

Founded	1984	1995	2004	2009
1M users	~6 years	30 months	10 months	?
50M users	N/A	~80 months	~44 months	~ 1 month

# 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**

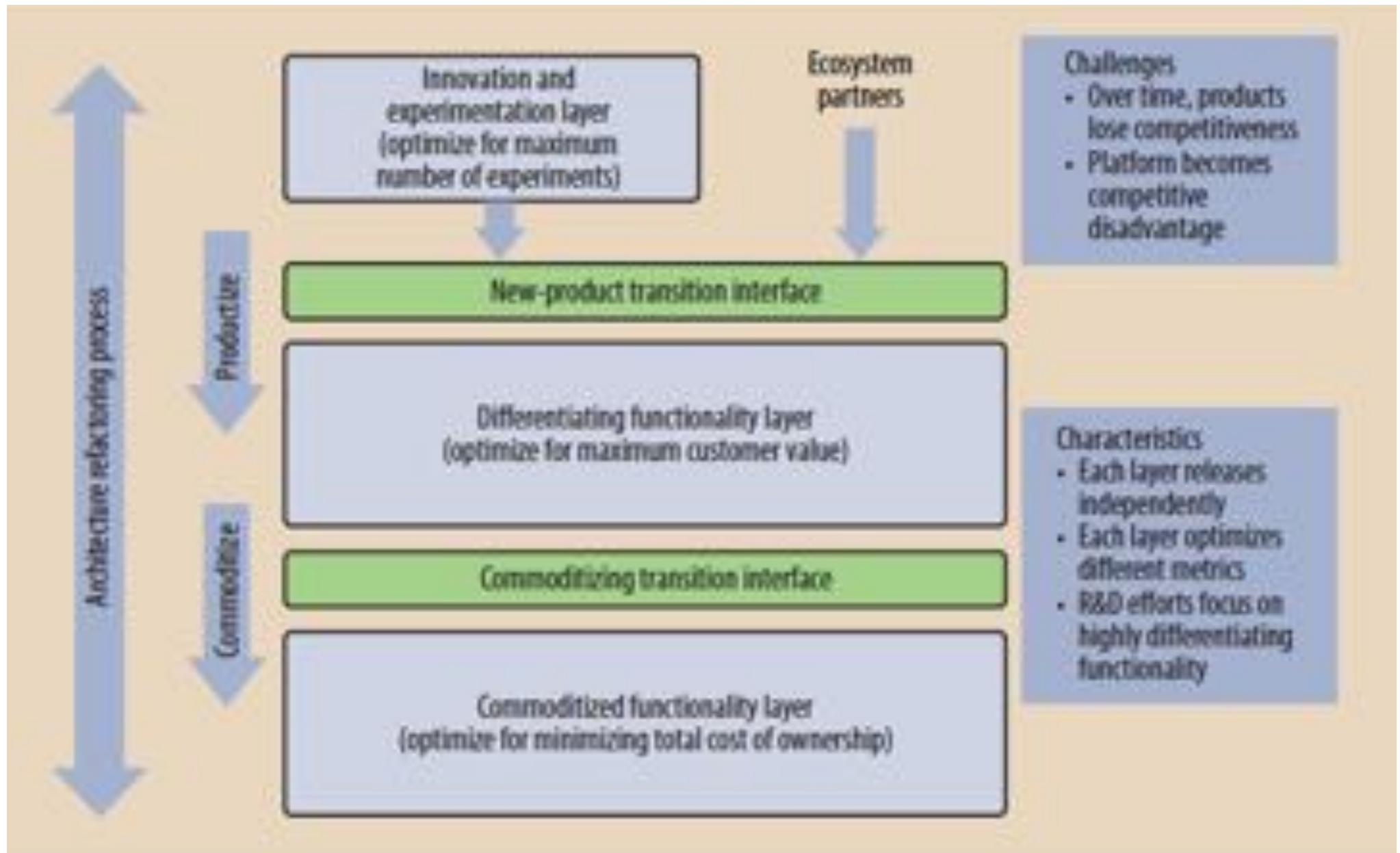


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# 3LPM: Three Layer Product Model



How do I organize for operating in this model?

innovation

- How do I expand my innovation funnel?

ecosystem

transition

- How do I deliver innovations to market faster?

speed

differen-  
tiation

- How do I know that what I'm building provides value to customers?

data

transition

- How do I identify commoditization of functionality?

data

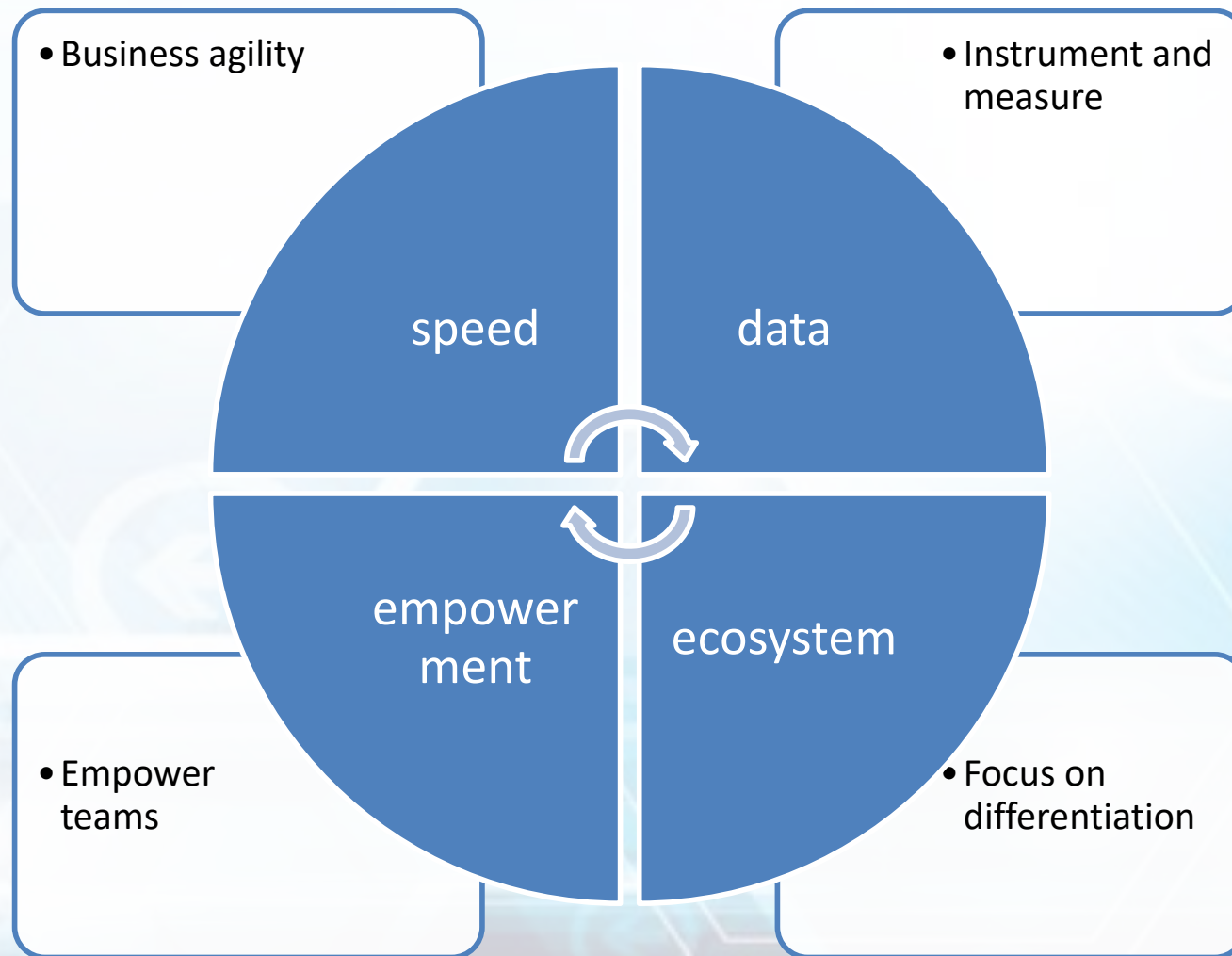
commodity

- How do I minimize total cost of ownership for commodity functionality?

ecosystem

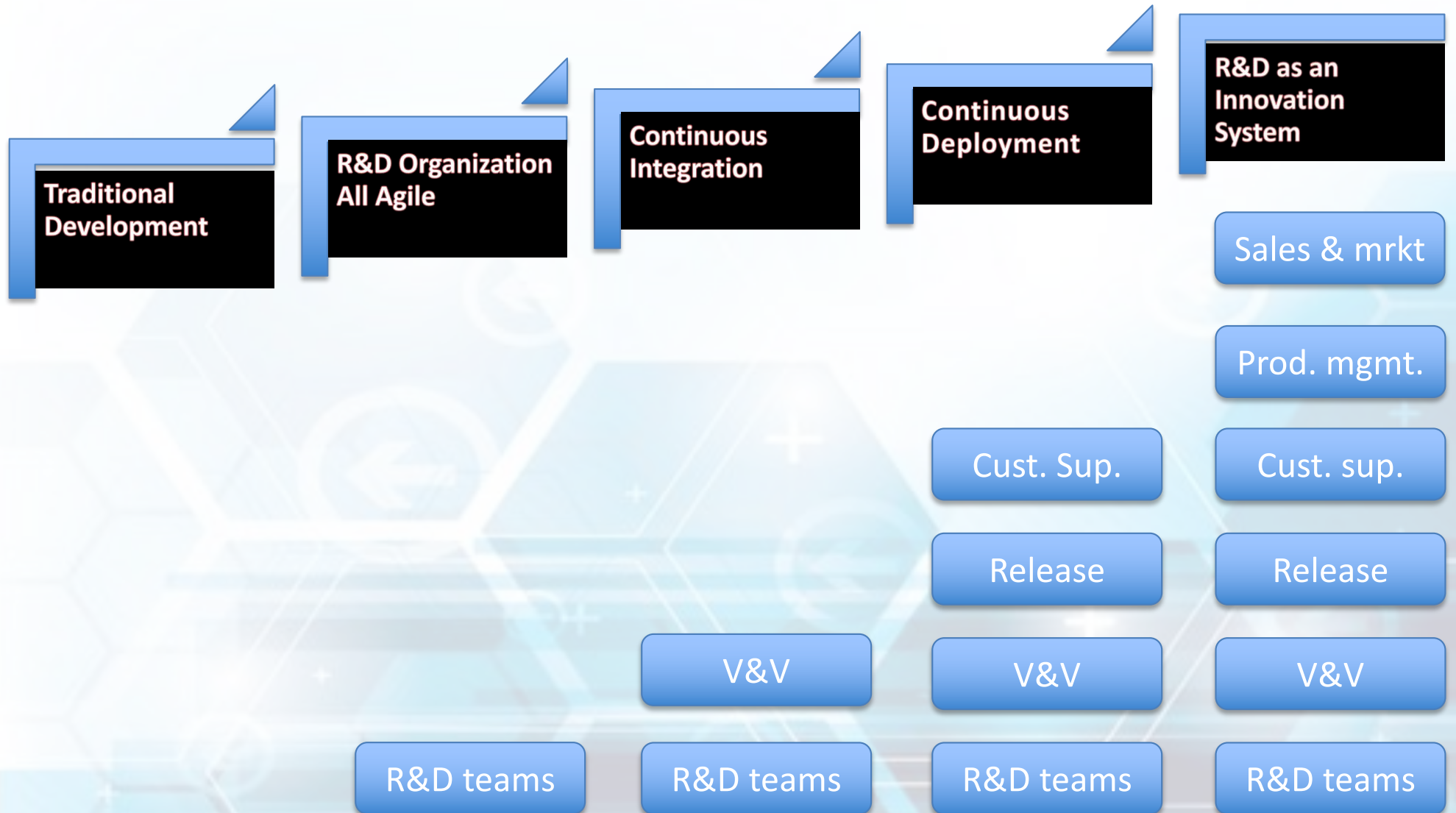
empowerment

# A New Business Operating System





# Stairway to Heaven: Speed



# Feedback Cycles

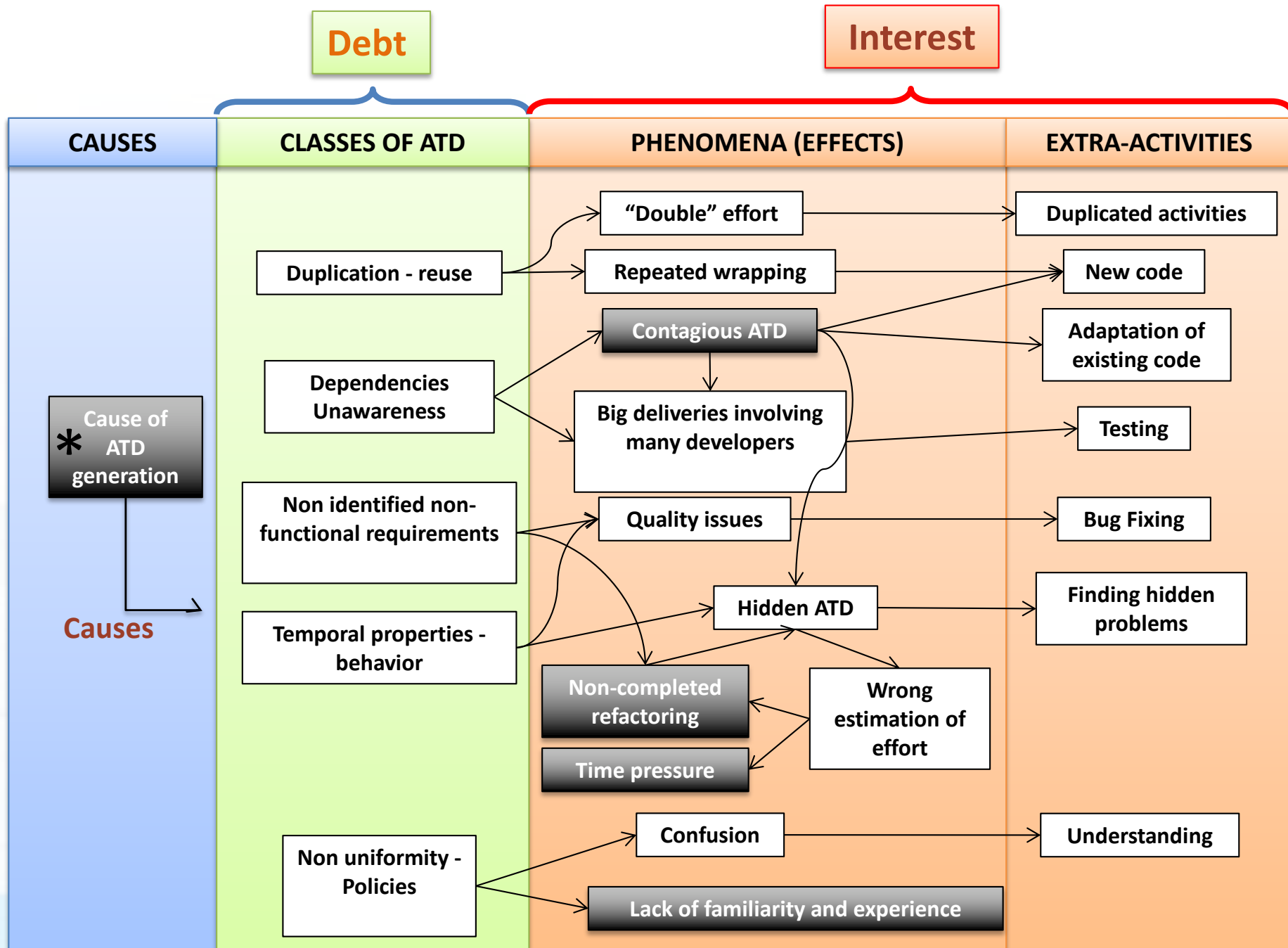
- Development cycle
- Requirements cycle
- Quality assurance cycle
- Governance cycle
- Deployment cycle
- Value creation cycle

# Feedback Cycles and Speed

	Traditional	Agile	CI	CD	Inno System
Development	Long	Sprint	Sprint	Sprint	Sprint
Requirements	Long	Sprint	Sprint	Sprint	Sprint
Quality assurance	Long	Long	Sprint (internal)	Sprint (external)	Sprint (external)
Governance	Long	Long	Sprint	Sprint	Sprint
Deployment	Long	Long	Long	Sprint	Sprint
Value creation	Long	Long	Long	Long	Sprint

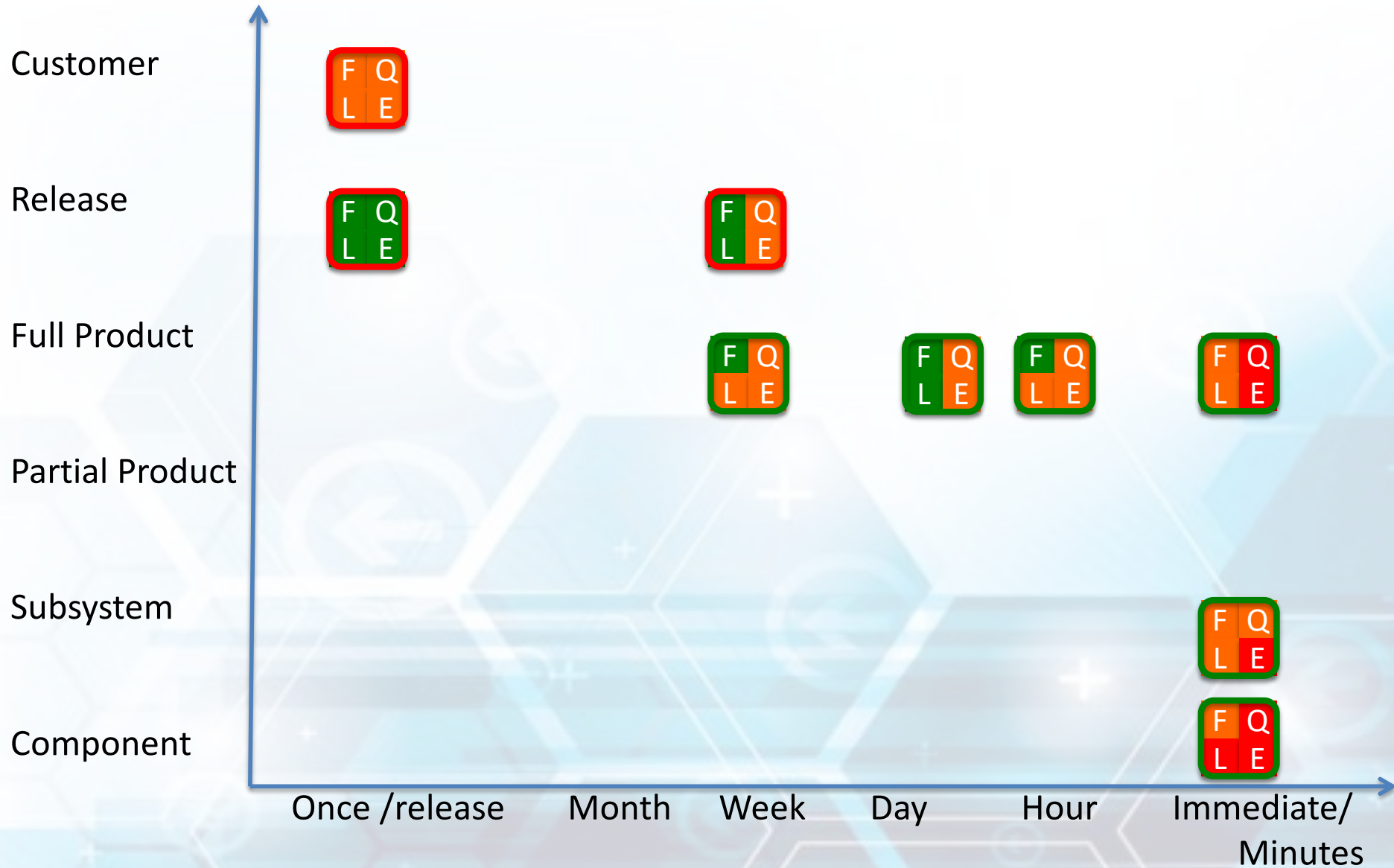
Slow: opinion-based; sprint: data-driven



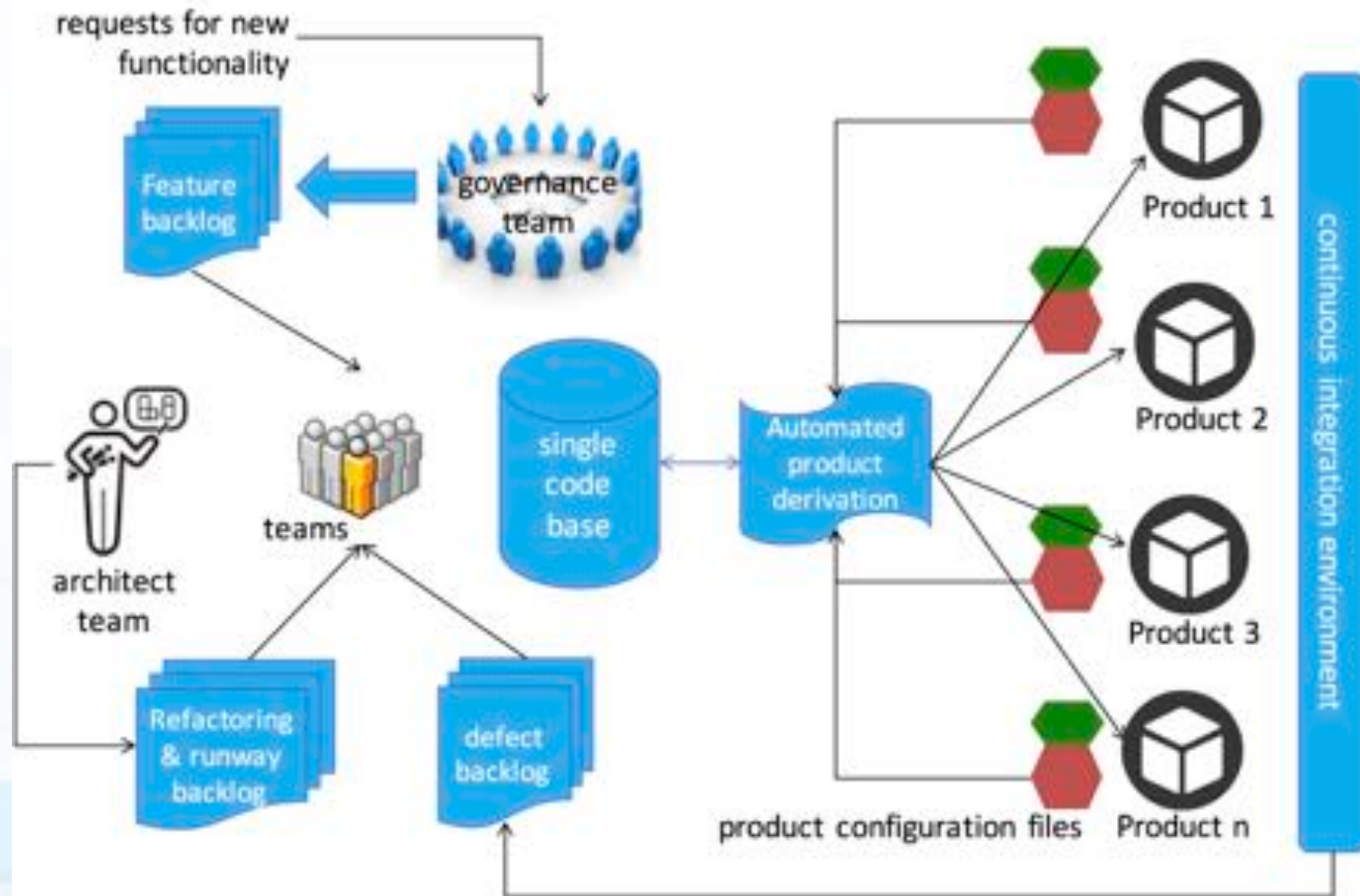


Martini, A., Bosch, J., Chaudron, M., 2014. "Architecture Technical Debt: Understanding Causes and a Qualitative Model",  
 \* Best Paper Award at 40th Euromicro Conference on Software Engineering and Advanced Applications.

# Visualizing Continuous Integration And Test

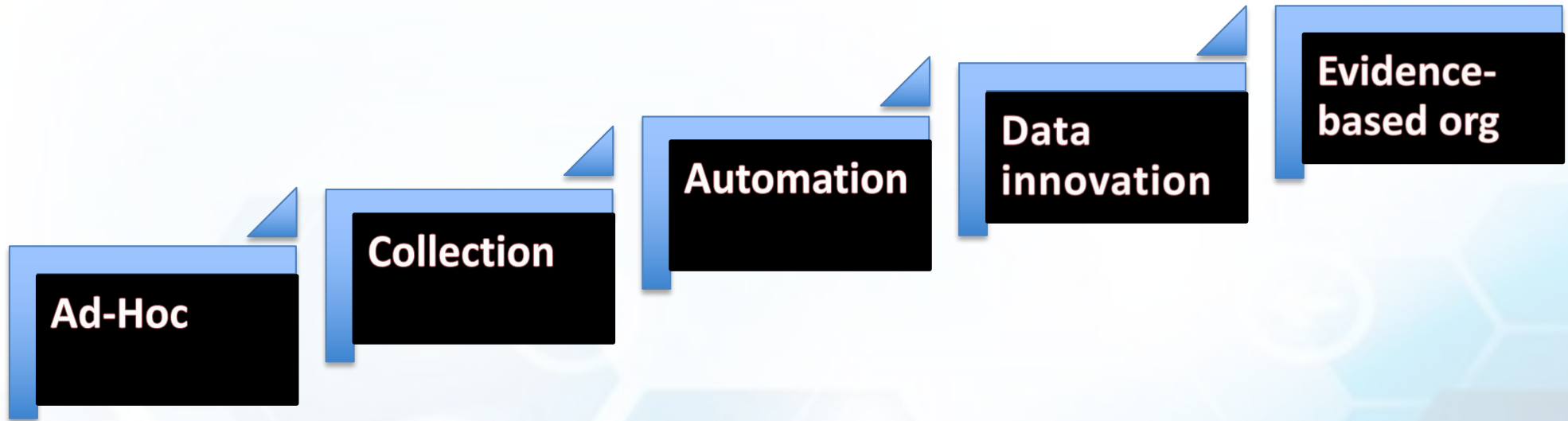


# Continuous Delivery Model





# Stairway to Heaven: Data



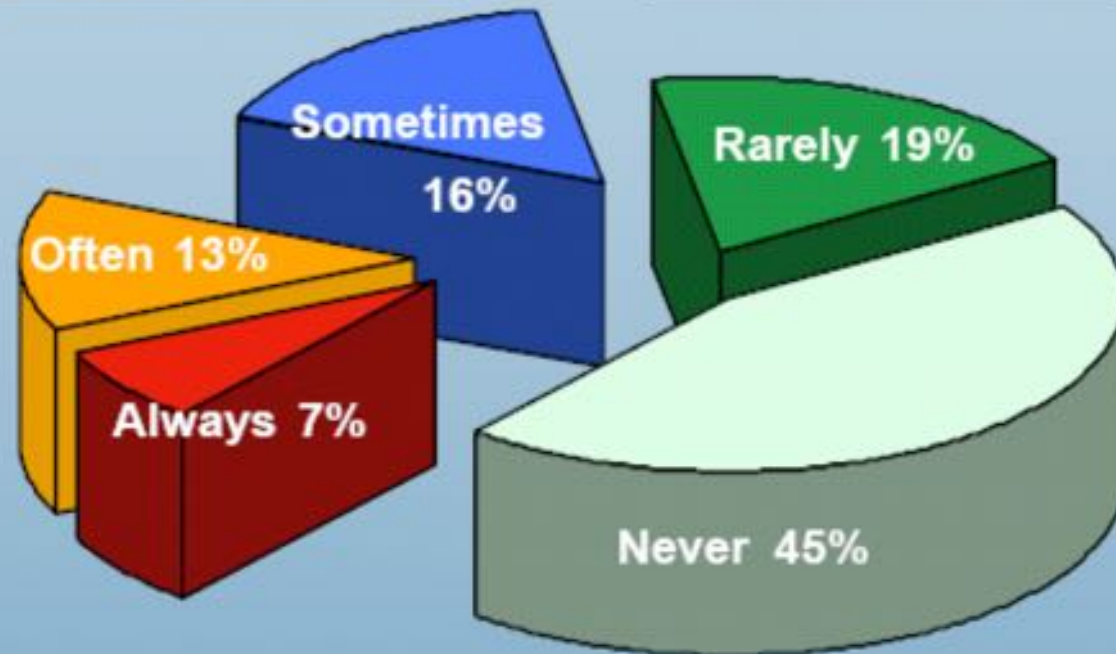
	Collection	Analysis	Reporting	Decision making
Ad-hoc	manual	manual	manual	manual
Collection	automated	manual	manual	manual
Automation	automated	automated	automated	supported
Data innovation	dynamic	dynamic	dynamic	supported
Evidence-based company	dynamic	dynamic	dynamic	automated

# “Featuritis”

Features / Functions Used in a Typical System

**Often / Always  
Used: 20%**

**Rarely / Never  
Used: 64%**

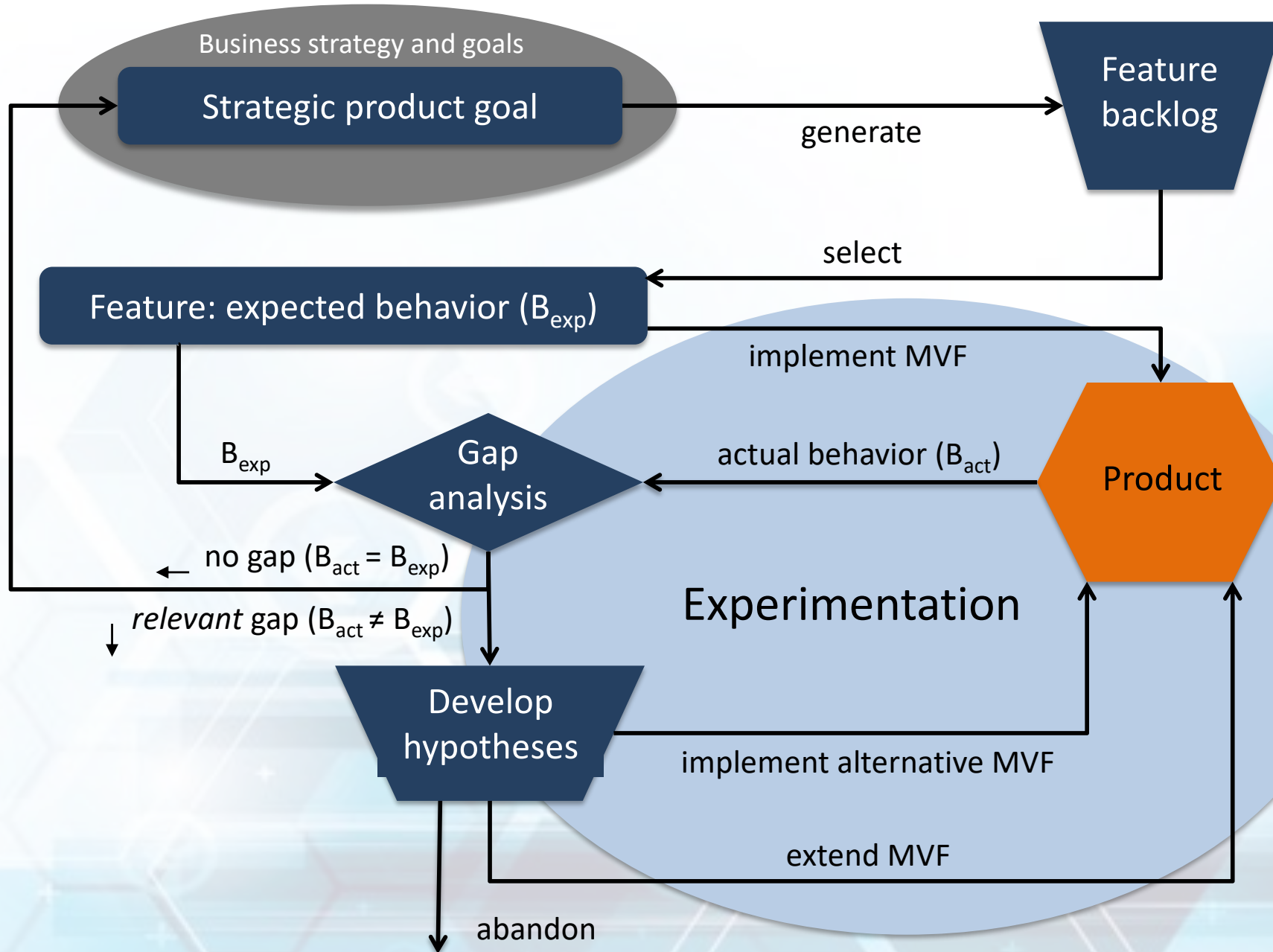


*Standish Group Study Reported at XP2002 by Jim Johnson, Chairman*

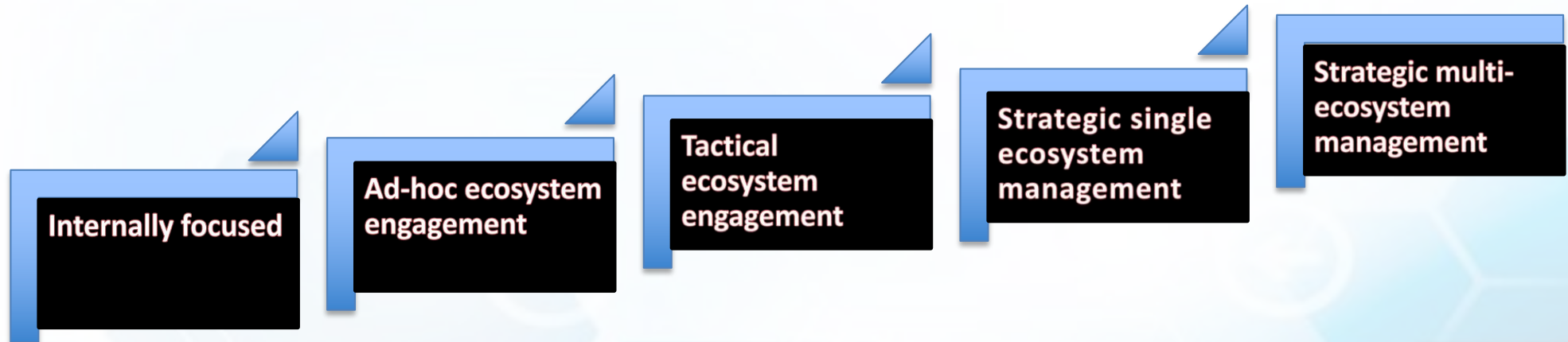




# The HYPEX Model

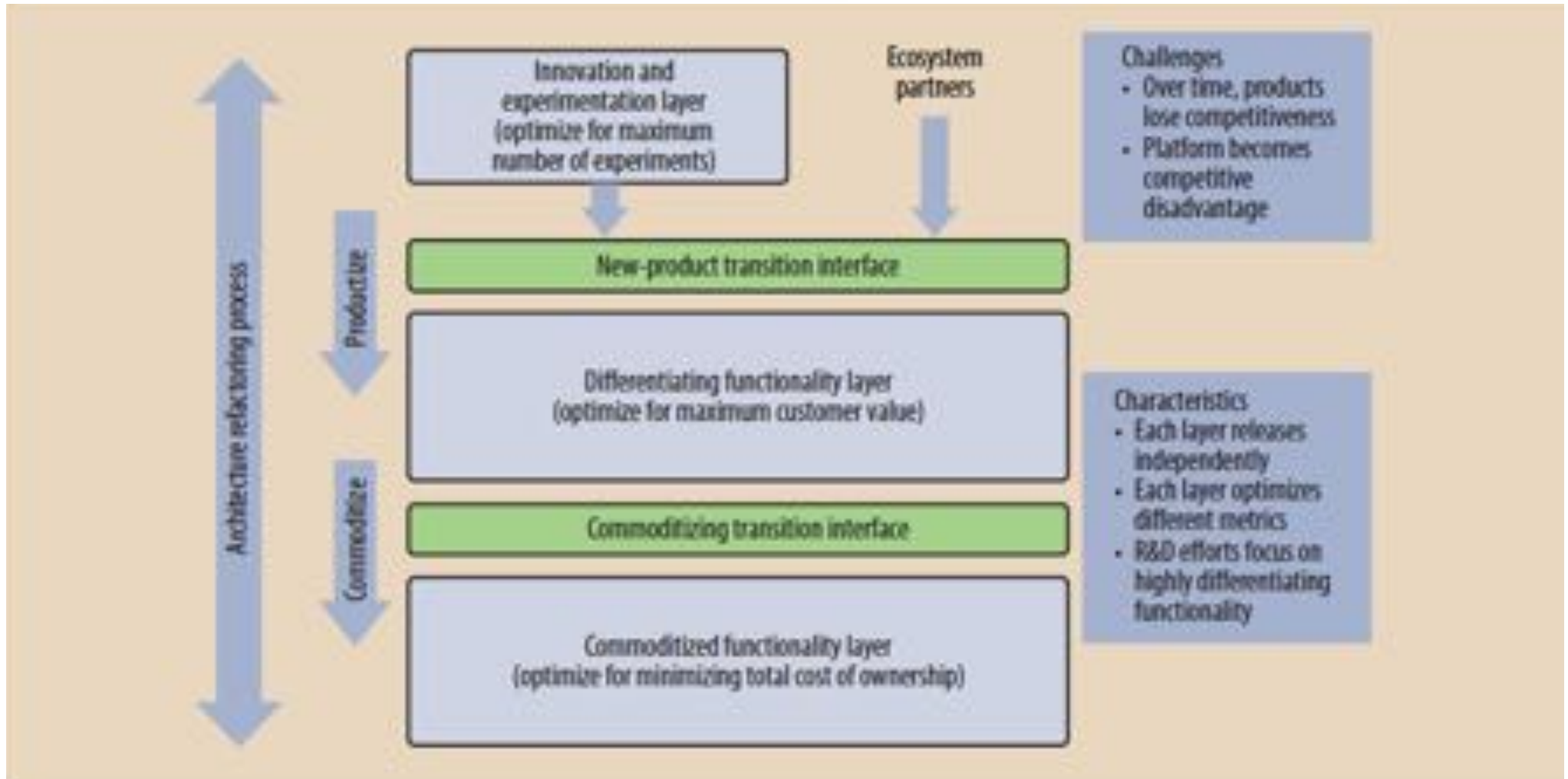


# Stairway to Heaven: Ecosystems



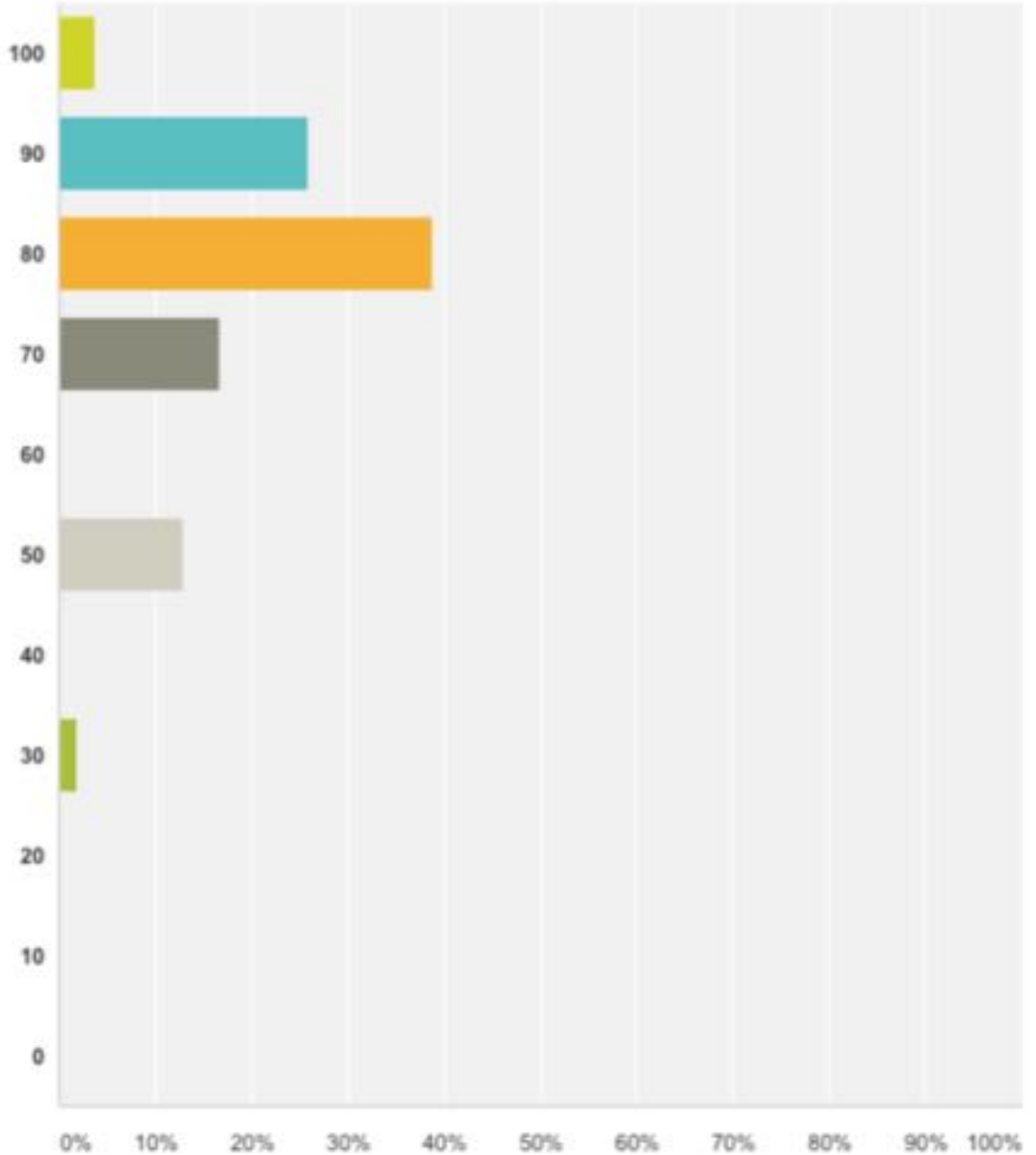
Levels	
Internally focused	do everything in-house unless it is really impossible
Ad-hoc ecosystem engagement	individuals take ad-hoc decisions to engage with ecosystem partners, but local optimization
Tactical ecosystem engagement	ecosystem engagement is centralized, but driven by tactical (rather than strategic) considerations
Strategic single ecosystem management	one of the ecosystem types is managed strategically
Strategic multi-ecosystem management	all three types (I, D, C) are managed strategically

# 3LPM: Three Layer Product Model



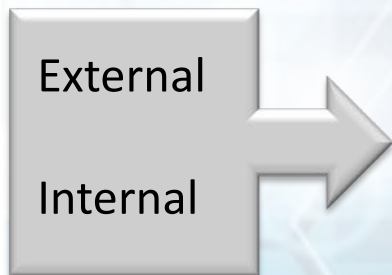
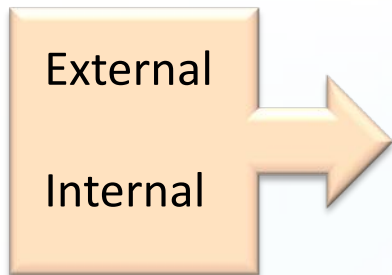
Bosch, J. (2013). Achieving Simplicity with the Three-Layer Product Model, *IEEE Computer*, Vol. 46 (11), pp. 34-39.

# What % of R&D for Commodity?





## Ecosystem Drivers



## Ecosystem Type

### Innovation ecosystem

- **Who:** Customers, 3<sup>rd</sup> 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.

## Ecosystem Characteristics

- 
- Collaborative
  - Internal/external
  - Exploratory
  - Risk prone
  - Less control-driven

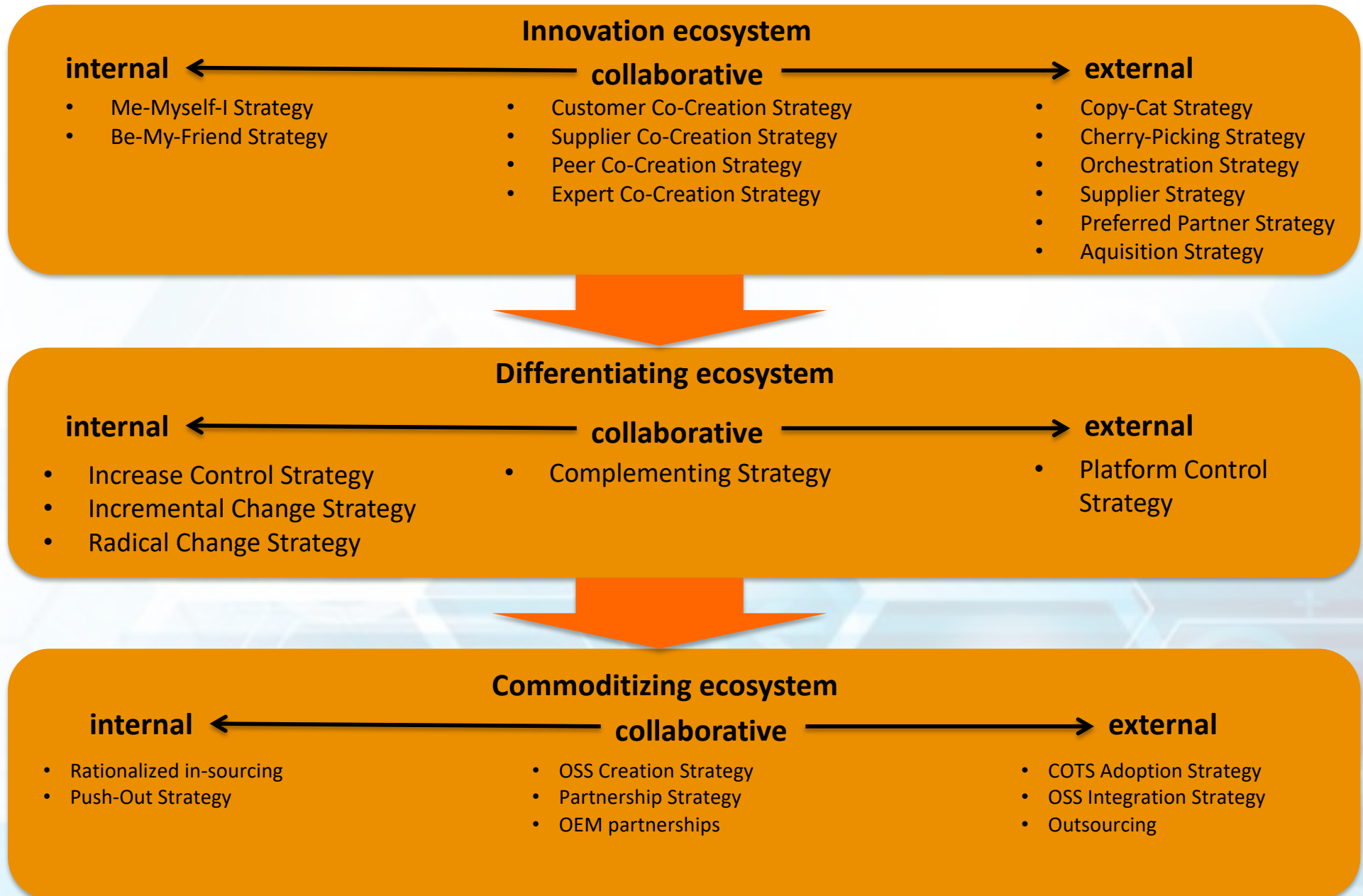
Functionality transfer

- 
- Competitive
  - Internal
  - Efficient
  - Risk averse
  - Control-driven

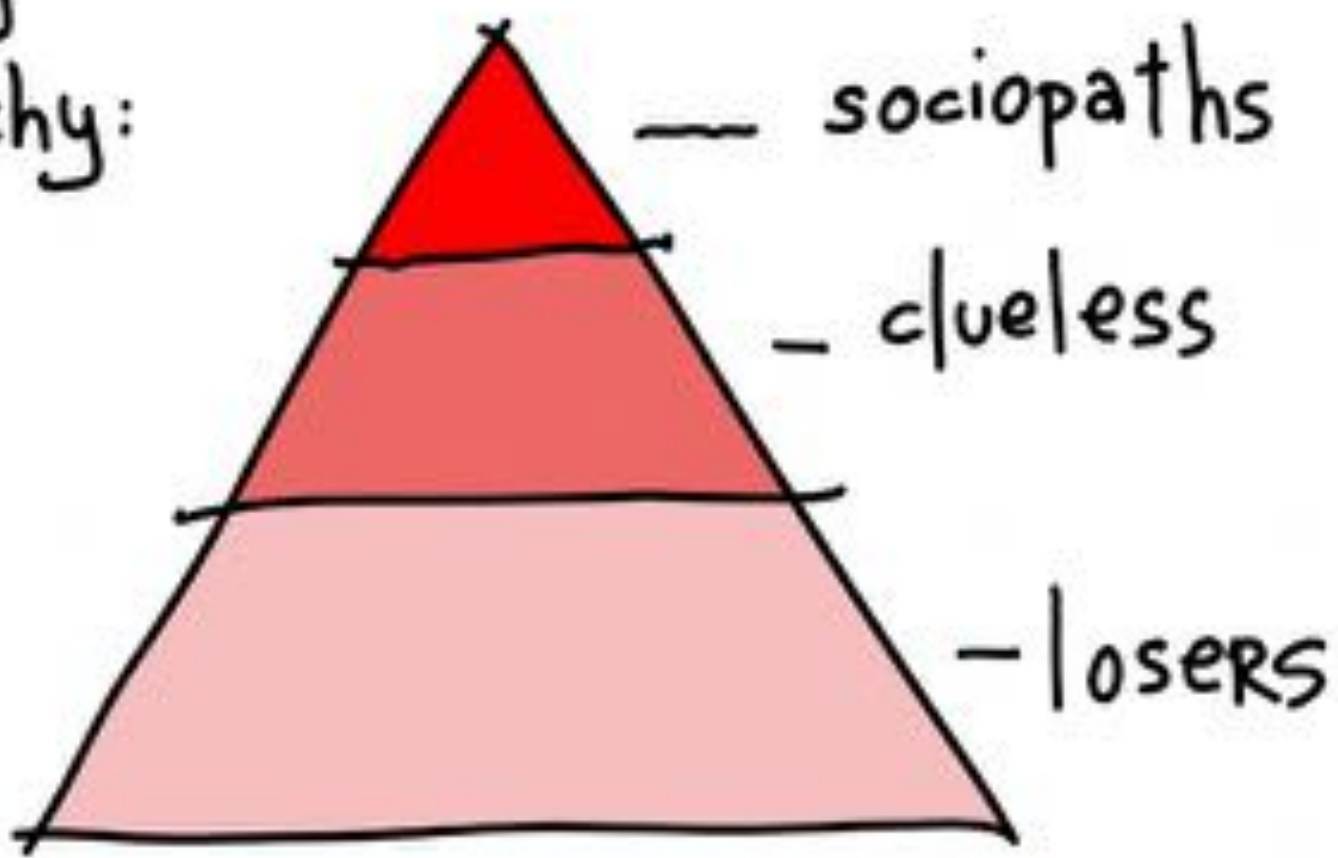
Functionality transfer

- 
- Collaborative
  - Internal/external
  - Cost-efficient
  - Risk averse
  - Less control-driven

# TeLESM: Three Layer Ecosystem Strategy Model

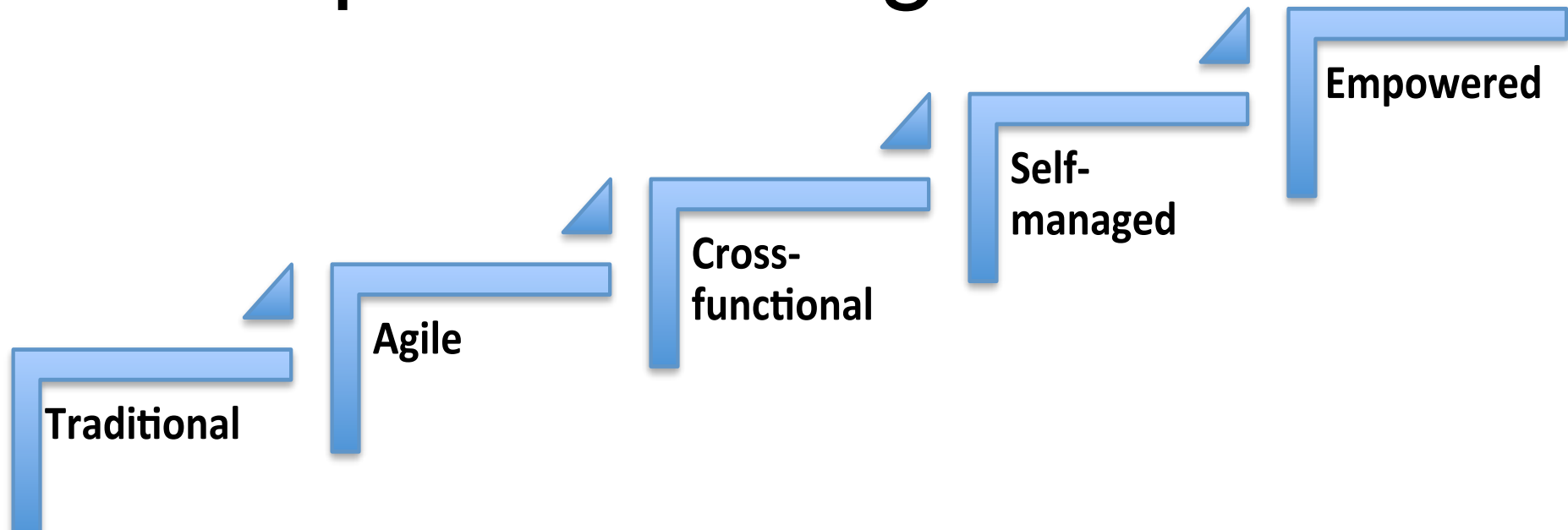


company  
hierarchy:



@gapingvoid

# Empowered Organizations



	Traditional	Agile	Cross-functional	Self-managed	Empowered
Culture	Hierarchical	Hierarchical	Hierarchical	Hierarchical	Empowered
General Mgmt.	Hierarchical	Hierarchical	Hierarchical	Empowered	Empowered
Inter-team (PdM/R&D)	Hierarchical	Hierarchical	Empowered	Empowered	Empowered
Local (R&D)	Hierarchical	Empowered	Empowered	Empowered	Empowered



# Hierarchical Organizations

## Strengths

- Effective scaling
- Controlling many people from a central position
- Very efficient for repeatable tasks
- Harmonization of processes
- Globalization
- Handles low complexity situations well

## Weaknesses

- Slow decision making processes
- Power driven by position; not capability
- Tendency to be internally focused
- Easily gravitates to politics
- Highly resistant to changes
- Challenged by high-complexity situations

# Employee Engagement

## *U.S. Employee Engagement, 2013 vs. 2014*

<b>% Employees</b>	<b>2013</b>	<b>2014</b>
Engaged	29.6	31.5
Not engaged	51.5	51.0
Actively disengaged	18.8	17.5

GALLUP®

## **Sweden (2013)**

Engaged	16%
Not engaged	73%
Actively disengaged	11%

## *U.S. Employee Engagement, by Generation*

% Employees engaged

	<b>2013</b>	<b>2014</b>
Millennials	27.5	28.9
Generation X	29.6	32.2
Baby boomers	30.9	32.7
Traditionalists	38.3	42.2

GALLUP®

**Gallup uppskattar att** oengagerade medarbetare kostar USA varje minst 450 miljarder dollar varje år. Tyskland går miste om minst 151 miljarder och Storbritannien 83 miljarder.

# Empowerment: Principles

- **Self management**
  - Nobody is in command.
  - Coordination mechanisms, but no boss
  - Natural leadership leads to spontaneous, temporary hierarchies
- **Wholeness**
  - No acting to suit your boss/fit the culture
  - Be yourself at work
- **Evolutionary purpose**
  - No top-down strategy
  - Wisdom of the crowds

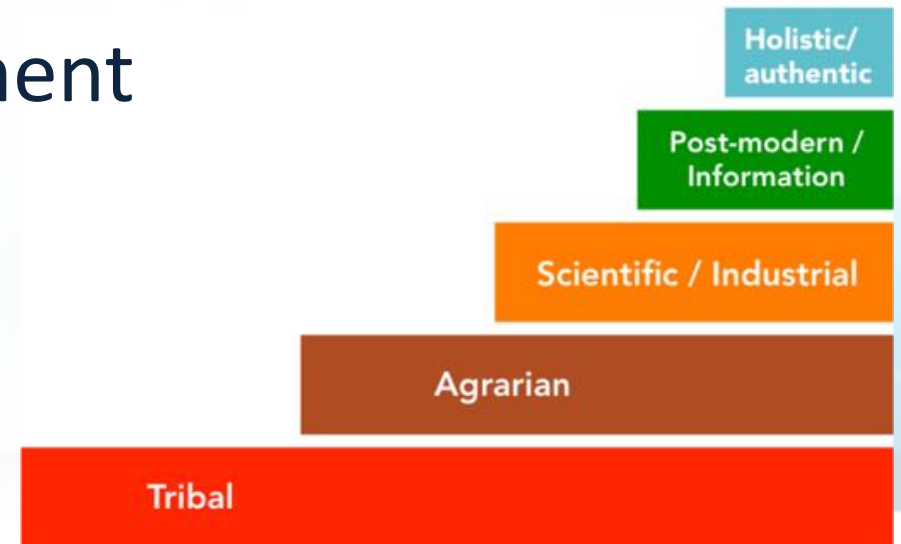
# Characteristics

- **Roles:** people can shoulder one or more roles, independent on place in the organization
- **Activities:** coordinate the work of one or more roles
- **Advice process:** everyone has complete autonomy to make decisions pertain to their role or roles. Stakeholders need to be asked for advice though. *Note: this is NOT consensus!*
- **Agreements:** People can negotiate agreements to coordinate work, agree on SLAs and other relevant factors. Agreements are entered voluntarily.
- **Evolution:** Roles, activities and agreements evolve constantly in mutual agreement

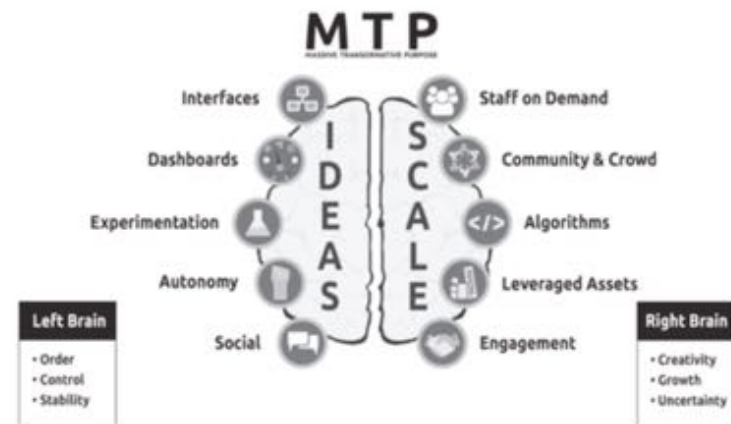


# Examples

- Agile software development
- Holistic organizations
- Holacracy
- Exponential organizations



## Exponential Organizations




# Empowerment

- **Principles** over *Orders*
- **Personal leadership** over *Leader – Follower*
- **Trust** over *Audits*
- **Customer first** over *Organization structure first*
- **Team appointed managers** over *Manager appointed teams*
- **Diversity** over *Homogeneity*
- **Agility** over *Long-term planning*
- **Emergent strategy** over *Top-down strategy*

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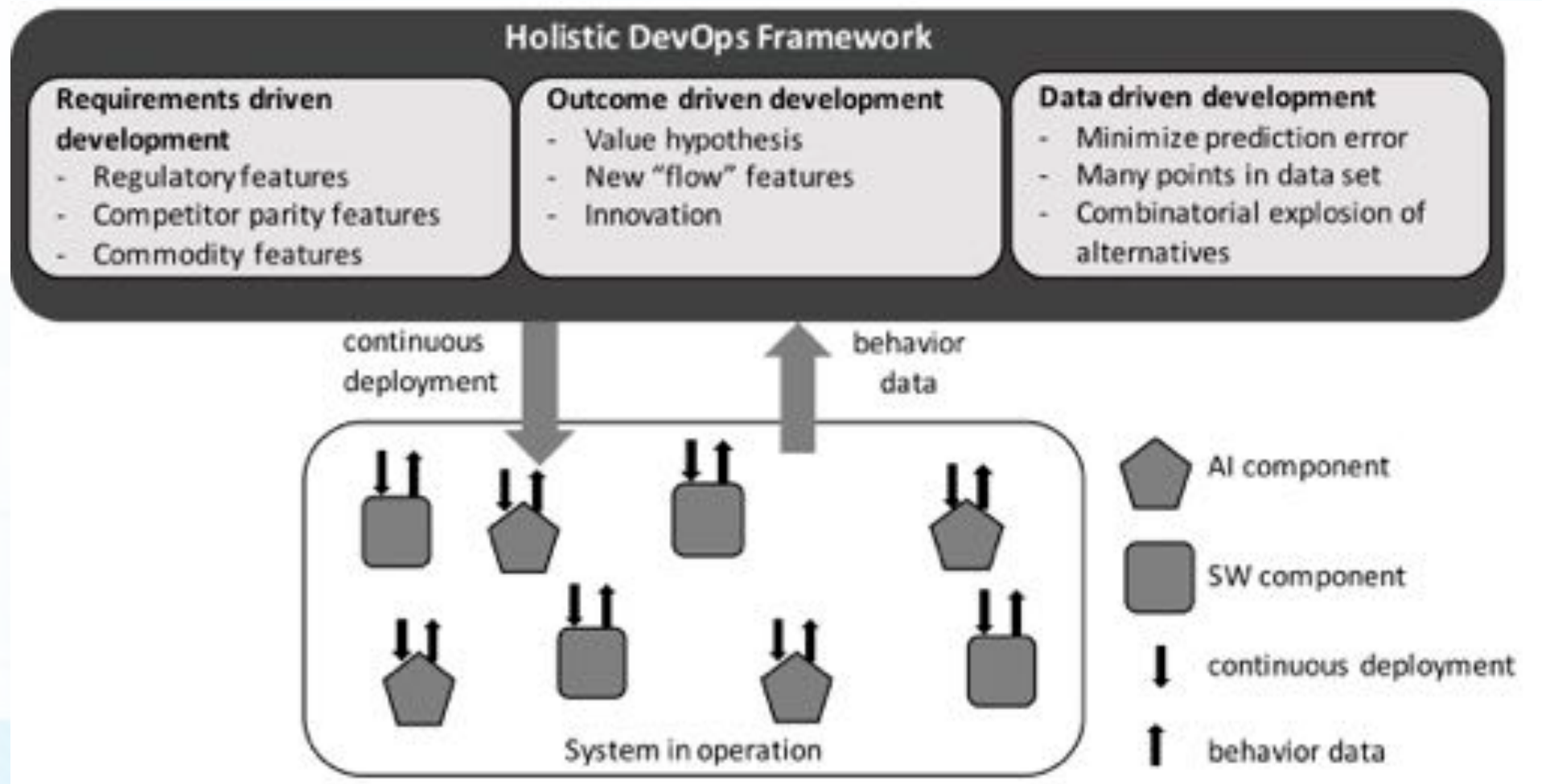
A photograph of George F. Colony, CEO of Forrester Research, speaking at a conference. He is wearing a dark suit, a white shirt, and a blue patterned tie. He has his hand near his chin in a thoughtful pose. The background is a dark blue wall with a repeating pattern of the Forrester Research logo.

**“In the future, all companies  
will be software companies”**

**George F. Colony (CEO Forrester Research)**



# Future Of Software Engineering

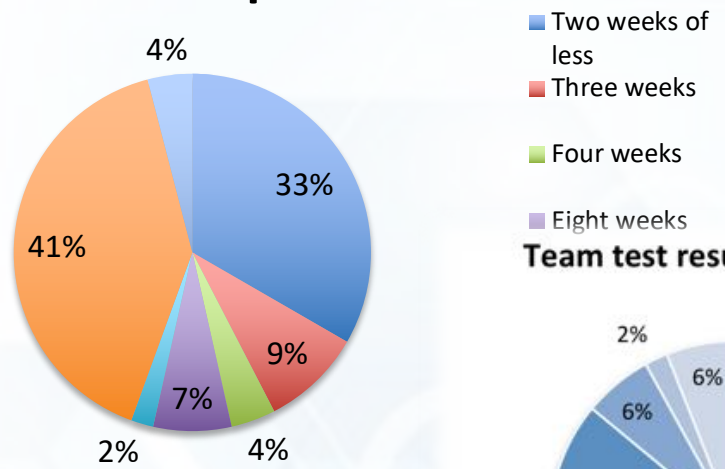


# Conclusion

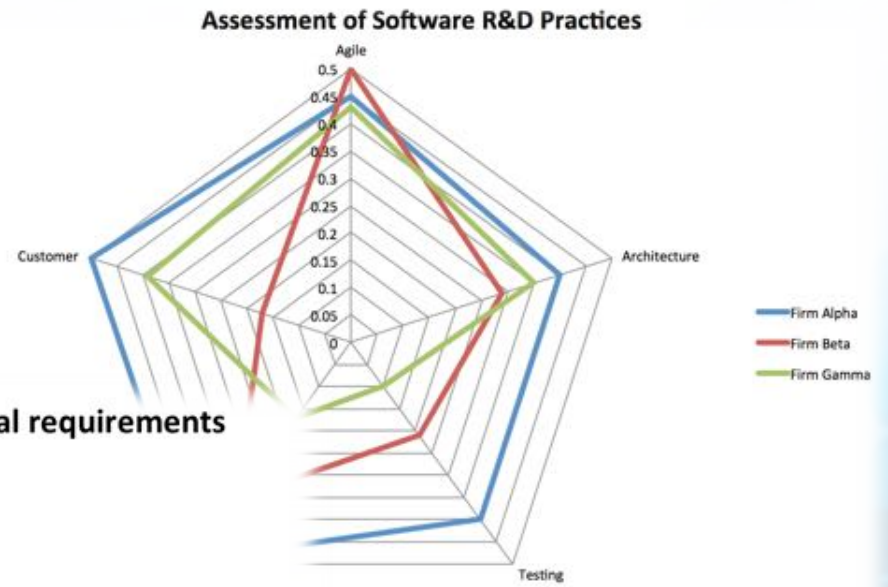
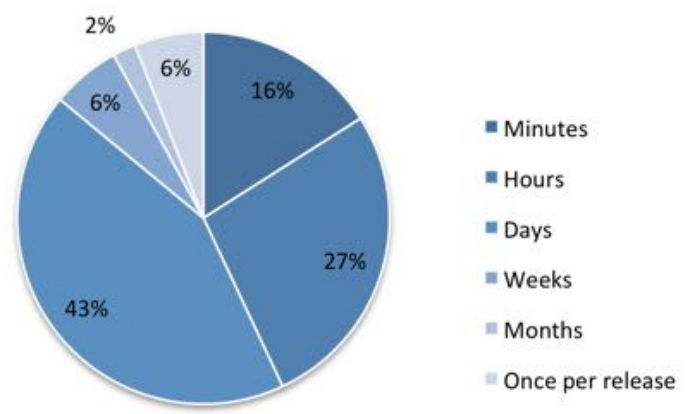
- Companies are increasingly **disrupted** and these days **digitalization** is the root cause
- The pathology of **change resistance** in companies shows several recurring patterns
- To survive, companies need to adopt a ***digital business operating system***

# Want to know how this applies to you?

Development process uses sprints of:



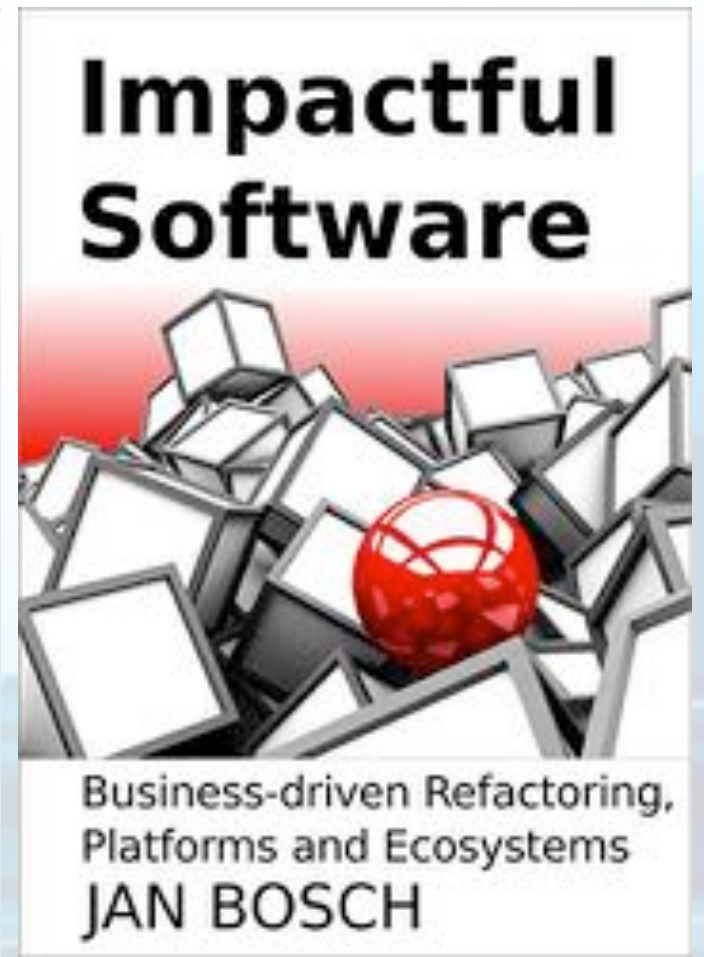
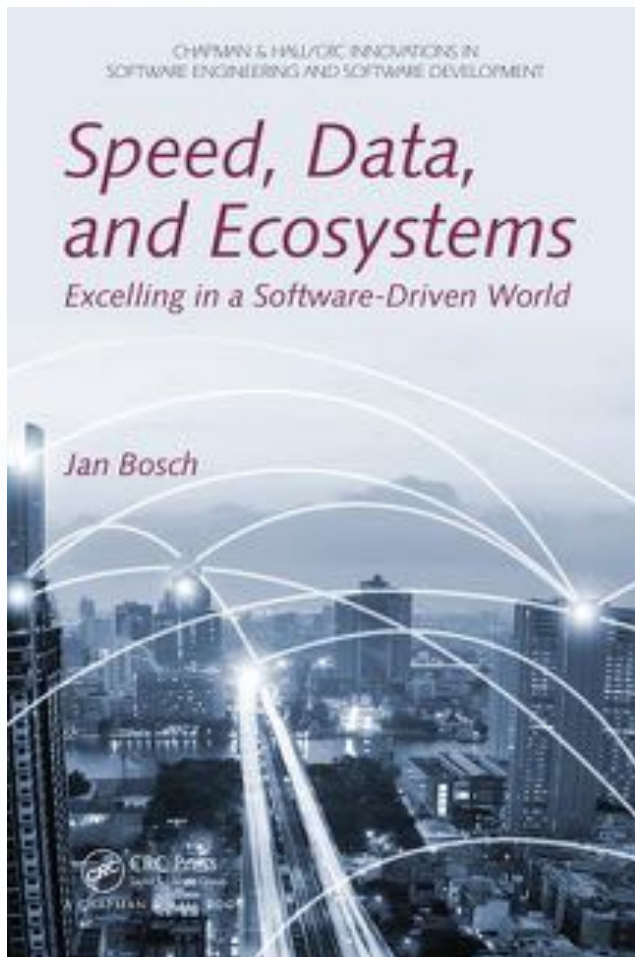
Team test results for functional requirements



**free assessment of your company**



# Learn More?







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of Technology**

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