



Software Center



Ecosystems and Systems of Systems

Jan Bosch

Director Software Center
www.software-center.se

Professor of Software Engineering
Chalmers University of Technology
Gothenburg, Sweden.
www.janbosch.com

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



CHALMERS



Malmö UNIVERSITY



MÄLARDALEN UNIVERSITY
SWEDEN



Tetra Pak



SIEMENS



verisure
ALARMS WITH IQ



JEPPESEN.[®]
A BOEING COMPANY

ERICSSON
GRUNDFOS

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



Business Ecosystem

Economic community supported by a foundation of interacting organizations and individuals, which can also be perceived as organisms of the business world (Moore, 1993).

1. Symbiotic relationship
2. Co-evolution
3. Platform: tools, services and technology used in ecosystem to enhance performance

Roles in ecosystems

- **Keystone:** central firm (e.g., Apple)
- **Complementor:** provide product/service complementing ecosystem product/platform and enhances value (e.g., suppliers, developers)
- **Integrator:** brings together parts provided by ecosystem players into an integrated solution for end-user
- **Customer** or end-user

Ecosystem Strategies

Two fundamental strategies

- **Collaborative** – cooperation in communities
e.g., android platform (Google), Wikipedia
- **Competitive** – market driven e.g., Apple app-store, Gore-Tex

COMPETITIVE MARKETS

- External innovators supply variants of mix-and-match, substitutable components.
- Governance is formal with orientation toward arm's-length, rule-based, contractually oriented and market relationships.
- External innovators primarily have competitive relationships among one another.
- Profit motive is central to driving distributed innovation.
- Value capture by the platform owner is possible through direct contracting and licensing with external innovators.

COLLABORATIVE COMMUNITIES

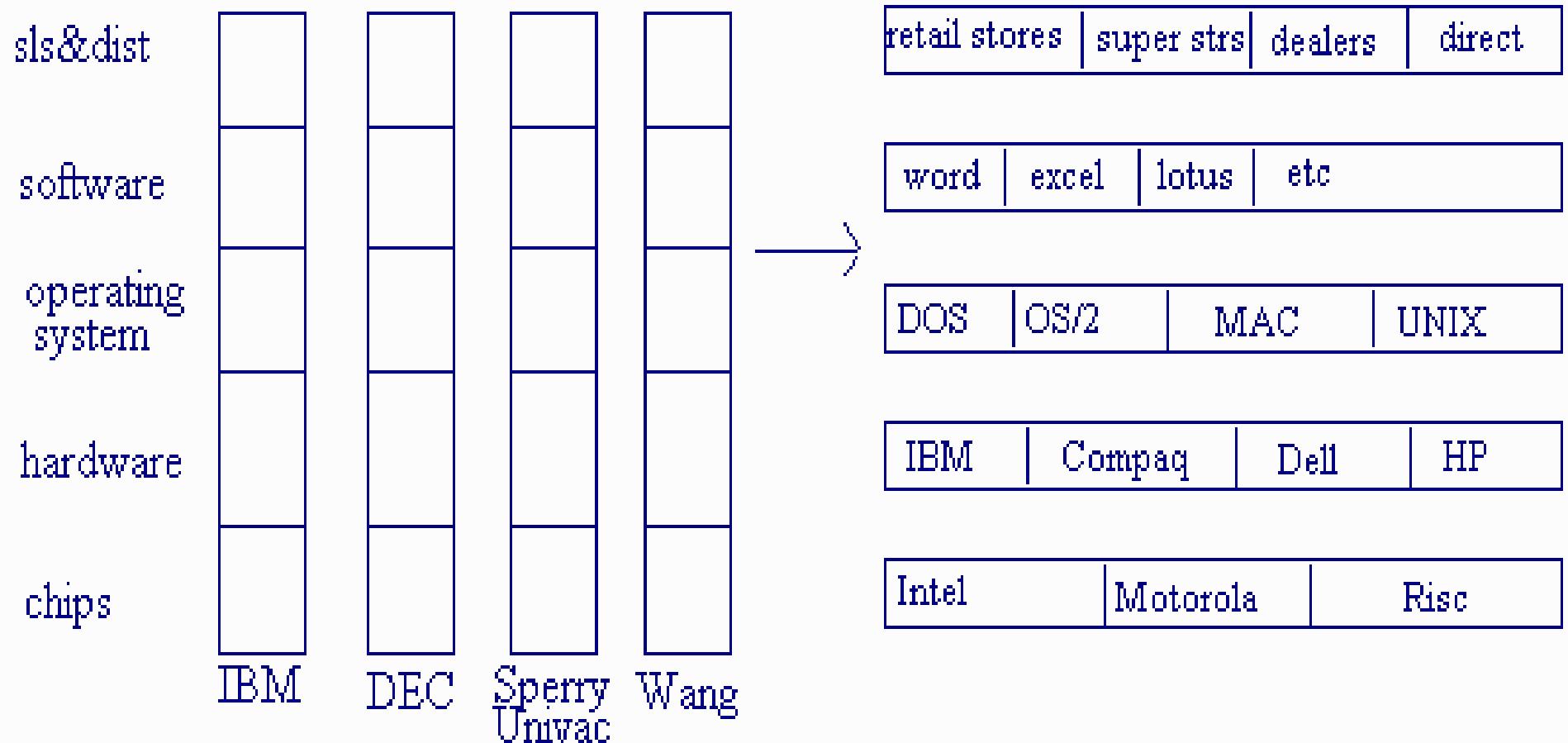
- Possible contributions of external innovators range from mix-and-match offerings to coproduction.
- Governance is informal with orientation toward highly socially embedded, norm-based interactions.
- External innovators primarily have cooperative relationships among one another — with a substantial amount of technology sharing and deliberate spillovers.
- A range of extrinsic and intrinsic motivations may drive external innovators' activities.
- Value capture by the platform owner might occur only through enhanced demand for the platform that is driven by the external innovation.

Innovation Ecosystems

| Strategy | Competitive | Collaborative |
|------------------------------|---|---|
| Internally driven innovation | Pure internal R&D based on insights from ecosystem | Develop internally proven innovation, then collaboration with ecosystem partners for scaling and testing at customers of partners |
| Externally driven innovation | APIs, certification process, shared revenue, competition between developers | Externally proven innovations invited and selected. Deep collaboration for scaling proven innovations with firm's customers |

Source: Bosch-Sijtsema & Bosch, 2014

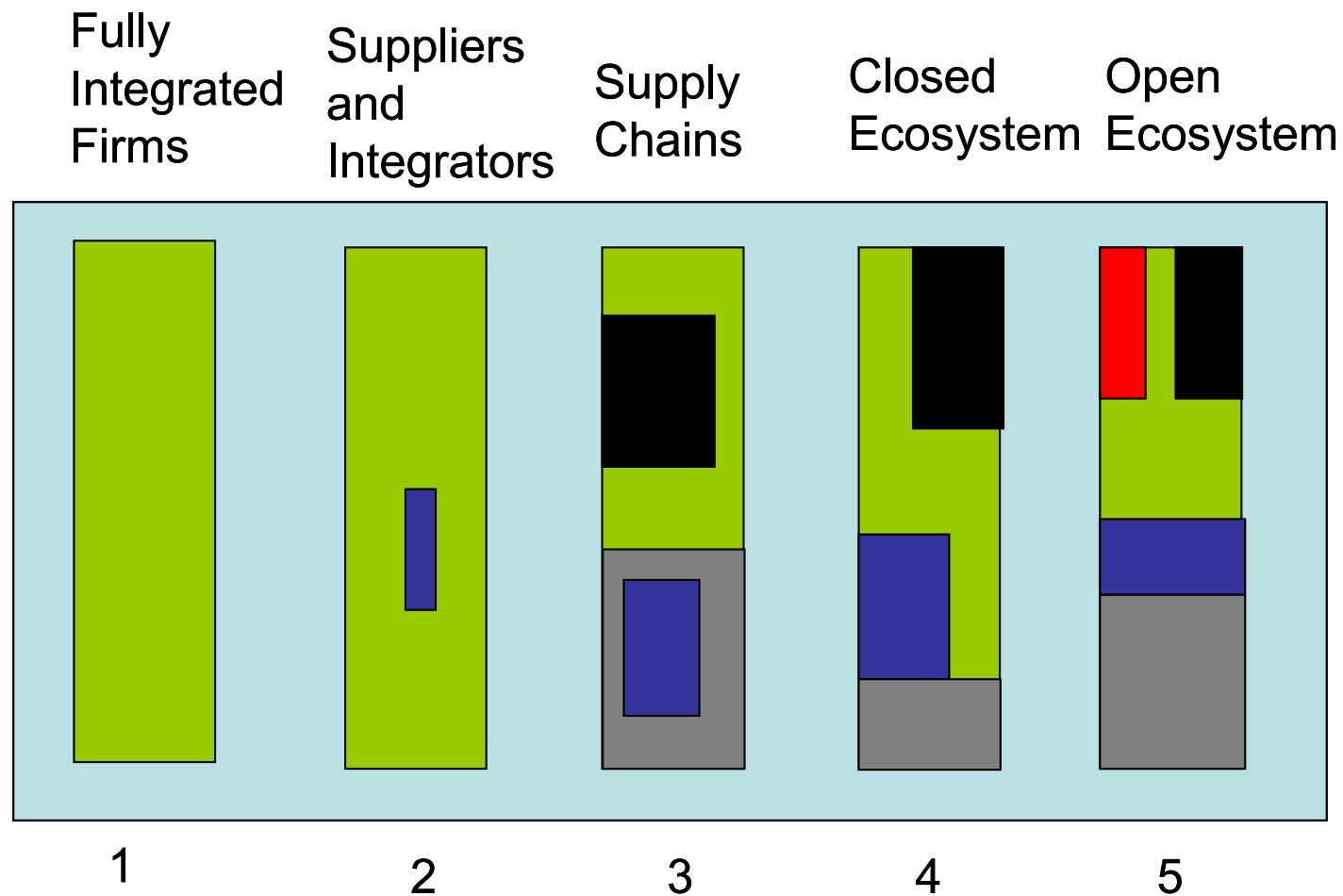
Horizontal vs Vertical



1980 - Vertical Silos

1995 - Modular Cluster

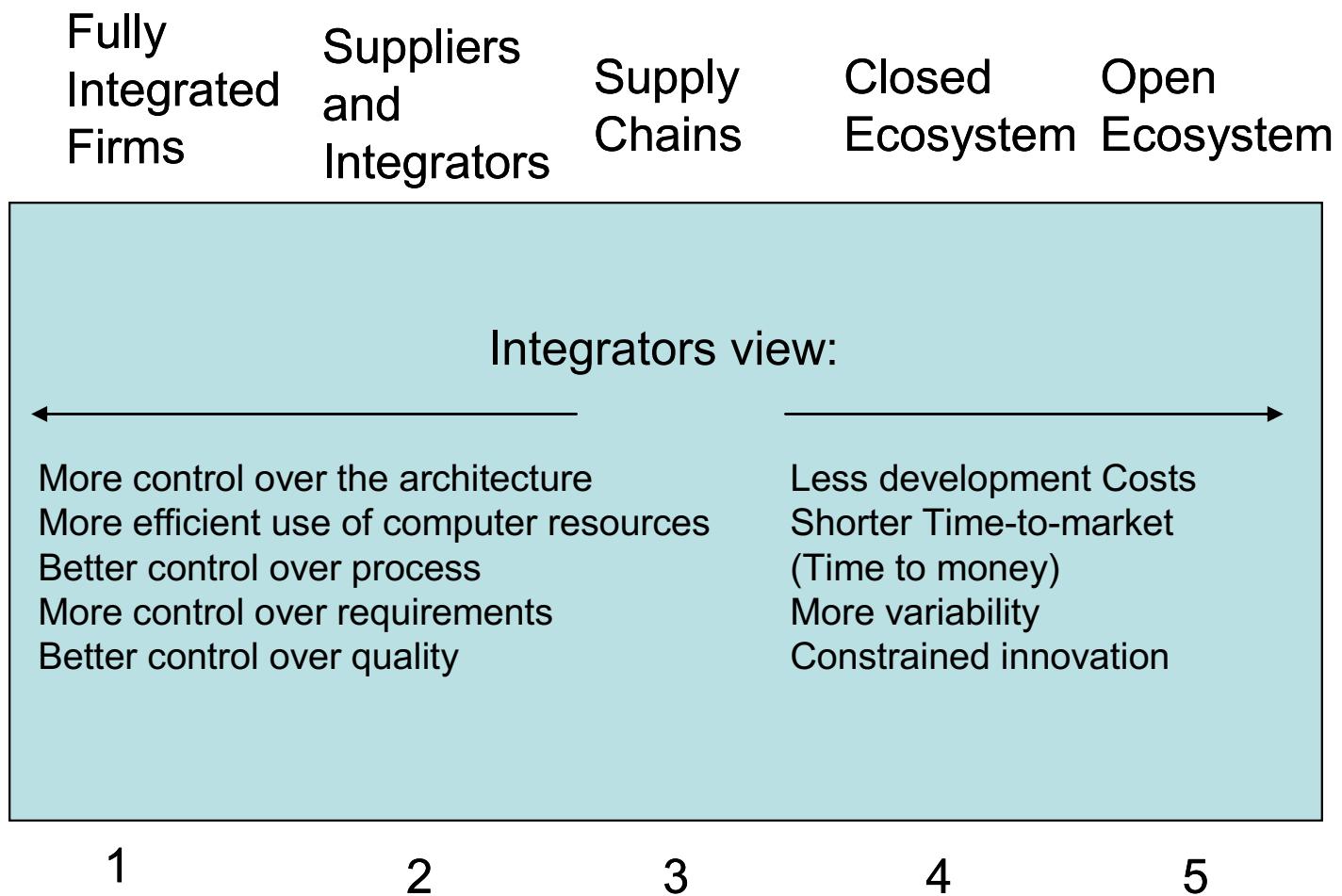
Model of Industry Structures

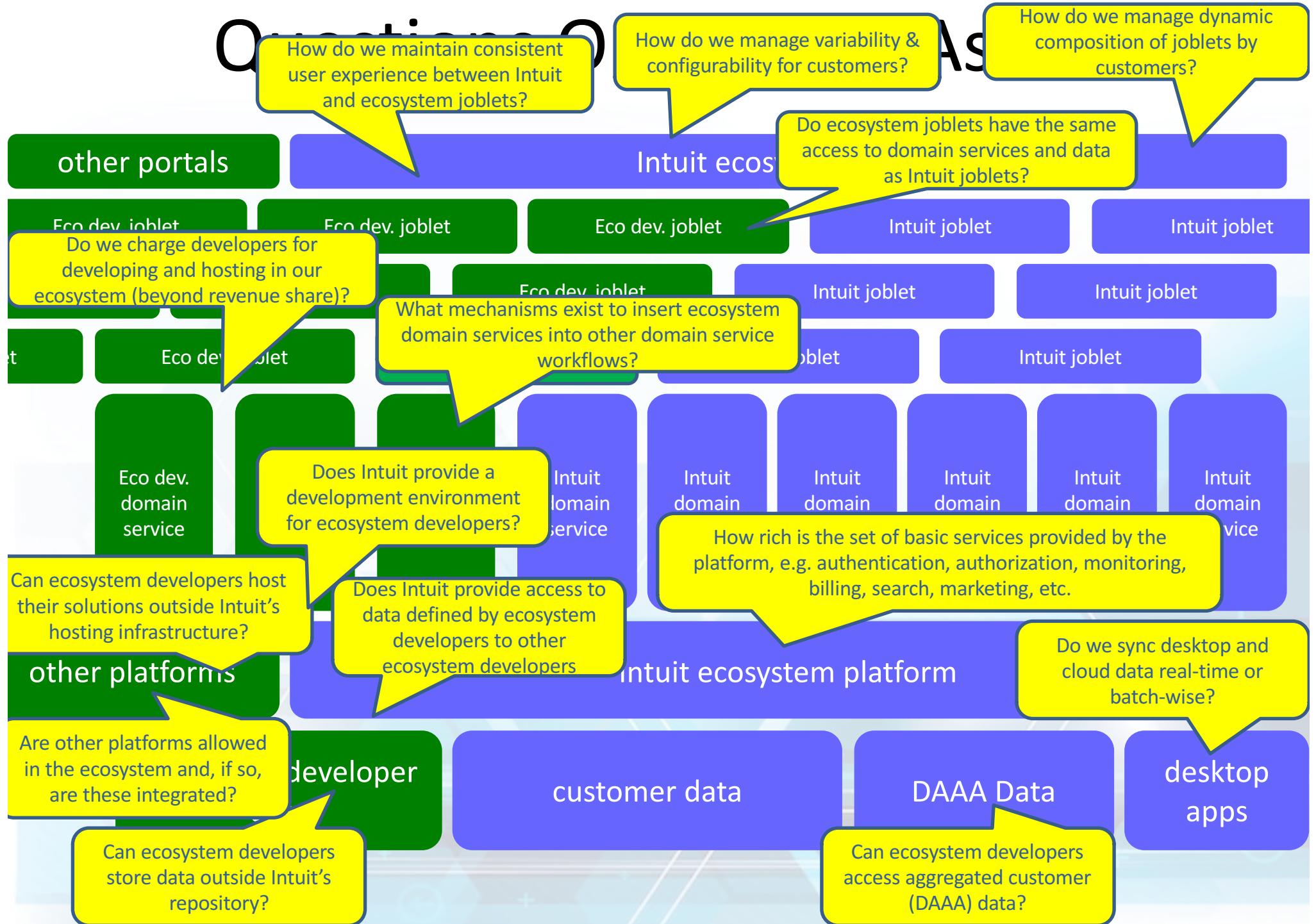


Industry Structures

| Charac- teristics | Fully integrated firm | Suppliers and integrator | Supply chains | Closed ecosystem | Open ecosystem |
|-----------------------|-----------------------------|--------------------------------|---------------------------------|--|----------------------------|
| Product architecture | Firm | Integrator | Shared control | Keystone partner & key partners | Open industry standards |
| Customer contact | Direct, sole contact | Integrator only | Last firm in chain | Keystone partner | All ecosystem participants |
| Platform architecture | N/A | N/A | Dominant player | Keystone partner | Open industry standard |
| Functionality | All done in-house | Selected parts sourced | Each party owns their own parts | Everyone, based on platform architecture | All ecosystem participants |

Conflicting Forces

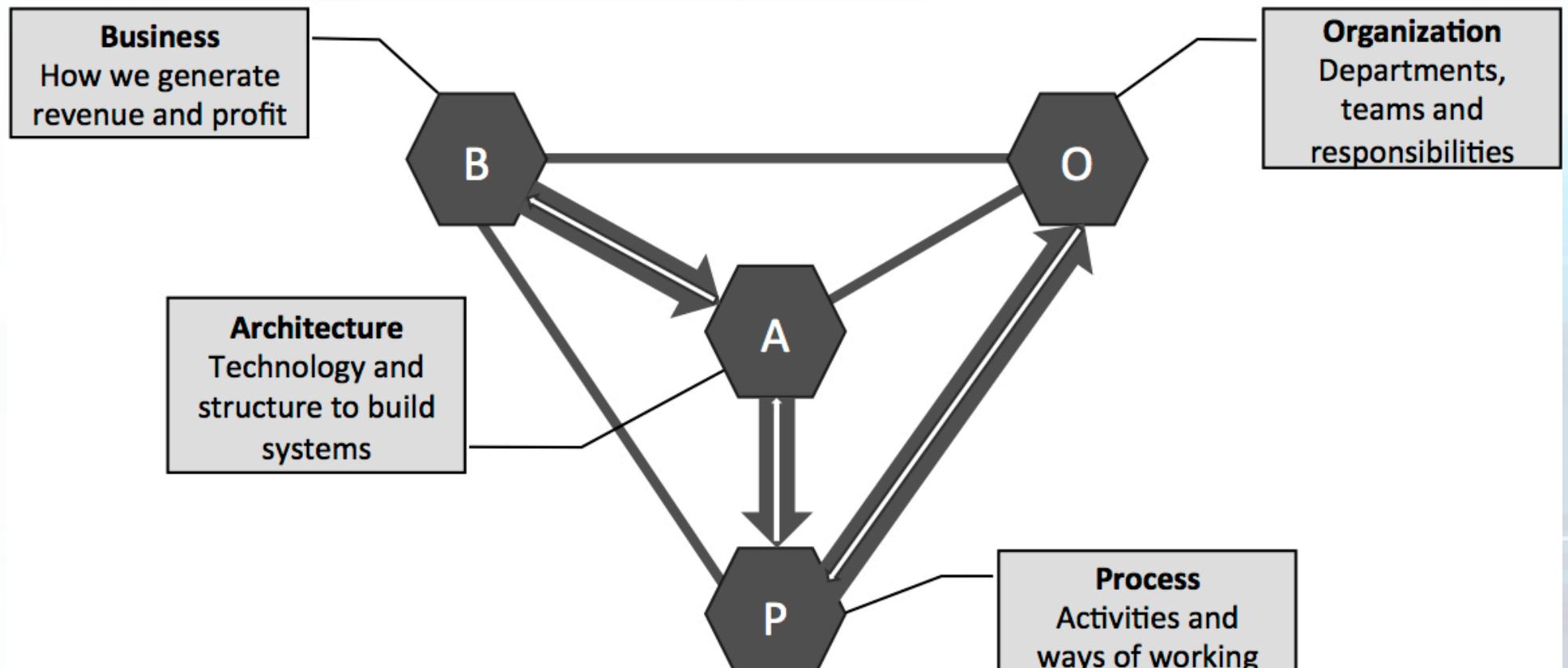




Implications for Software Engineering

- Coordination mechanisms
 - Process “human-centric” coordination does not work
 - From integration-oriented to composition-oriented
 - From process- to architecture-based coordination
 - From centralized roadmapping and requirements mgmt to decentralized and bottom-up
 - SCM and QA focus on backward compatibility and compositionality
- Engineering agility
 - Risk: frequency of platform releases decreases
- Product composition
 - End to end quality in customer-performed product composition
 - User experience

BAPO



ESAO



Ecosystems and Systems of Systems



EcoSoS - BAPO

- Business
 - added value of the composition versus individual systems
 - central control versus decentralized
- Architecture
 - centralized vs collaborative vs decentralized governance
- Process
 - Process for integration and evolution
- Organization
 - Certification and approval of new systems/extensions



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

Jan Bosch

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Reviews

Description

Table of Contents

Author(s) Bio

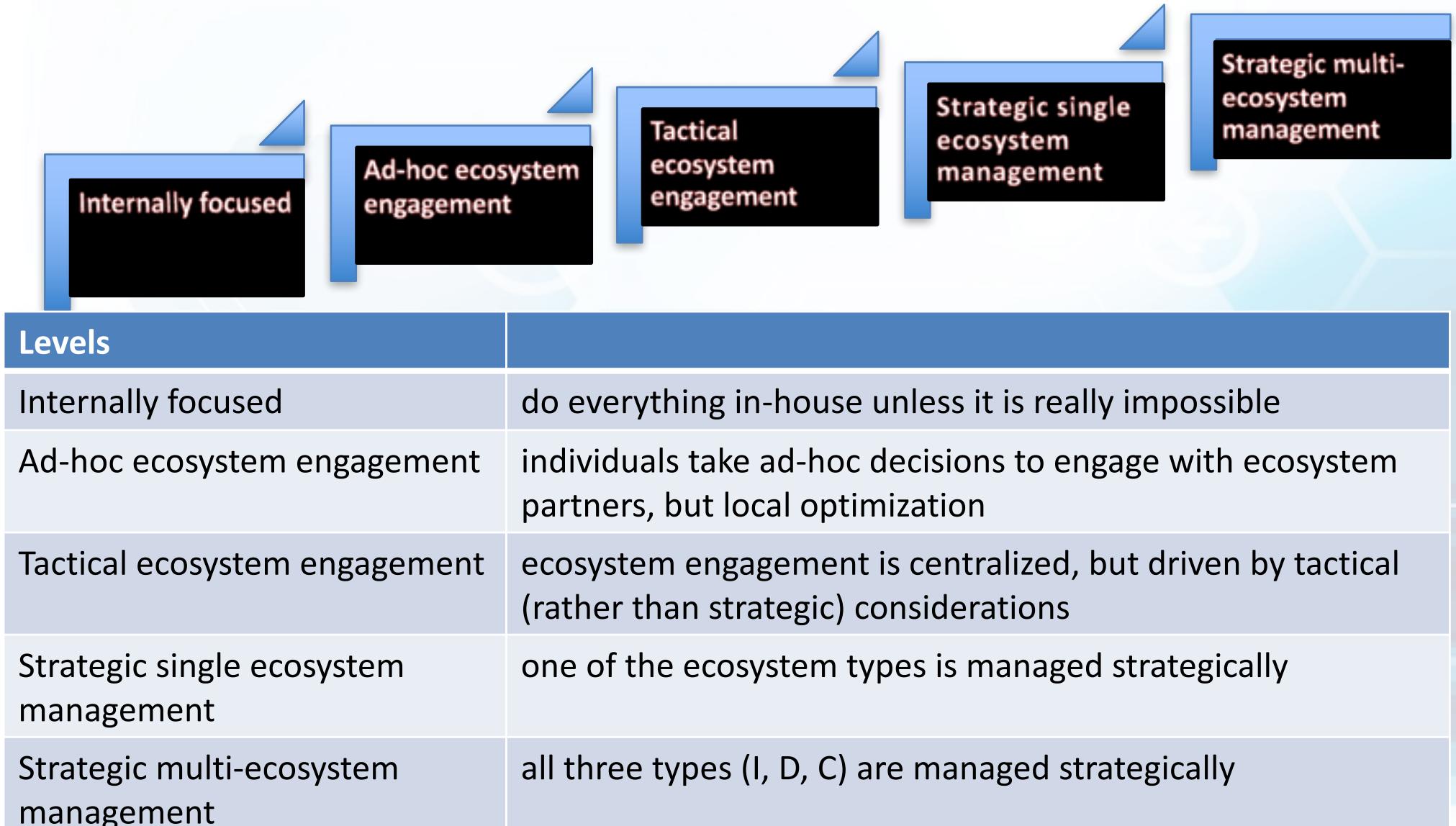
Reviews

"SDE offers a fascinating and well-researched overview of the major trends in the software industry. If you want to survive as a software company in the 21st century, add this wonderful book to your reading list."

– Jurgen Appelo, author of Management 3.0 and Managing for Happiness

"Jan Bosch has a unique background with both leading academic expertise and a profound industry experience, and utilizing his knowledge and ideas in conjunction with digitalization will result in great improvements and export values for Swedish companies. Jan Bosch is a pioneer in how he systematically demonstrates the strength of changing the perspective for working with software. He shows how new

Stairway to Heaven: Ecosystems





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Chalmers University
of Technology