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

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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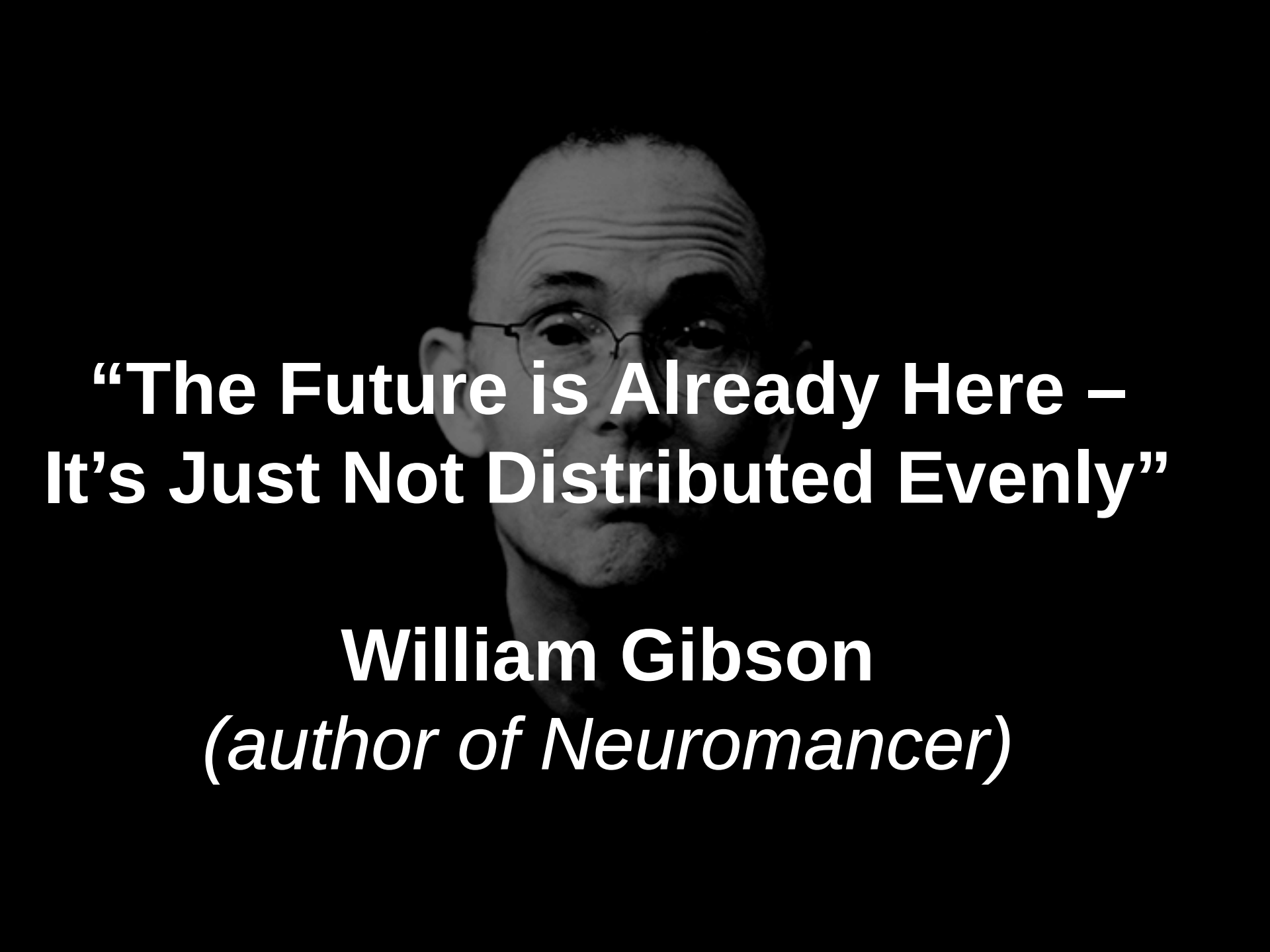
“The Future is Already Here –
It’s Just Not Distributed Evenly”
William Gibson
(author of Neuromancer)

Three Key Take-Aways

- 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

Academic Research

10X Software Center

Software Center

Consultancy

ERICSSON BOSCH SIEMENS BASF
GRUNDFOS SONY JEPPESEN THALES
VARIAN AirTies transmode SEB

Entrepreneur

fidesmo Remente

Industry Innovation

intuit NOKIA

AUQTUS
Automated Quality Testing of User Scenarios

Industry Operations

NOKIA

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Software Changes Everything

Self-D bots

Gripen Drone

Air Pollution
Control of CO_2 emissions of factories, pollution emitted by cars and toxic gases generated in farms.

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

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

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.

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

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.

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

Smart Parking
Monitoring of parking spaces availability in the city.

Golf Courses
Selective irrigation in dry zones to reduce the water resources required in the green.

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

Quality of Shipment Conditions
Monitoring of vibrations, strokes, container openings or cold chain maintenance for insurance purposes.

libelium
www.libelium.com

Nature of Product Innovation is Shifting

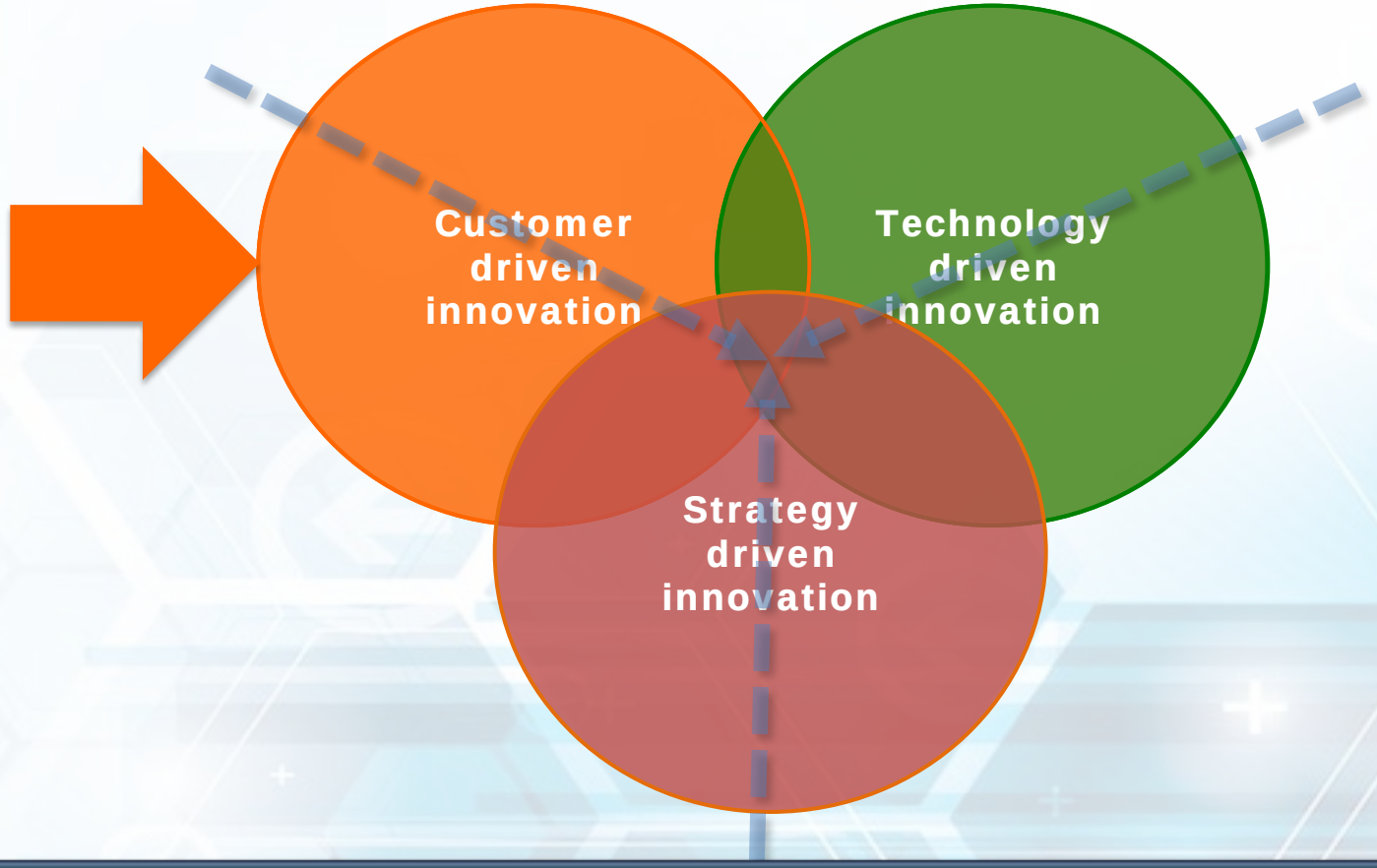
- More than 80% of R&D is related to software according to Ericsson
  - The world's 5th largest software company
- 70% of all innovation is related to software according to AB Volvo
- 80-90% of all innovation in a car is related to electronics (HW & SW) according to Volvo Cars

https://hbr.org/2015/06/does-hardware-even-matter-anymore

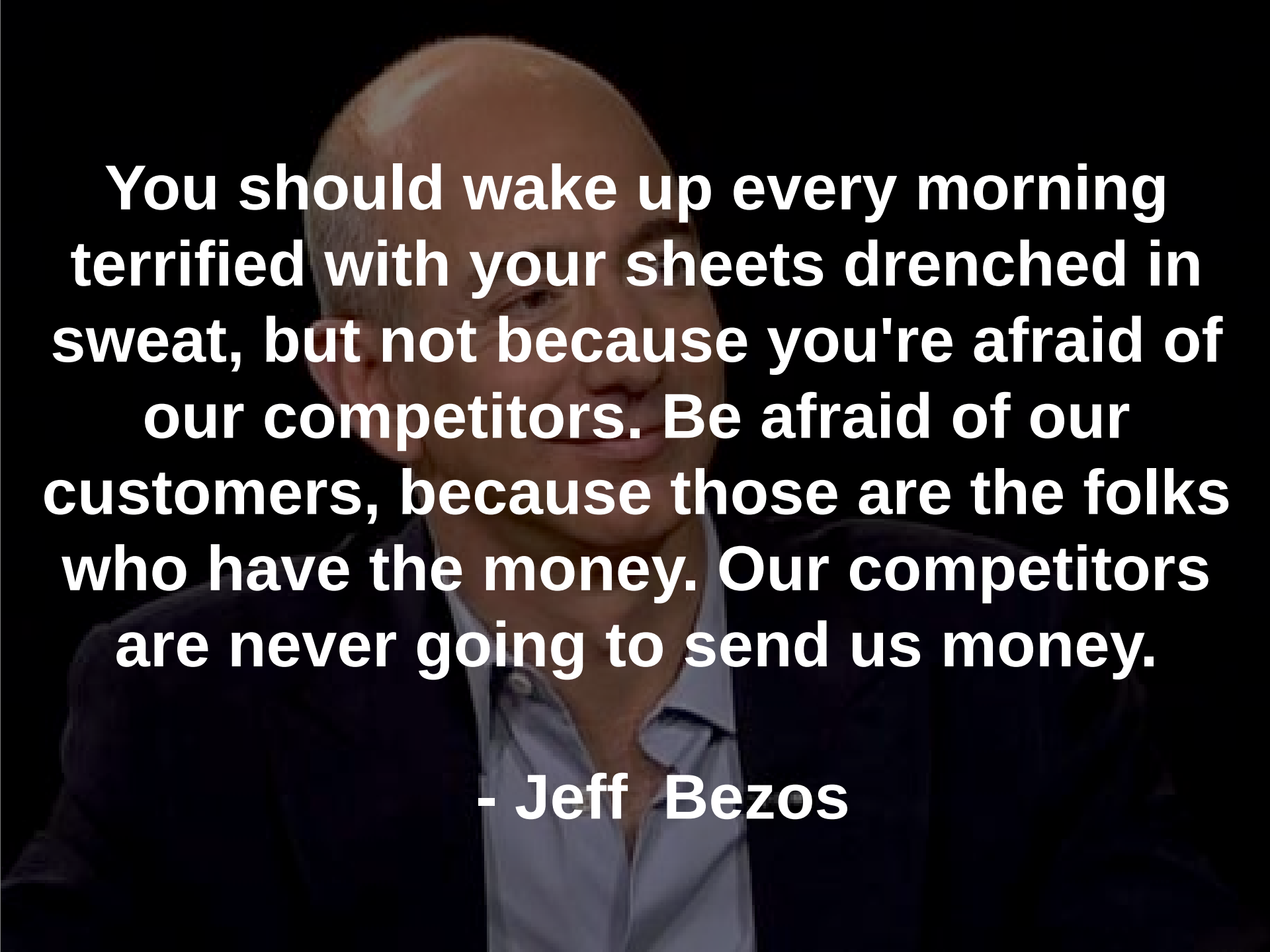
Towards Products As Services

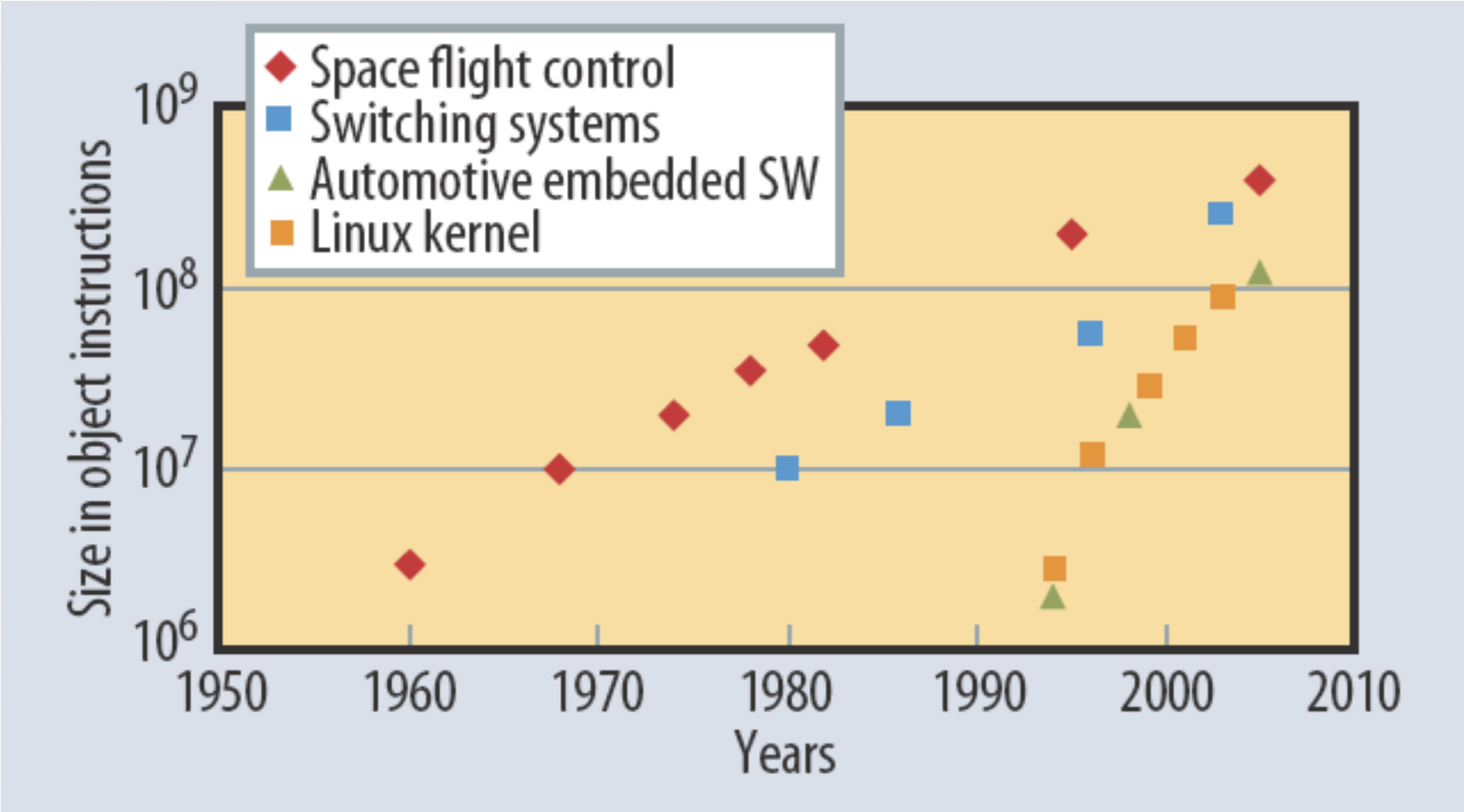
This requires continuous deployment throughout the lifetime of the product

Innovation Approaches



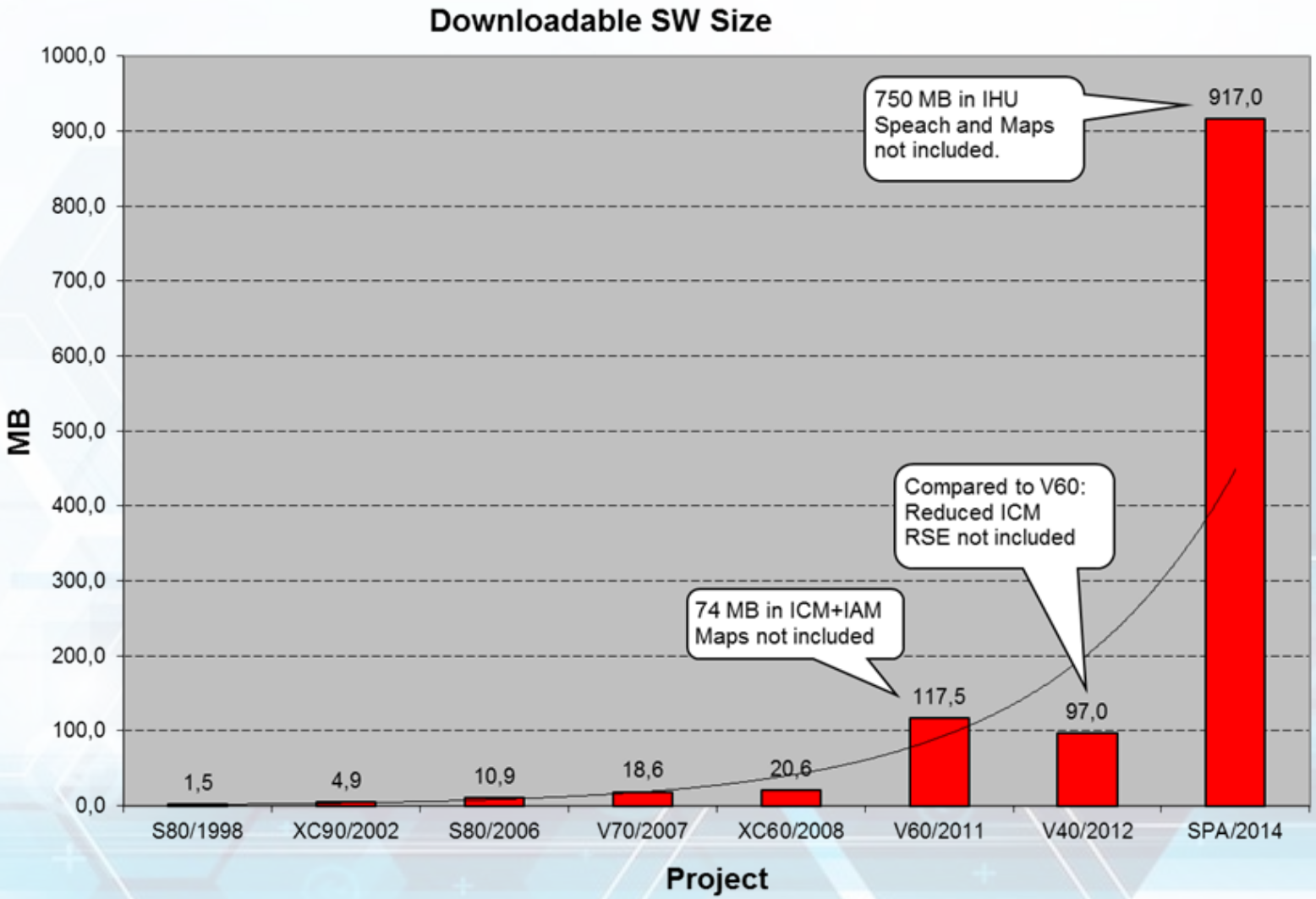
This requires continuous experimentation with customers


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

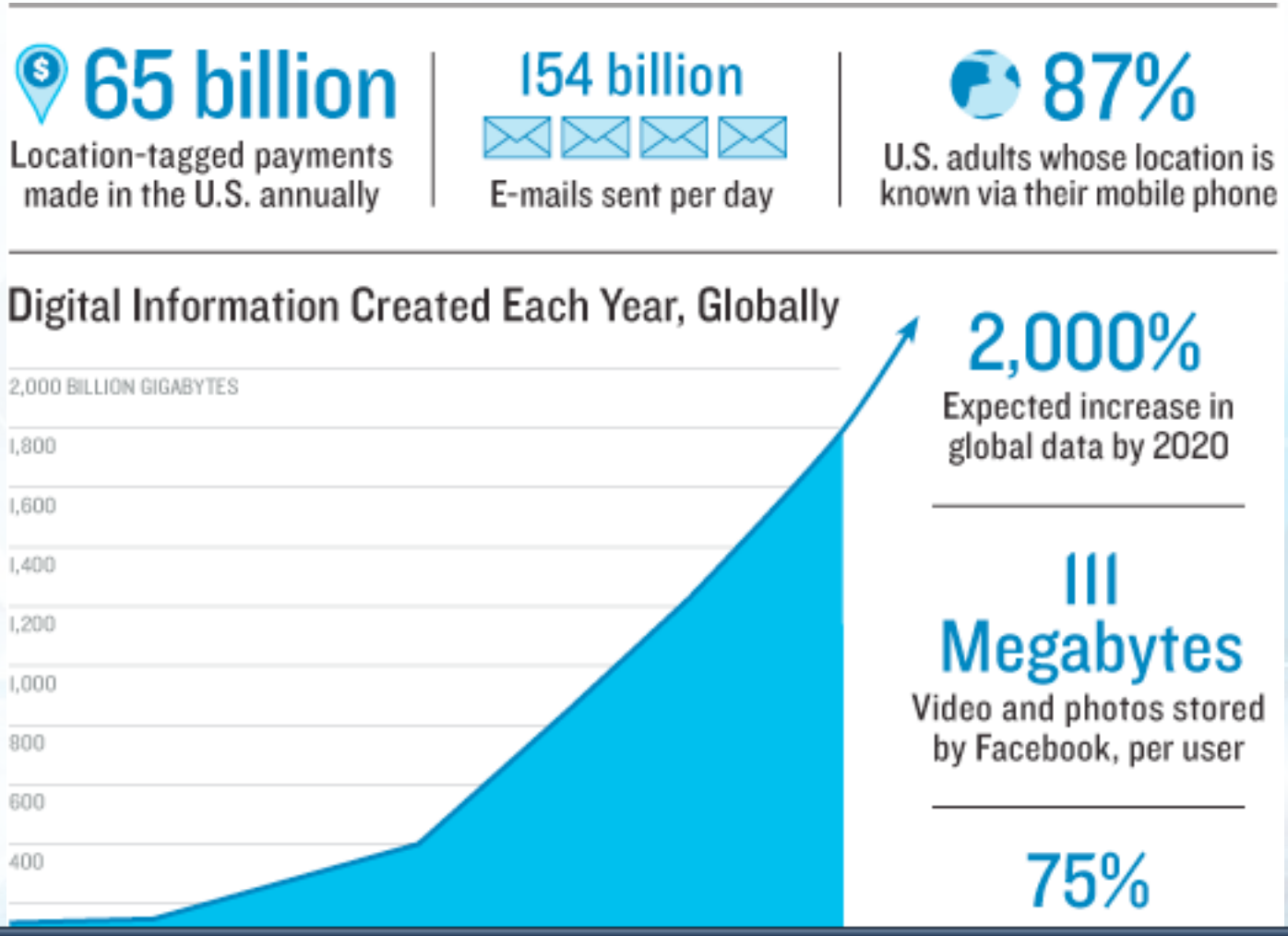


10x every ~7 years

Volvo XC 90


Downloadable SW Size
MB
1000,0
900,0
800,0
700,0
600,0
500,0
400,0
300,0
200,0
100,0
0,0
750 MB in IHU
Speach and Maps
not included.
917,0
Compared to V60:
Reduced ICM
RSE not included
74 MB in ICM+IAM
Maps not included
117,5
97,0
1,5
4,9
10,9
18,6
20,6
S80/1998
XC90/2002
S80/2006
V70/2007
XC60/2008
V60/2011
V40/2012
SPA/2014
Project

Data Generated in the World



50 Terabytes of data are created every second

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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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 …

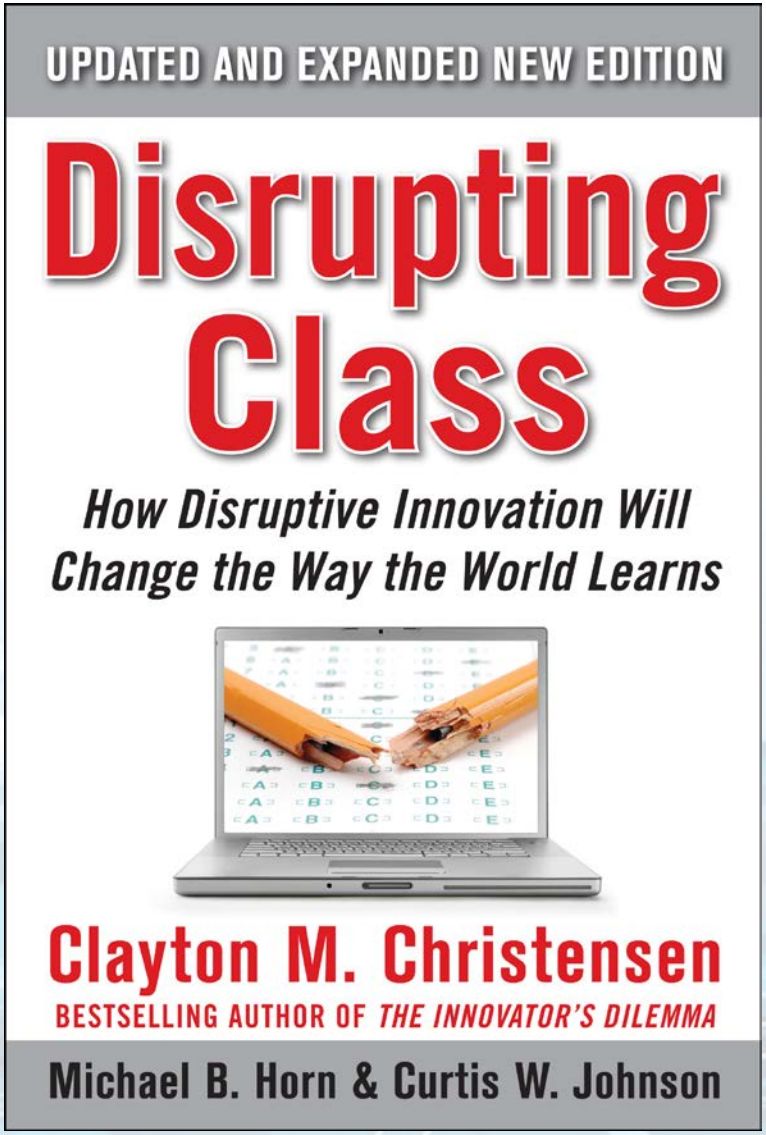
When a subject becomes totally obsolete, we make it a required course

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



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”

Industry

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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

Success: Industrial impact

SIEMENS

verisure
ALARMS WITH IQ

AXIS COMMUNICATIONS

CHALMERS

MALMÖ UNIVERSITY

JEPPESEN
A BOEING COMPANY

MÄLARDALEN UNIVERSITY
SWEDEN

ERICSSON

GRUNDFOS

Some Online Companies

Klarna
Simplifying Buying

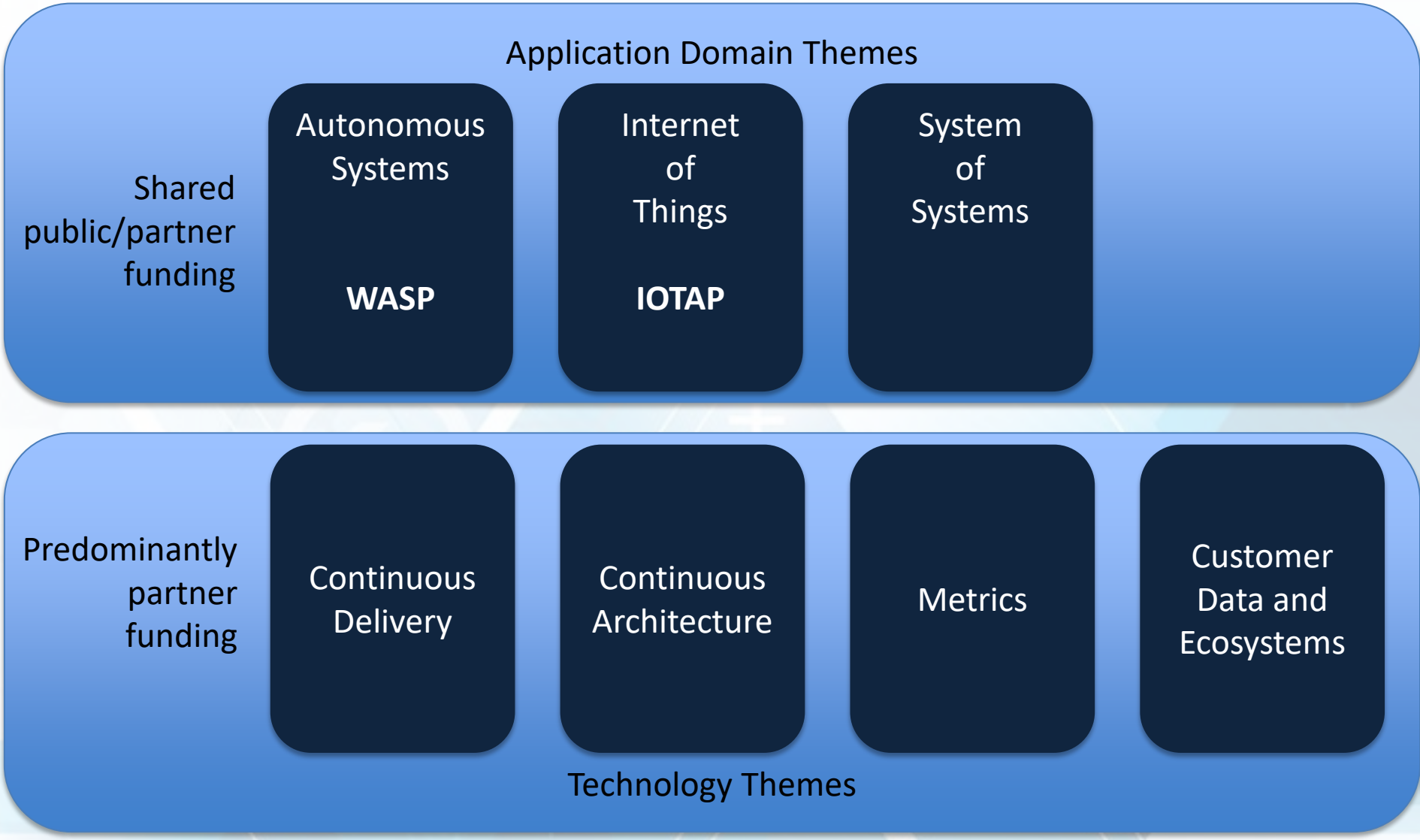
bing

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

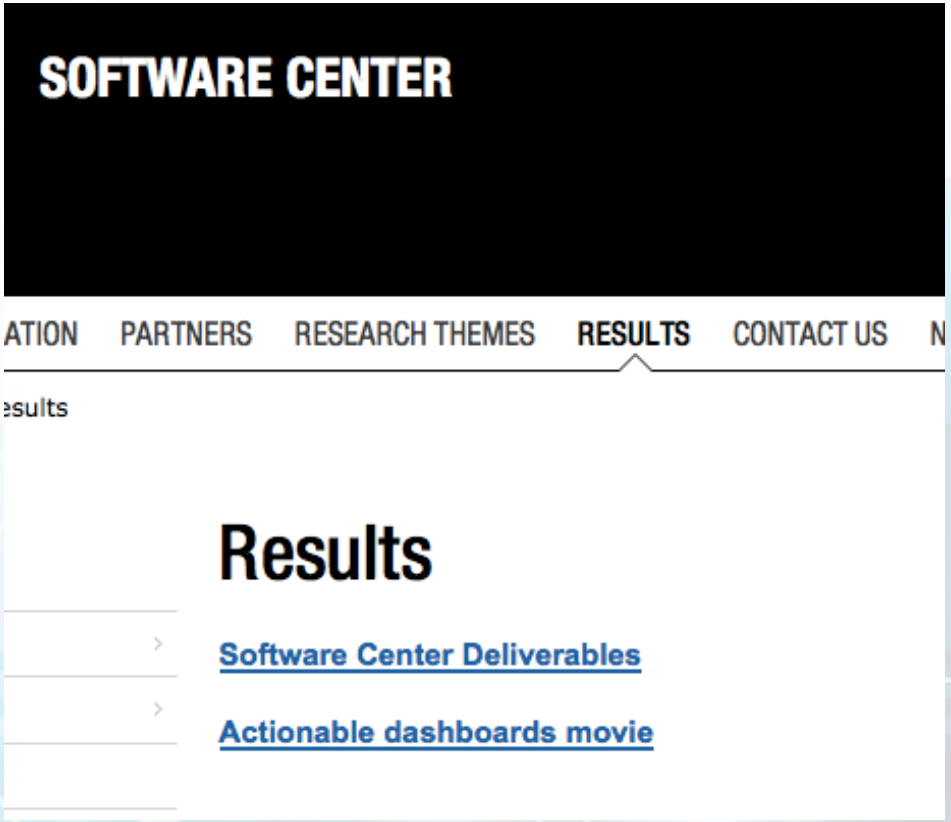
- Research is performed in 6-month sprints
- Long term goal; short term value
- System-level, holistic perspective, including business, architecture, ways of working and organizational aspects

Theme Structure



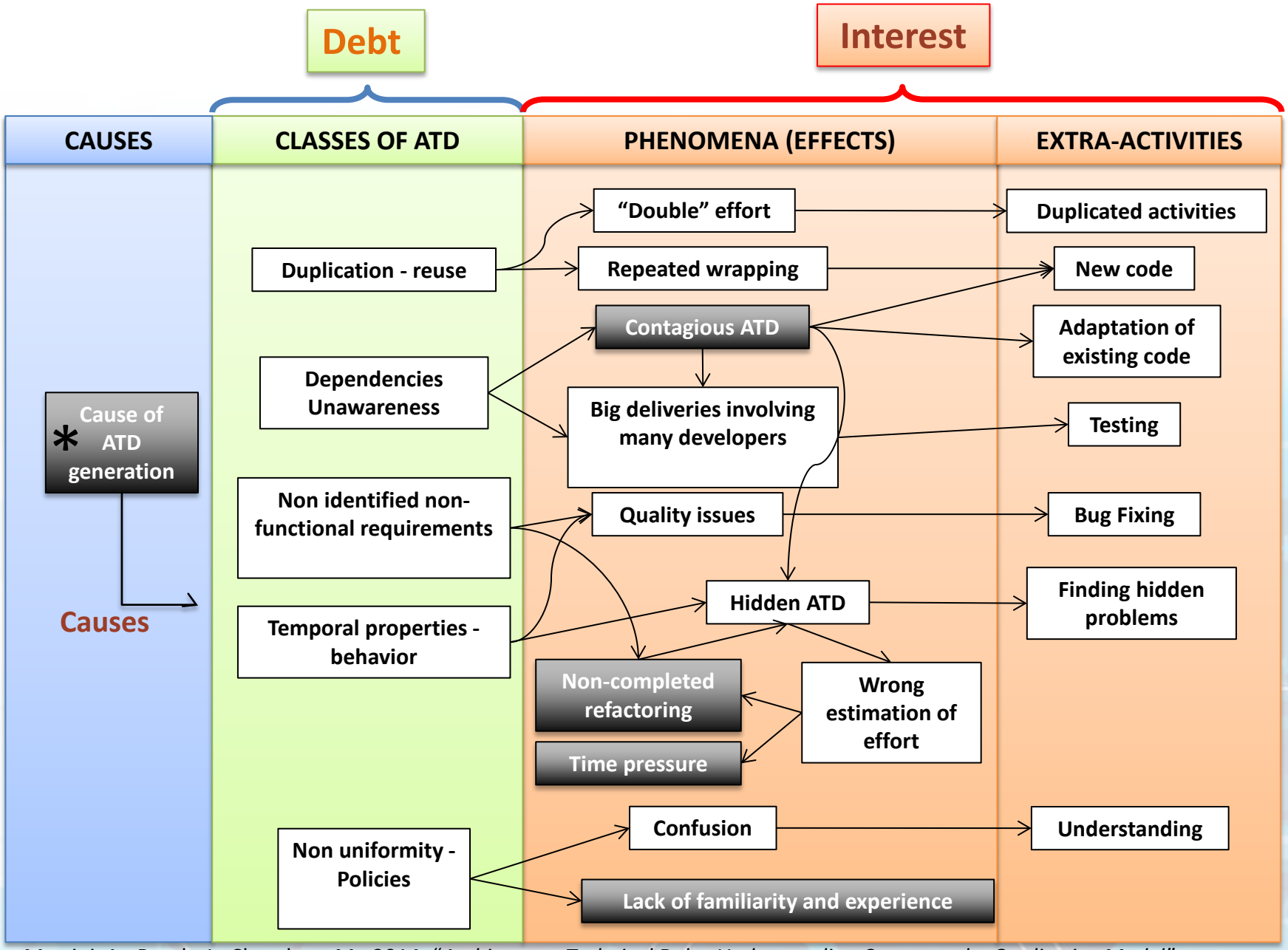
How are we doing?

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



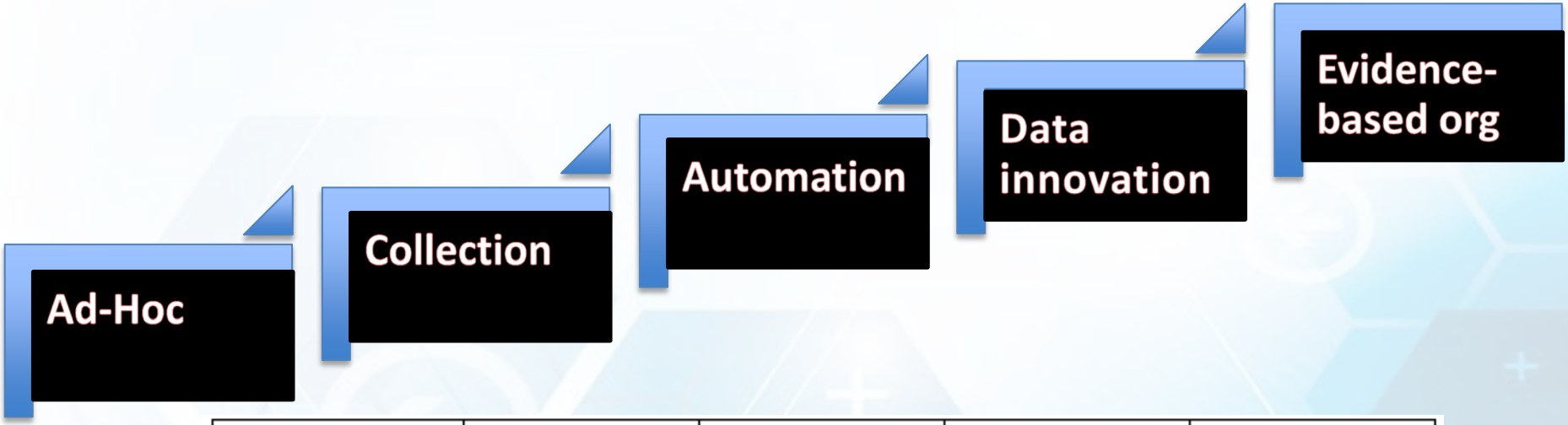
Active use by the Software Center companies!

Stairway to Heaven: Speed



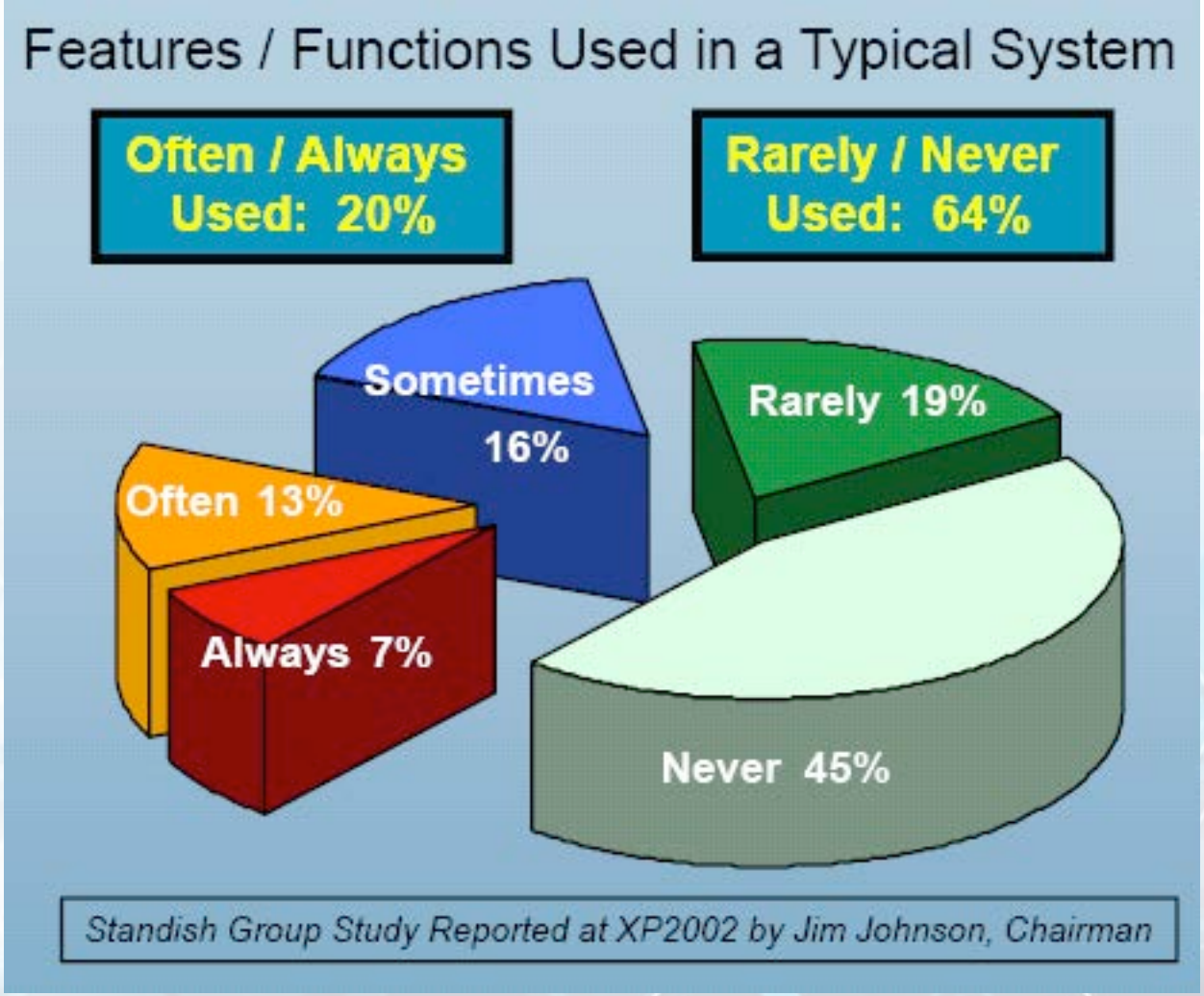
* Martini, A., Bosch, J., Chaudron, M., 2014. "*Architecture Technical Debt: Understanding Causes and a Qualitative Model*", Best Paper Award at 40th Euromicro Conference on Software Engineering and Advanced Applications.

Stairway to Heaven: Data

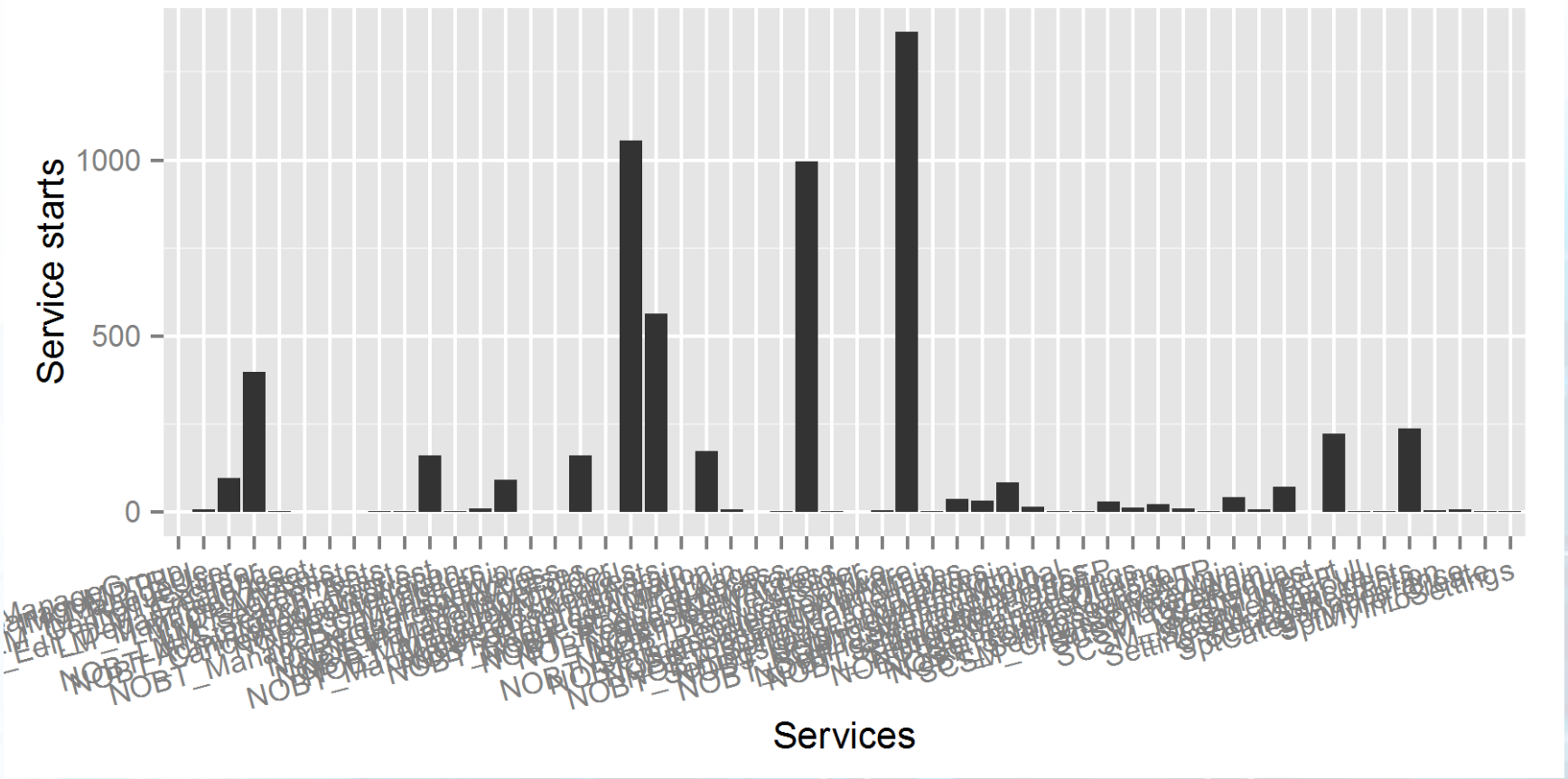


	Collection	Analysis	Reporting	Decision making
Ad-hoc	manual	manual	manual	manual
Collection	automated	manual	manual	manual
Automation	automated	automated	automated	supported
Data innovation	dynamic	dynamic	dynamic	supported
Evidence-based company	dynamic	dynamic	dynamic	automated

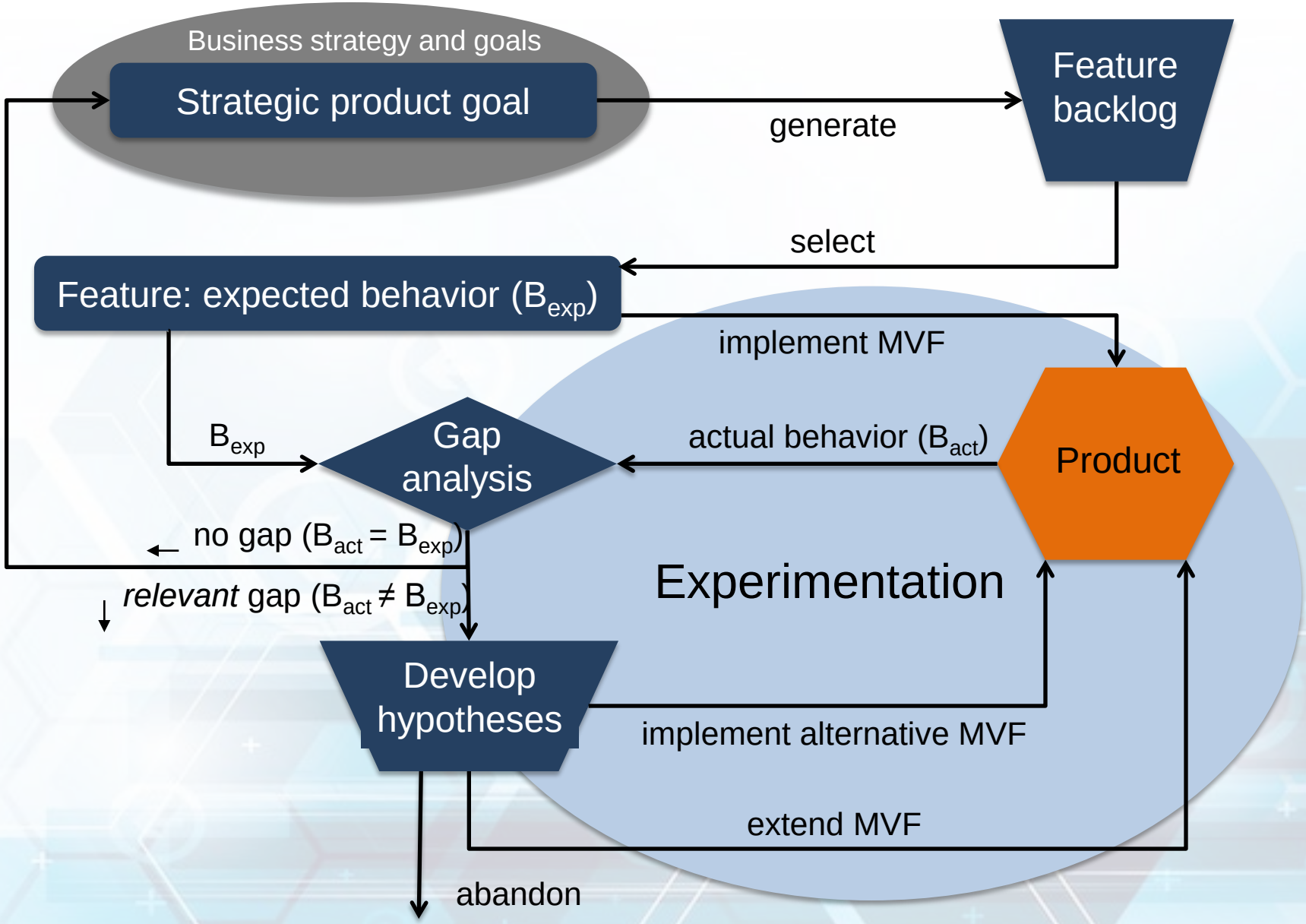
“Featuritis”


Features / Functions Used in a Typical System
Often / Always Used: 20%
Rarely / Never Used: 64%
Sometimes 16%
Rarely 19%
Often 13%
Always 7%
Never 45%
Standish Group Study Reported at XP2002 by Jim Johnson, Chairman

Our Research …



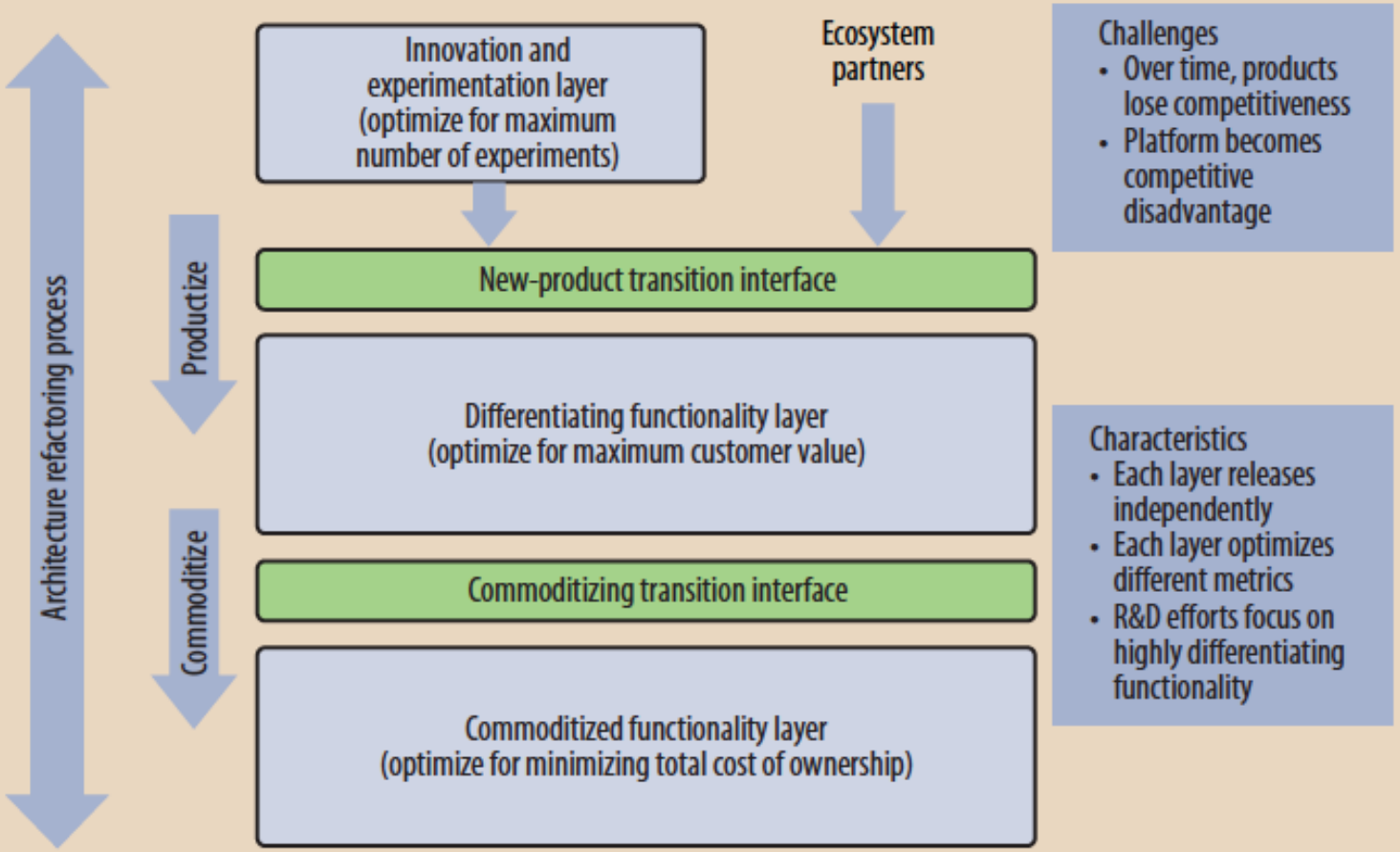
The HYPEX Model



Stairway to Heaven: Ecosystems

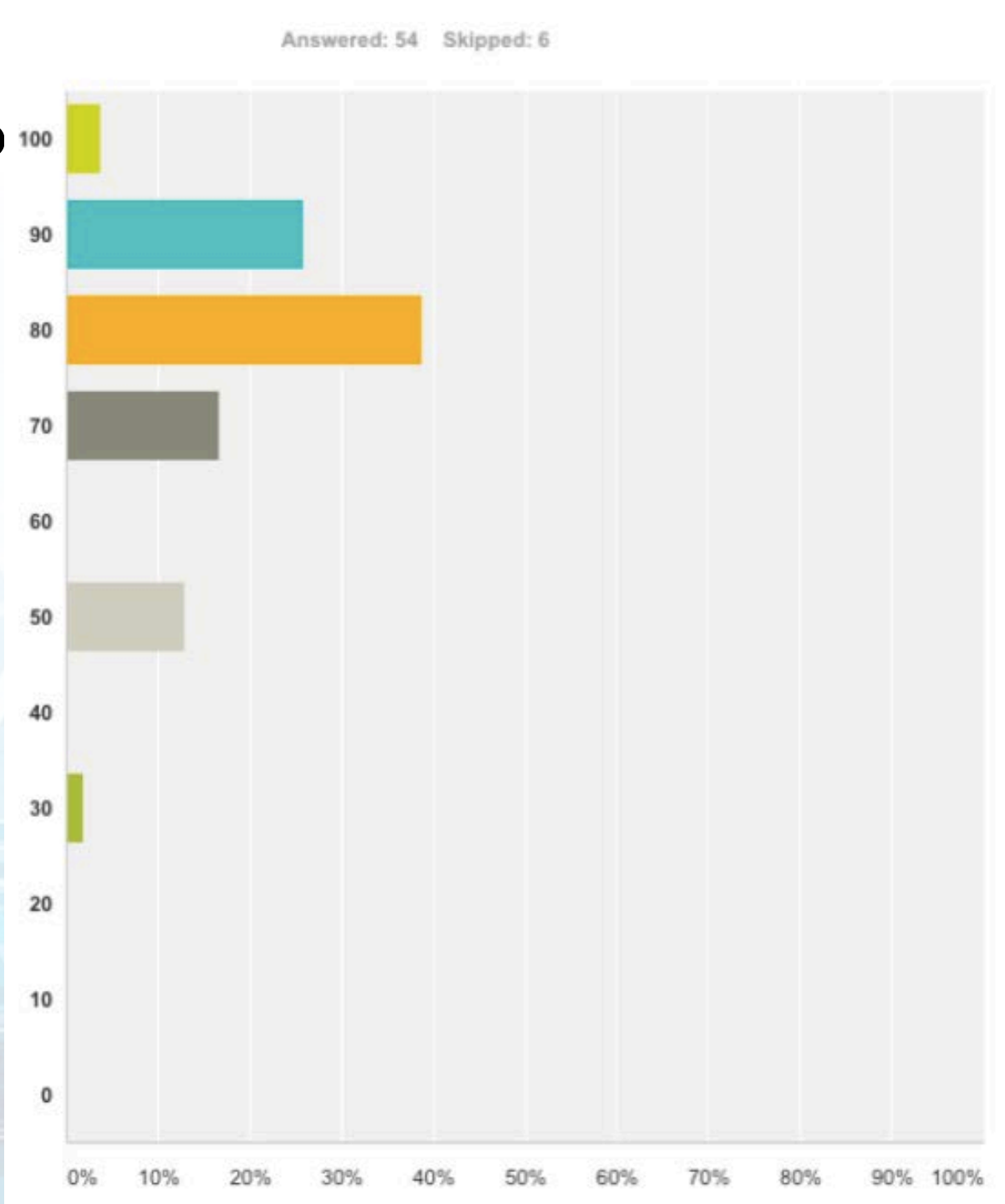
Levels	
Internally focused	do everything in-house unless it is really impossible
Ad-hoc ecosystem engagement	individuals take ad-hoc decisions to engage with ecosystem partners, but local optimization
Tactical ecosystem engagement	ecosystem engagement is centralized, but driven by tactical (rather than 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

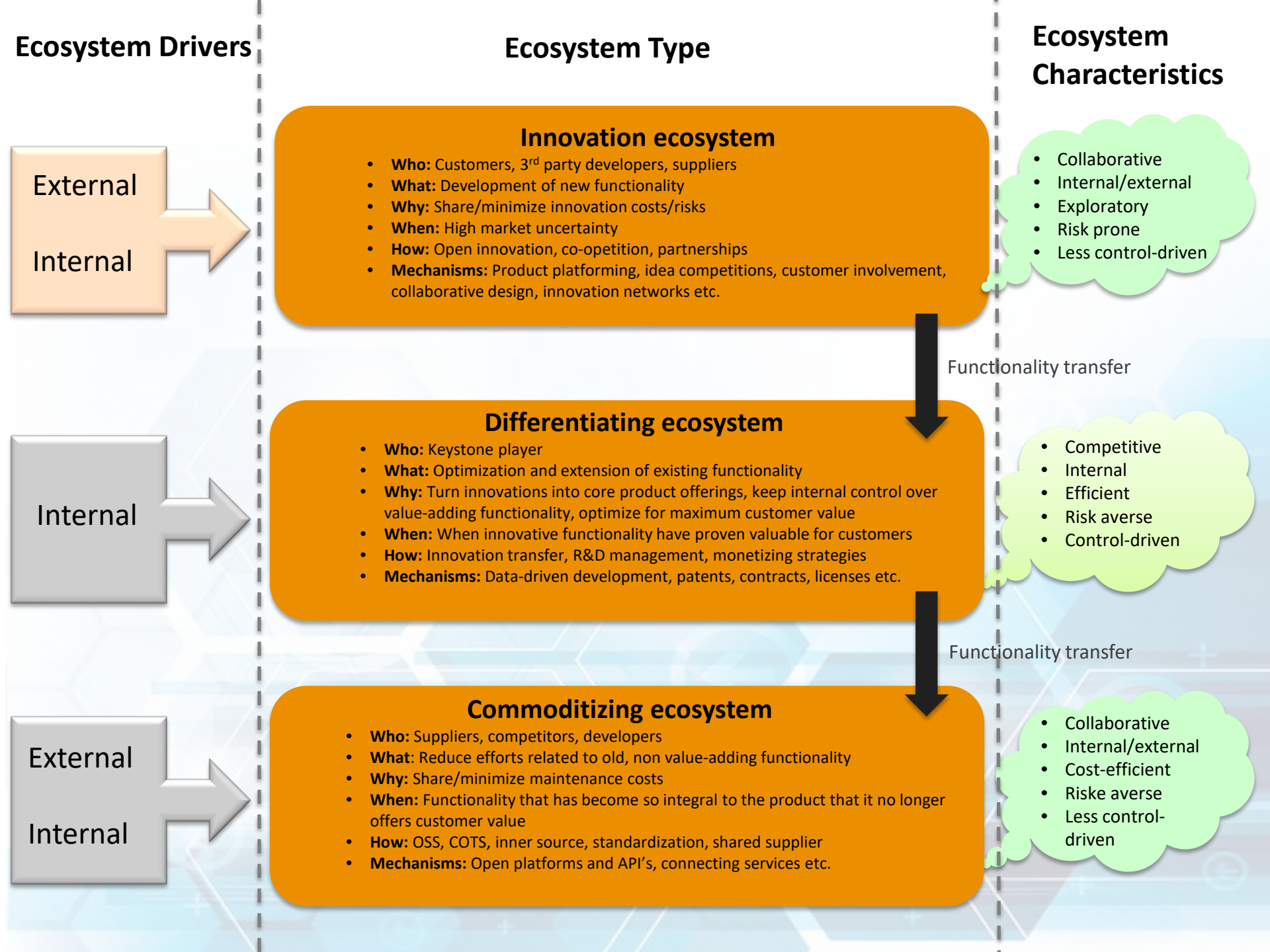
3LPM: Three Layer Product Model



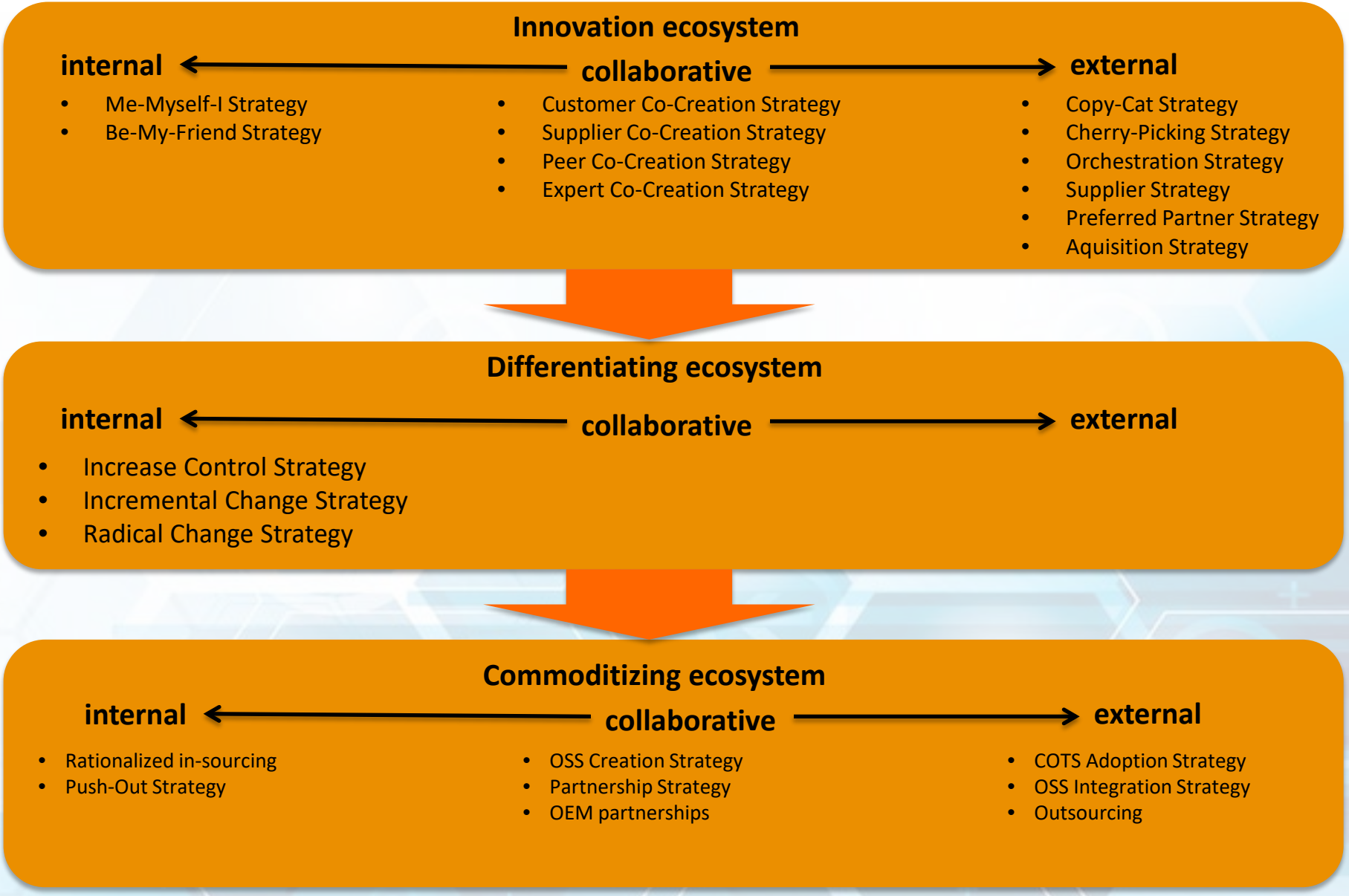
Bosch, J. (2013). Achieving Simplicity with the Three-Layer Product Model, *IEEE Computer*, Vol. 46 (11), pp. 34-39.

What % of R&D for Commodity?




Ecosystem Drivers
Ecosystem Type
Ecosystem Characteristics
External
Internal
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.
Collaborative
Internal/external
Exploratory
Risk prone
Less control-driven
Functionality transfer
Internal
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.
Competitive
Internal
Efficient
Risk averse
Control-driven
Functionality transfer
External
Internal
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.
Collaborative
Internal/external
Cost-efficient
Riske averse
Less control-driven

TeLESM: Three Layer Ecosystem Strategy Model



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