42. Software Ecosystems

what we really tried in this course..

Prof. Dr. Uwe Aßmann

Softwaretechnologie

Fakultät Informatik

Technische Universität Dresden

2019-0.4, 19-4-5

http://st.inf.tu-dresden.de/teaching/saab

1) Software Ecosystems
2) B2C business models

Obligatory

- [Bosch09] Jan Bosch. From Software Product Lines to Software Ecosystems. SPLC 2009, https://dl.acm.org/citation.cfm?id=1753251

- [LeanRobotics] Samual Bouchard. Lean Robotics. A Guide to Making Robots Work in your Factory. https://leanrobotics.org/de/
  - On the design of robotic coworking cells. A disruptive industrial ecosystem.

- [Cusumano] Michael A. Cusumano. Staying Power: Six Enduring Principles for Managing Strategy and Innovation in an Uncertain World. Clarendon Lectures in Management Studies. Oxford University Press, 2010.
  - Try to buy this book second hand, it is revolutionary.
  - Spend 20€ to win your lifetime's income!

- http://www.drkarlpopp.de/VeroeffentlichungenPublications.html

References

▶ [Popp] Karl Michael Popp and Ralf Meyer. Profit from Software Ecosystems: Business Models, Ecosystems and Partnerships in the Software Industry. Books on Demand, 2040.

▶ Karl Popp. Software industry business models. IEEE Software, 28(4):26-30, 2040.

Software as a Business, © Prof. Uwe Aßmann

Different Kind of Ecosystems and their Business Models

- ▶ Social ecosystem (SOCO)
- ▶ Market places (Multi-sided (web) platform (web ecosystem, WECO)
- ▶ Supply-chain (mixed value) ecosystems
  - ▪ Hardware ecosystem (HACO)
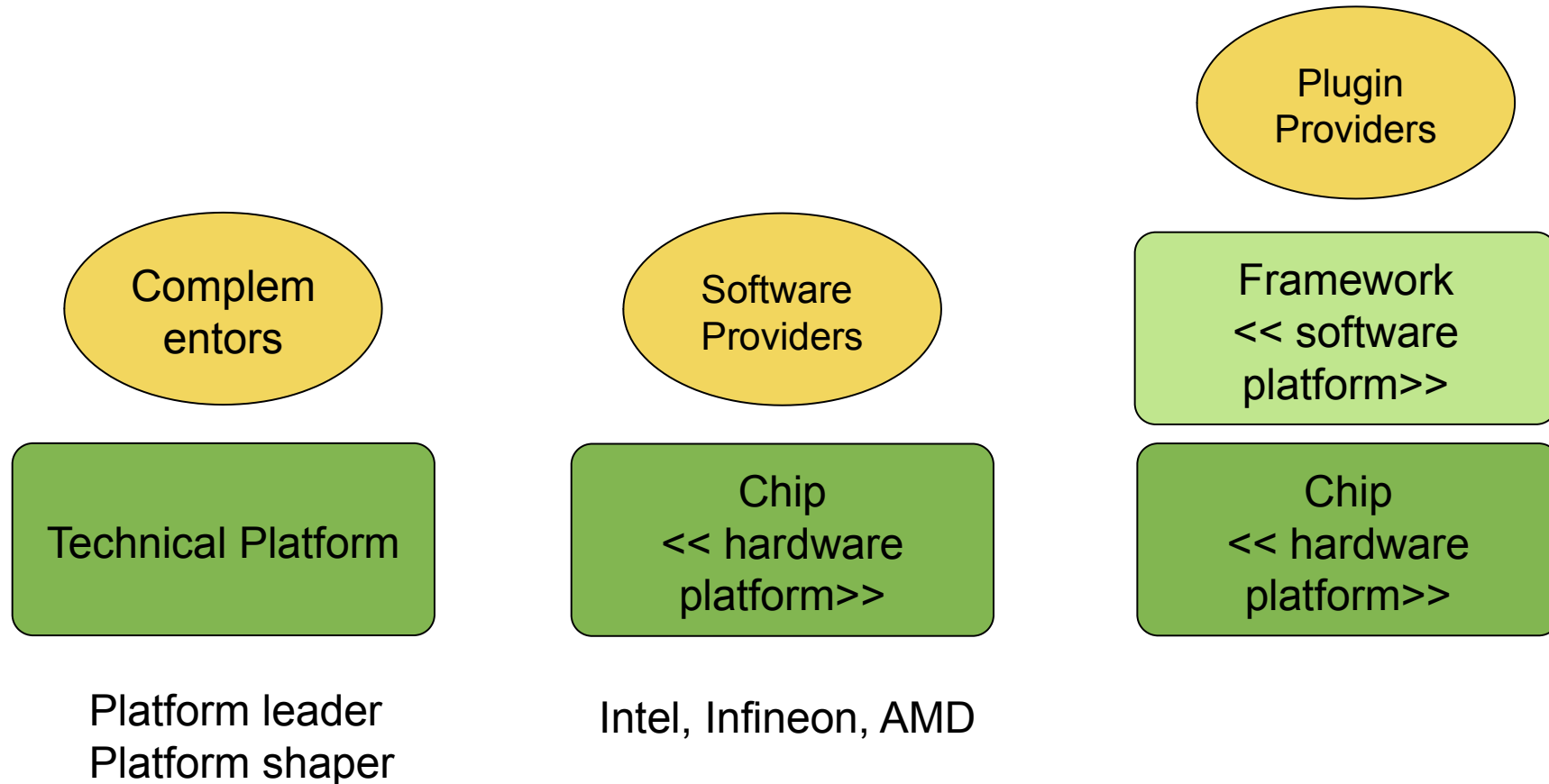 - ▪ Software ecosystem (SECO)

Pay-per-transaction

Mixed-value plugin

Software as a Business, © Prof. Uwe Aßmann

42.1 Business Model "Mixed-Value Platform" (Software Ecosystem, Seco; Hardware Ecosystem, Haco)

Platforms and Ecosystems

▶ „Platforms, not only products" (Book „Staying Power" Michael Cusumano)

▶ Markets need market platforms

▶ With Vendor Lock-In

Software as a Business, © Prof. Uwe Aßmann

Complementors

Technical Platform

Platform leader
Platform shaper

Software Providers

Chip << hardware platform>>

Intel, Infineon, AMD

Plugin Providers

Framework << software platform>>

Chip << hardware platform>>

Plattform Leadership in Secos

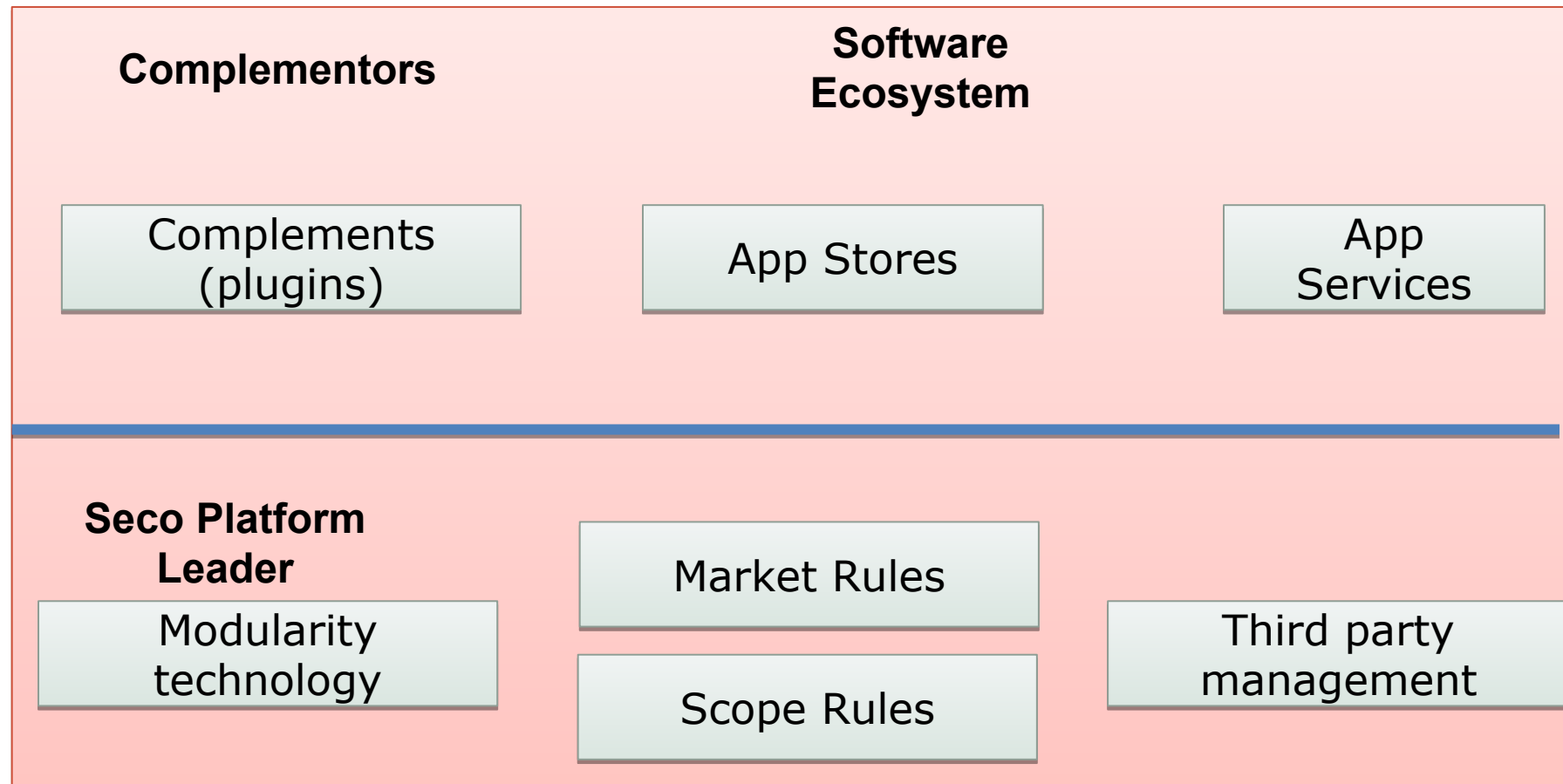- ▶ Platform leadership "wars" and „platform wannabie"
- ▶ Platform can be open or closed
- ▶ Platform can be for end users or for developers

Plugin Providers	App Providers	Module Providers	Component Providers
Eclipse	App Store	AutoSAR	Genivi Multimedia Infotainment Platform
IBM, Itemis, many	Apple, Intel, Google	BMW, Bosch,...	Genivi consortium
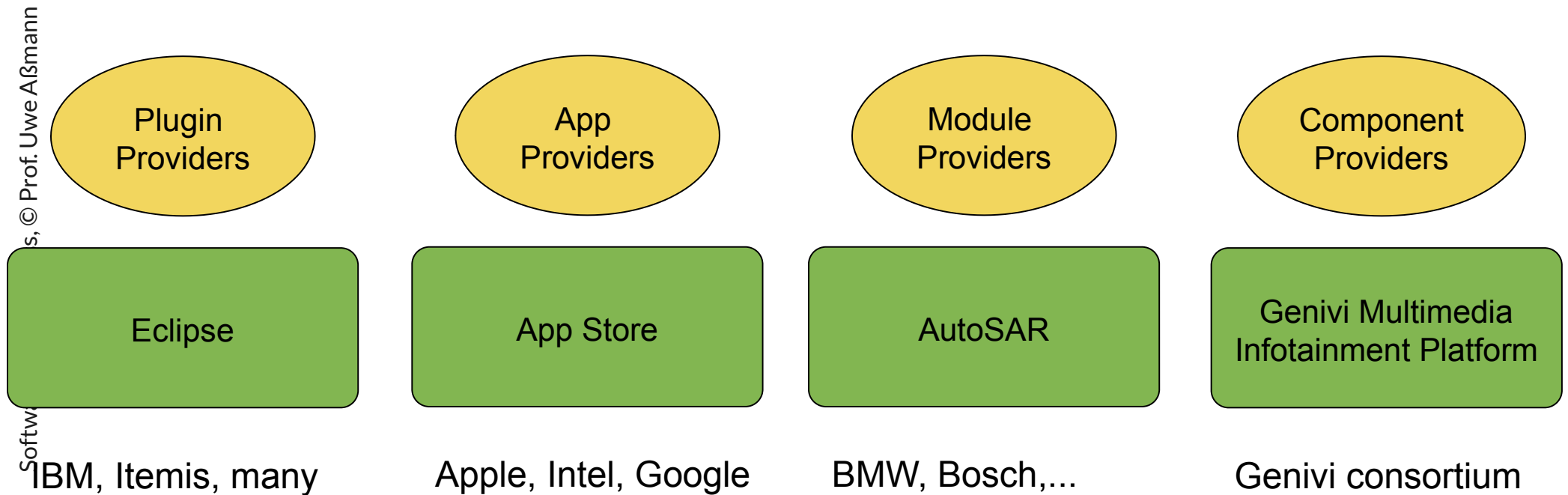
Software Platforms and Ecosystems

- ▶ A **software platform** is the basis of a **software ecosystem (seco)** [Cusomano] [Popp]
- ▶ Value is divided between platform leader and complementor
- ▶ Large companies want to be Seco platform leaders

Complementors

Software Ecosystem

| Complements (plugins) | App Stores | App Services |

Seco Platform Leader

| Modularity technology | Market Rules | |
| | Scope Rules | Third party management |

Consortial Software Ecosystems a la iPad, AutoSAR, GENIVI

Software as a Business, © Prof. Uwe Aßmann

Software Ecosystem

Apps

Apps

Apps

Plugin/App Provider

| Uncertified App Store | Certified App Store | App Services |

| **Seco Platform Leader Consortium** | | Platform Services |

| Component Model with plugin concept | Plugin Tools | |
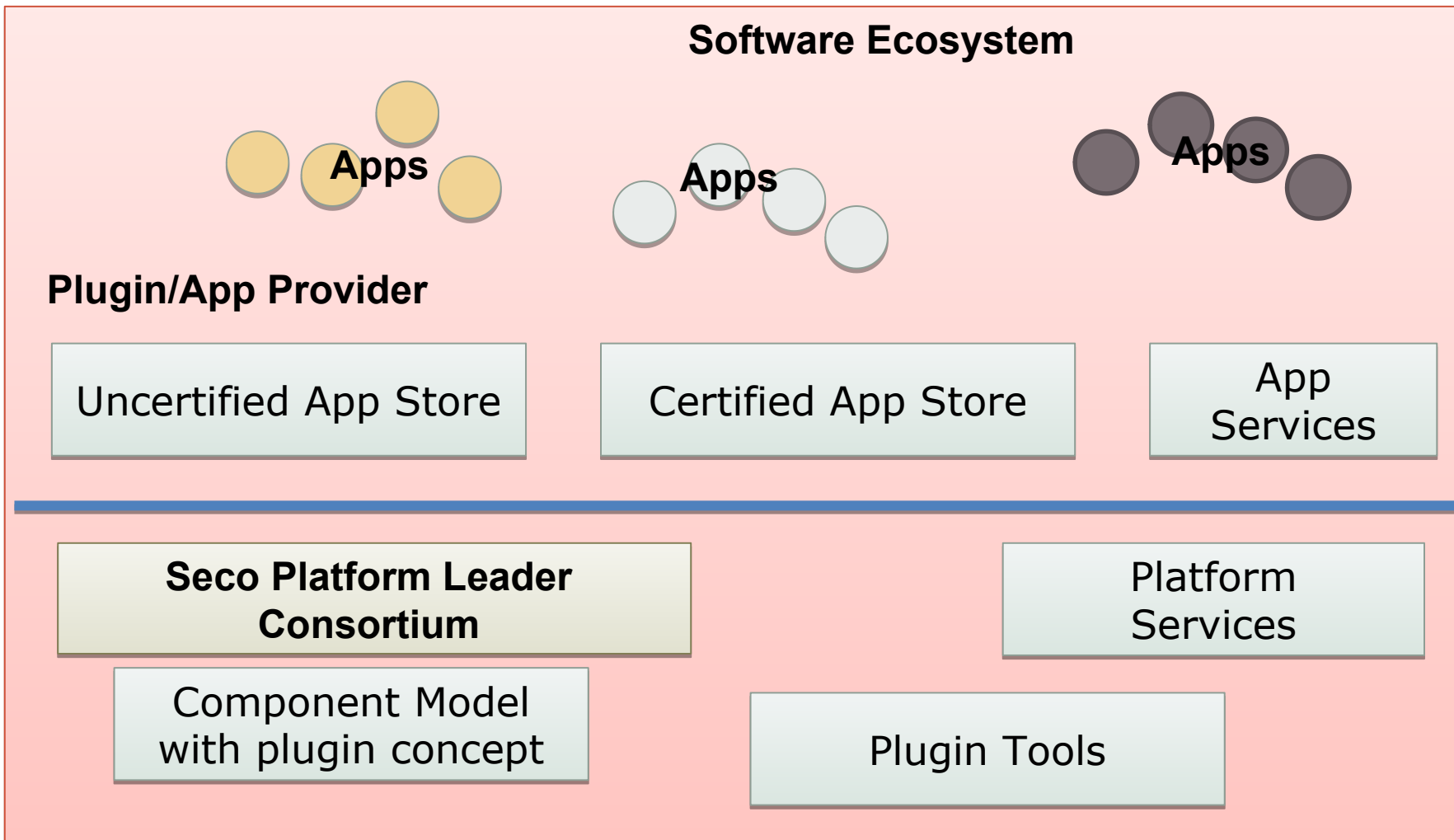
Layered Seco Platforms and Layered Ecosystems (Eclipse.org)

Software as a Business, © Prof. Uwe Aßmann

Many more layers possible (platforms and ecosystems)

Software Ecosystems

Plugin/App Providers

Domain-specific platforms

Seco Platform Domain 1 Business Intelligence

Seco Platform Domain 2 Modeling

Seco Platform Domain 3 Automotive

.....

Domain-independent Seco platform Eclipse RCP, RAP
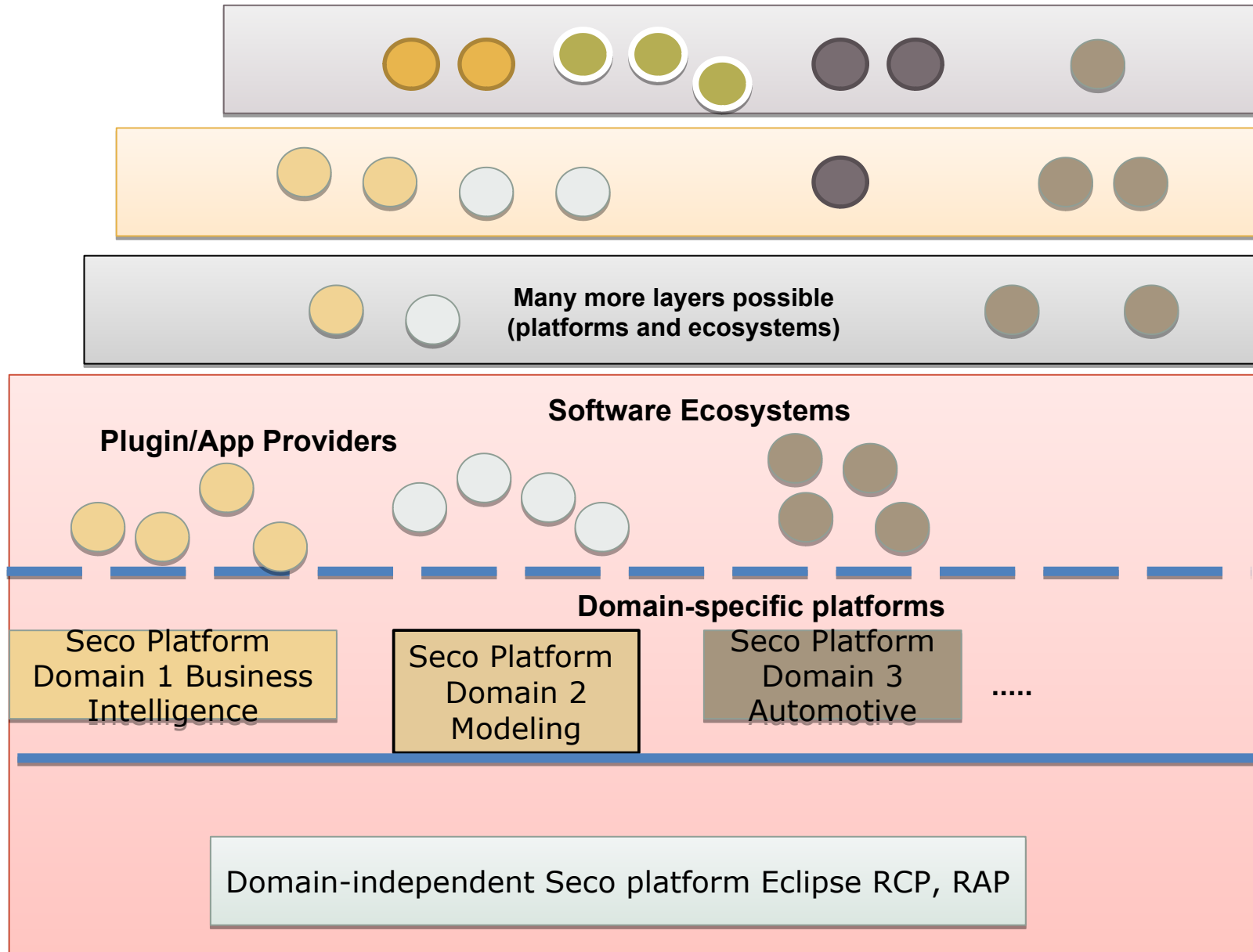
Generic Producer Roles in Business Models for Software Ecosystems

Software as a Business, © Prof. Uwe Aßmann

Role of Producer	Kind of Product			
	Financial	Physical	Intangible	Human
Creator	Entrepreneur	Manufacturer	Inventor	-
Distributor	Financial trader	Wholesaler, Retailer	IP distributor	-
Lessor	Financial lessor		IP lessor	Contractor
Broker	Financial broker		IP broker	HR broker

[Popp,Meyer; Wei05]

Software Platforms and Software Ecosystems

- ▶ **Software ecosystems (Seco)** are technical platforms plus complements (plugins)

  - ▪ Interdependent companies and value creation (mixed value creation)

- ▶ [Gawer/Cusomano] describe 4 factors of software ecosystems:

  - ▪ **Scope** of the firm: Which roles are played by the platform leader and the complementors?

  - ▪ **Modularity technology (**Component model and composition system, see course CBSE)

    - · static, dynamic, reliable, consistent, versioning, ...

    - · Extensibility concept for complements (plugins)

    - · Interface openness

    - · Runtime infrastructure (security checker and monitor)

  - ▪ **Relationship** with external complementors (contracting, revenue sharing, taxes)

    - · IPR strategy

    - · Quality management (Certification, test management)

    - · World-wide Distribution via AppStore

    - · Multi-sided web platform

  - ▪ **Internal organization** of the firm

Software as a Business, © Prof. Uwe Aßmann

Software Ecosystem for Smart Grids in Smart Homes

https://www.kiwigrid.com/de/products-solutions.html

▶ Kiwigrid is a Dresden startup to form a software ecosystem for smart grids (Cusomano style), Founder Carsten Bether

▶ Energy-Cloud Platform with Energy Apps

  ▪ Monitor devices in your house

  ▪ Help to define strategies for individual energy management and selection of price models

  ▪ Predefined apps or user-defined apps

  ▪ Plugin concept available

  ▪ Contracting for roles in the energy app ecosystem available

▶ → One of the fastest-growing startups in Dresden

▶ http://www.lichtblick.de/privatkunden/schwarm-energie/innovationen/schwarmhaus
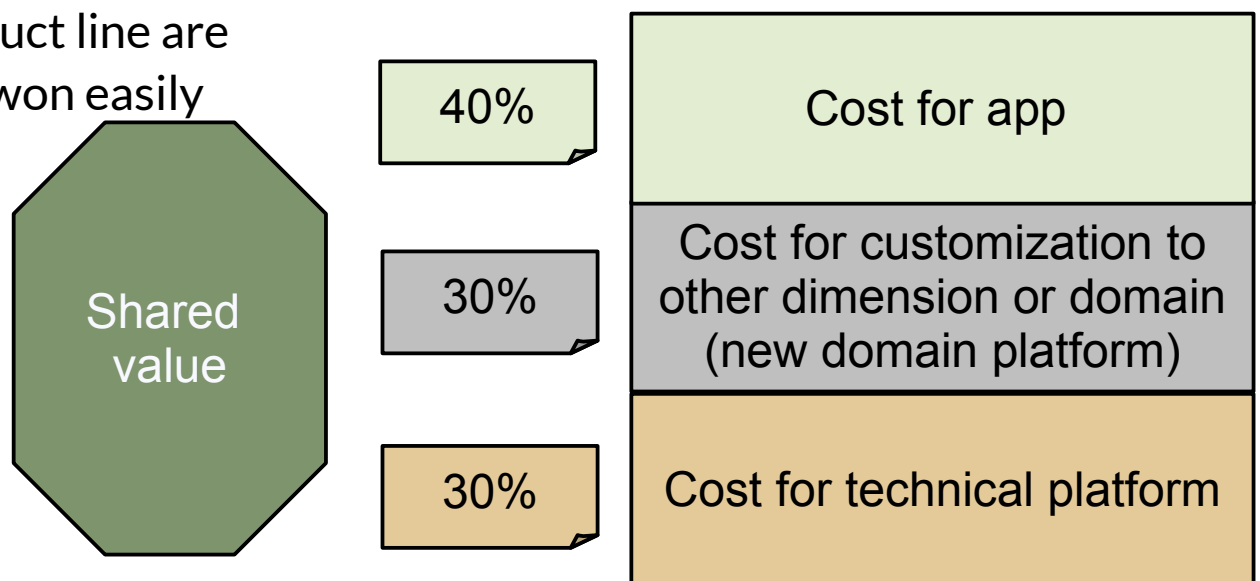
Software as a Business, © Prof. Uwe Aßmann

42.2 Opening Up a Software Product Line for a Seco

A good product matrix can always be opened up for a Seco.

Product Matrix Extension

▶ A product matrix can be extended by

- **New entries in a dimension** (more domains, more regions, more technical platforms)

- A *new dimension*, e.g.,

  · Internationalization: adding Country to (Domain x Region x TechnicalPlatform)

  · Regionalizing: adding a Region-specific component of the business model

  · Age-Group: adding a specific age group of humans to the customer set (babies, kids, parents, employees, grandparents, handicapped, etc.)

▶ If the interfaces of the product line are open, new partners can be won easily (shared value, mixed value)

Shared value

40% — Cost for app

30% — Cost for customization to other dimension or domain (new domain platform)

30% — Cost for technical platform

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Transformation of Business Model: SPL to Seco

Private value of SPL

40%	Cost for app
30%	Cost for customization to other dimension or domain (new domain platform)
30%	Cost for technical platform

▶ **Seco Market Rules:** which domains/dimensions does the platform leader **not enter?**

▶ **Seco shared-value rules:** how is the shared value divided among Peers?

Shared value

40%	Cost for app
30%	Cost for customization to other dimension or domain (new domain platform)
30%	Cost for technical platform

Software as a Business, © Prof. Uwe Aßm

Peers (Producers, Consumers), Partners, and Stakeholders

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THE PLATFORM DESIGN CANVAS
PLATFORM DESIGN TOOLKIT 2.1

notes

PLATFORM OWNERS

This category refers to the "owners" of the Platform: ultimately this set of players owns the vision behind the realization of the market, and are ultimately responsible to ensure that the platform exists in production.

Enabling Services (Platform to Partners)

Services targeted to helping partners generate value from their professional capabilities, gain market, opportunities and visibility to gain decisive improvement as professionals.

Core Value Proposition

The core value proposition is the primary value that the platform seeks to create for its core target (the target of the Core Value Proposition).

Transactions

These transactions happen between two entities in the ecosystem and consist of exchanging or transferring ownership of a currency or other stores of value (assets, money, token, credits), providing elements of intangible value (such as reputation, trust, kudos, likes, etc...), providing labour/work or enabling access to resources.

PARTNERS

Partners are essentially professional entities that seek to create additional professional value and to collaborate with platform owners at a stronger stage of relationship. Typically, partners are professional value creators that tend to specialize in a niche product/service and become better and better within time. Partners sometimes also facilitate, cater, enhance the value production by acting as broker, facilitators, connectors.

Ancillary Value Propositions

A secondary value that the platform seeks to enable. This is usually targeted to the same target segment of the Core Value proposition but can also be targeted to a different one.

PLATFORM STAKEHOLDERS

Are the entities that have a specific interest in platform success or failure, in controlling platform externalities and outcomes, in regulating it or in exercising rights in the platform governance.

Empowering Services (Platform to Peer Producers)

Services targeted to helping peer producer hone capabilities, get better and generate more opportunities from the platform.

Channels & Contexts

Every relationships borns in contexts and transactions happen better thanks to controlled and designed contexts that evolve into what we call channels. A context is defined more broadly than a channel and the latter can be often considered an evolution of the first. A refined and optimized channel should be available to make transactions easier. When complex transactions are broken into several sub-transactions a channel must exist for every phase to happen smoothly.

PEERS (producers)

Entities interested in providing value on the supply side of the ecosystem/marketplace, seeking for opportunities to improve their professionality and honing their capabilities towards better performance.

Infrastructures and Core Components

Controlled and owned by the platform owners and governed according to the platform governance. Typically we talk about digital and physical assets, tangible components, that ensure the platform works: these components need effort and energy to be run smoothly and in coordination.

Other Services (Platform to Peer Consumers)

More classical industrialized services can be provided to peer consumers as complementary of the experiences provided by the ecosystem through the platform.

PEERS (consumers)

Entities interested in consuming, utilizing, accessing the value that the is created through and on the platform.

PLATFORM VISION → ECOSYSTEM DYNAMICS

Developing a Seco

Software as a Business, © Prof. Uwe Aßmann

▶ Directed seco: Platform company selects all Strategic Solution Vendors (SSV)

  ▪ Examples:

  ▪ SAP built its ecosystem with the SSV IDS Scheer, selling ARIS workflow platform on top of SAP

  ▪ https://en.wikipedia.org/wiki/Architecture_of_Integrated_Information_Systems

  ▪ Atlassian

▶ Undirected seco: Wild growth, Independent Solution Vendors (ISV)

  ▪ B2B, B2C

    · Communication among Independent solution vendo

    · Example: Google Play, Apple Appstore

  ▪ Mass-configuration Ecosystem (end-user program)

    · Communication among ISV and users

    · Example: Game Of Life ecosystem

    · Game ecosystems

  ▪ C2C: Market places (multi-vendor web platforms)

Market places

Mass-configuration SECO development

Undirected SECO development

Directed SECO development

TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät Informatik - Institut Software- und Multimediatechnik - Softwaretechnologie – Prof. Aßmann - Software as a Business
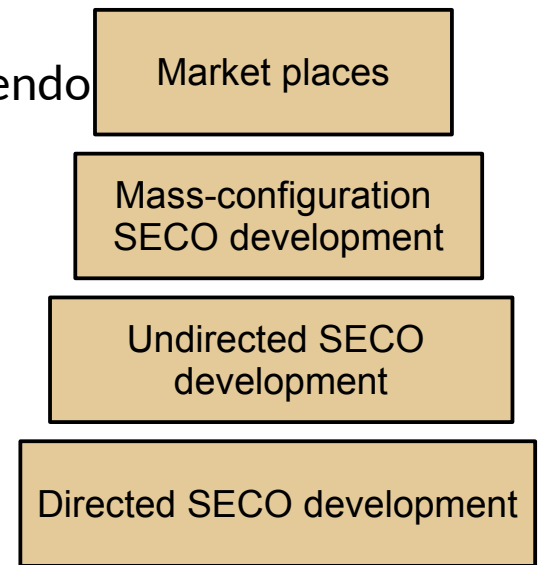
42.3 Marketplaces (Multi-Sided Web Platforms) for Scaling Relationships

„Multi-sided (web) platforms bring together two or more distinct but interdependent groups of customers." [BMG]

- Facilitating interactions between producers and consumers
- Growing by the Metcalfe network effect
- http://www.platforminnovationkit.com/
- https://medium.com/platform-innovation-kit/introduction-to-lean-platform-innovation-35bbbea57cc0

Multi-Sided (Web) Platform Canvases
(Market Place Canvases)

▶ Ebay, Amazon, AirBnB, Creatlr, Atlassian, …

▶ https://www.deutsche-startups.de/2016/04/05/endlich-ein-canvas-fuer-plattform-geschaeftsmodelle/

▶ Platform BMC

- https://www.creatlr.com/template/um2yxrXADndCd8ftsGgY2/platform-business-model-canvas/

- https://www.linkedin.com/pulse/intro-platform-business-model-canvas-matthias-walter

▶ Platform Strategy Canvas

- https://www.creatlr.com/template/NTw2Xj740OVOm91qLPZTHh/platform-strategy-canvas-1-0/

▶ Walter's iPlatform Innovation kit

- https://www.kanal-egal.de/maerkte-neu-definieren/

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Owner

Producer

Stakeholder perspective   Value Propositions   Value Transactions   Key Platform Components

Partner

Consumer

Platform Business Model Canvas 3.0

It's very hard to create a platform or marketplace business model with the original
Business Model Canvas and Lean Canvas. The Platform Business Model Canvas makes it easier than
ever to design a platform from every stakeholder's perspective. It works very well with other templates
like Stakeholder Map, Value Proposition Design Canvas, Business Model Canvas and Lean Canvas.

DIGITAL
AHEAD

Project

Workshop

Done

Saved online

AirBnB Multi-Sided Platform Canvas

22

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" Owner

AirBnB

help people find affordable & cool places to stay

being a disruptor of the hotel industry

product development

network / community building

3% commission of every booking

6-12% commission of every booking

data & user security protection

Self Service for room management

payment & transfer of money

" Producer

Hosts

3% commission of every booking

earn more money effortlessly with already available resources

receipt about the booking + information about the guests

" Stakeholder perspective

" Value Propositions

" Value Transactions

" Key Platform Components

local service firms

payment partners

more orders

more payments fees

order information

payment information

partner registration & management

API to connect to partner processes

efficient search & filter functionality

6-12% commission of every booking

Guests

book great places around the world for low prices

service Informations (availablity, prices, etc.)

receipt about the booking + information about the host

" Partner

" Consumer

Platform Business Model Canvas [template] [by Creatlr Toolkit Development] [smart]

Create business models for platforms and marketplaces

Template license: Creative Commons Attribution-Share Alike 4.0 Unported License.

Workspace / project
PBMC Examples
https://www.creatlr.com/workspace/ouv7Wh1sa0IBVWOezXT9ud/

Workshop
PBMC Example: AirBnB
https://www.creatlr.com/workshop/AFtiShfKKHvrw7A7TSsQf/

Creatlr.com - The visual thinking platform

Exported by Matthias Walter on 04/01/2016

creatlr

sT

https://www.deutsche-startups.de/wp-content/uploads/2013/12/pbmc-example-airbnb-bg.gif

Creatlr Multi-Sided PBMC

Software as a Business, © Prof. Uwe Aßmann

Owner

Producer

Creatlr.com

Help people get the most out of their teams with design thinking solutions

Revenue streams

Network

Getting the word out. Sharing knowledge

People and organizations that create design thinking tools

Improve collaboration and knowledge sharing

Design thinking tools / canvases / templates

Turn knowledge into revenue streams

Thought leaders

Redesign collaboration

Effort (lots of it)

An open (source) knowledge platform

Have an online platform to work with our own tools

Exposure

Feedback features

Add your own tools

Network and leads

Coffee

Revenue streams (direct and indirect)

Feedback on tools

Stakeholder perspective   *Value Propositions*   *Value Transactions*   *Key Platform Components*

Basic analytics

Workspaces, online workshops and agile project management

Feedback on tools

Shares

Admin features

Investors

Money

Advanced search and analytics

Creatlr Premium subscription

Improve collaboration within teams and with clients

Visual / design thinkers

Development partner

Find experts and thought leaders behind tools

Work less, create more

Teams and organizations worldwide

Create something that really matters

Expertise, time and effort

Find design thinking tools

Online and offline collaboration

A platform that makes multiple platforms obsolete. Cancel other subscriptions, simplify workflows in teams

Partner

Make teams more productive

Consumer

DIGITAL AHEAD

Platform Business Model Canvas `template` `by Creatlr Toolkit Development` `smart`

Create business models for platforms and marketplaces

Template license: Creative Commons Attribution-Share Alike 4.0 Unported License.

Workspace / project
Platform Business Model Canvas example
https://www.creatlr.com/workspace/1wJhi1DJVi4G2jLDseOI1f/

Workshop
Creatlr as a platform
https://www.creatlr.com/workshop/tghnDN3BxrROPGn2Lgcse/

Creatlr.com - The visual thinking platform

Exported by Matthias Walter on 04/01/2016

INFLUENCER

STAKEHOLDERS

BUSINESS DRIVERS

ENDOGENOUS   EXOGENOUS

COMPETITION

POSITION

VISION

USP

UNFAIR ADVANTAGE

MISSION

STRATEGIES

RESOURCE-BASED STRATEGY

TECHNOLOGY-BASED STRATEGY

MARKET-BASED STRATEGY

PLATFORM STRATEGY CANVAS v1.0

Business Platform

Created by

Version / Date

42.3 Who wins the Software Ecosystems for CPS and IoT?
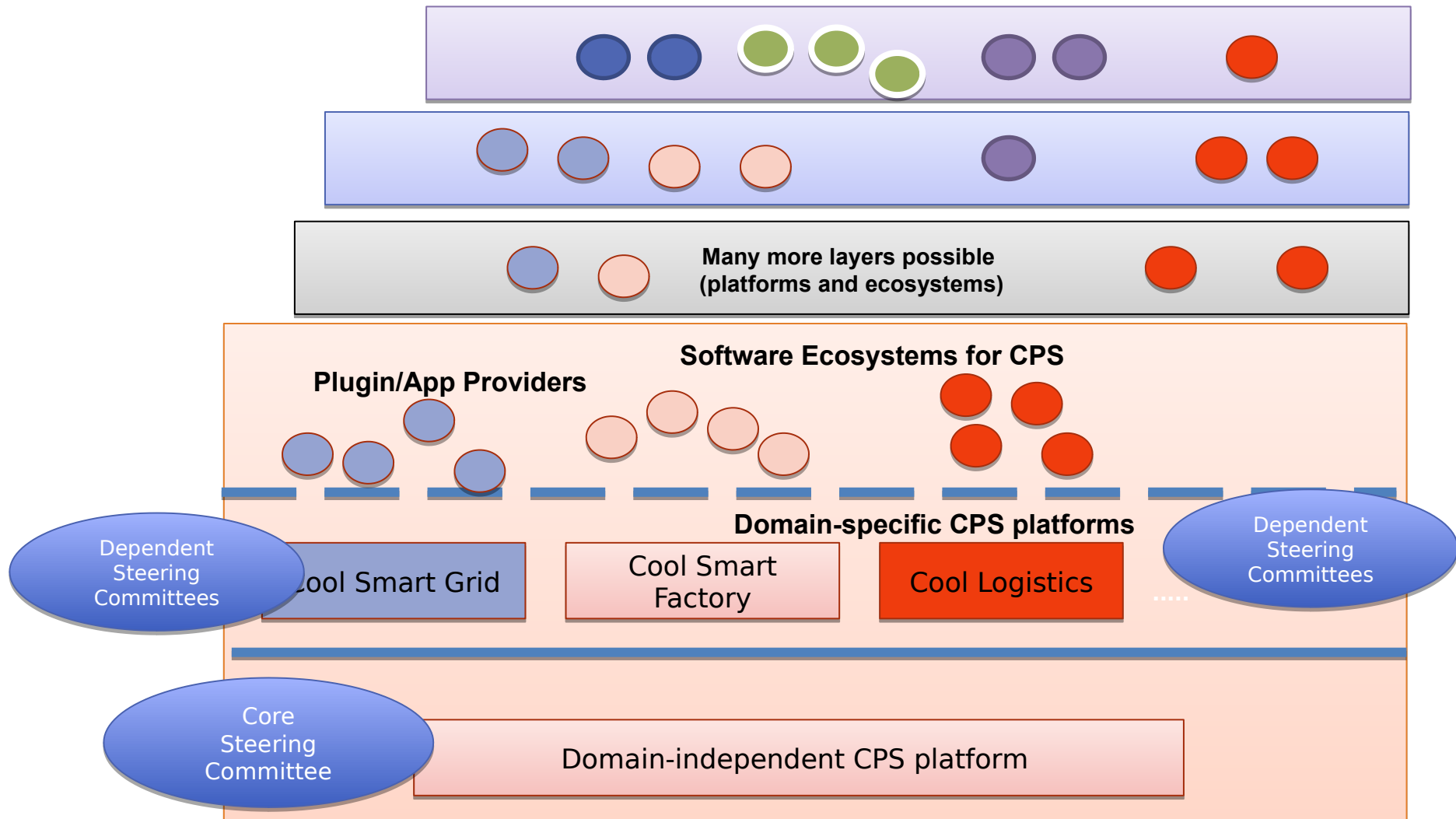
The Eclipse Attempt to take over the world

Vision: CPS Software Ecosystems

- ▶ Apps of CPS are safety critical, need to be certified
- ▶ Who will be platform leader?
- ▶ Who will be the ecosystem service providers?

Software as a Business, © Prof. Uwe Aßmann

CPS SECO

Apps

Apps

Apps

Plugin/App Provider

| Uncertified App Store | Certified App Store | App Services |

Platform Leader

| | Certification Tools | Platform Services |

| Rich Component Model with plugin concept | Plugin Tools | Composition Tools |
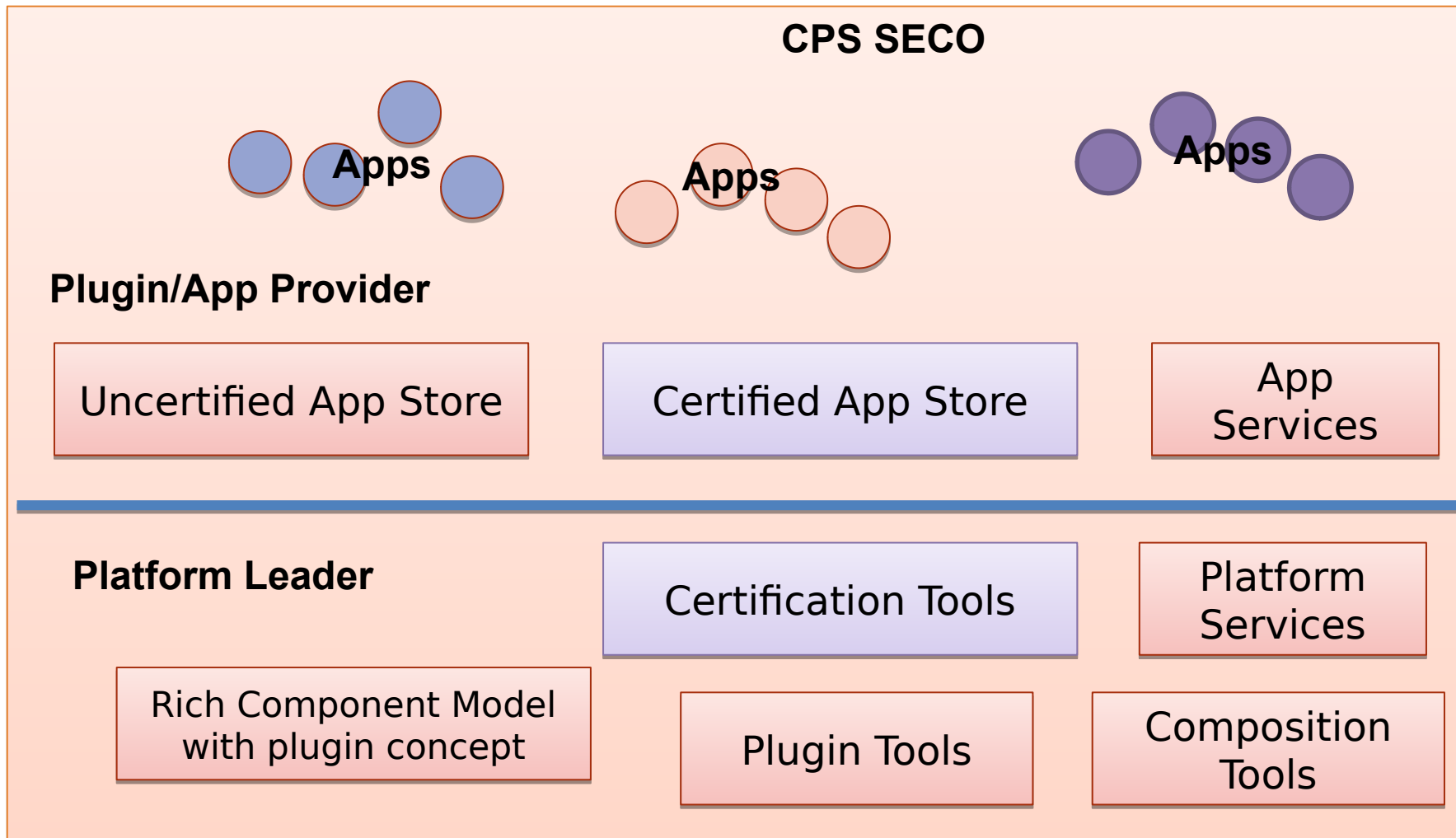
Layered Software Ecosystems for CPS

- ▶ Structure like Eclipse
- ▶ Eclipse tries with OpenHAB

Software as a Business, © Prof. Uwe Aßmann

Many more layers possible (platforms and ecosystems)

Software Ecosystems for CPS

Plugin/App Providers

Domain-specific CPS platforms

Dependent Steering Committees

Dependent Steering Committees

Cool Smart Grid

Cool Smart Factory

Cool Logistics

.....

Core Steering Committee

Domain-independent CPS platform

Layered Hardware/Software Ecosystems for Intelligent Things in IoT

Software as a Business, © Prof. Uwe Aßmann

► With a hardware platform for an intelligent thing

Many more layers possible
(platforms and ecosystems)

Software Ecosystems for CPS

Plugin/App Providers

Domain-specific CPS platforms

Cool Smart Grid

Cool Smart Factory

Cool Logistics

Domain-independent CPS software platform

Domain-independent CPS Hardware platform
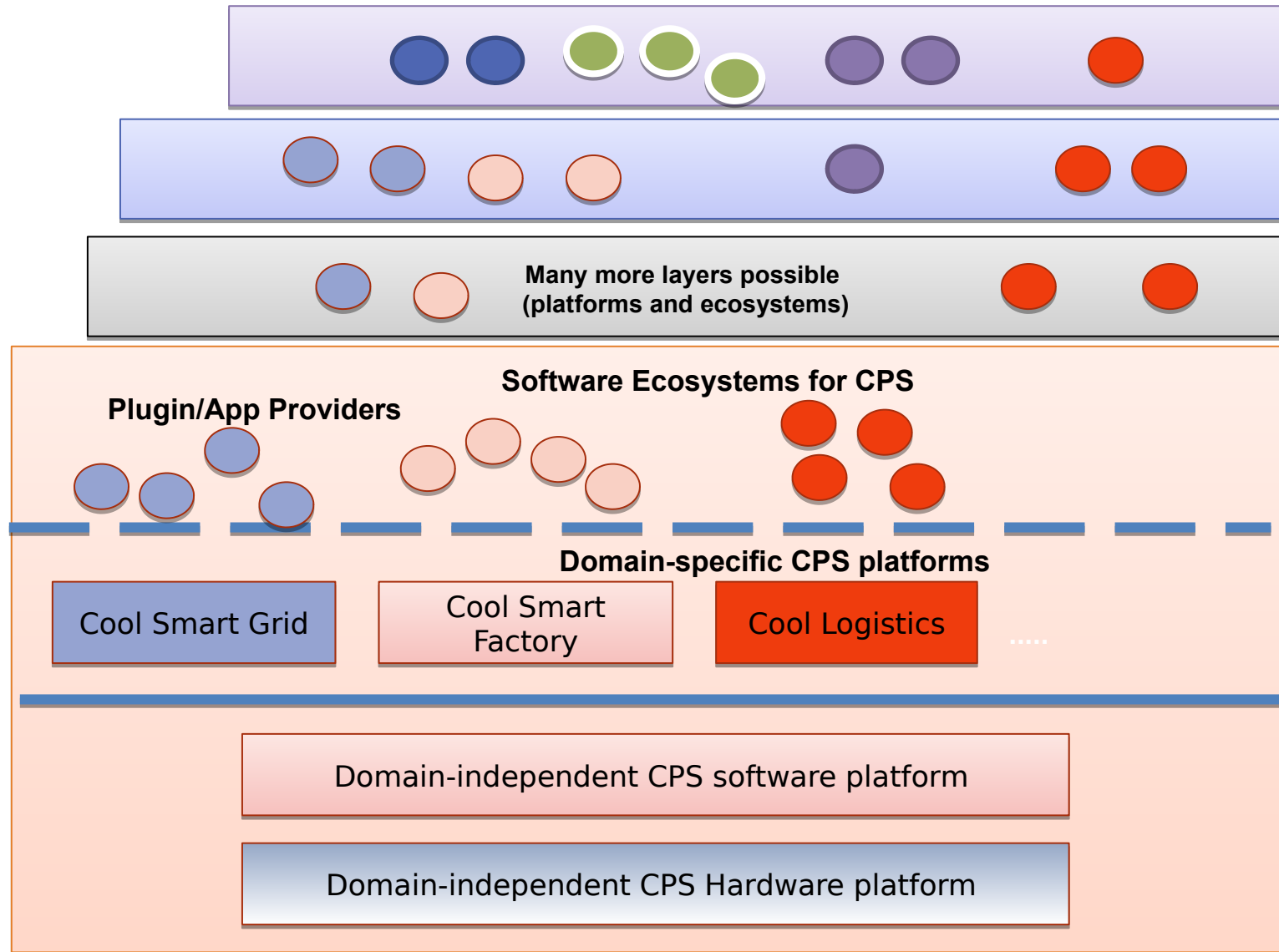
CPS-Plattform-Leadership

▶ In a value chain, every level can consist of a platform

Chips	Operating System	CPS Platform	CPS App Store	CPS App
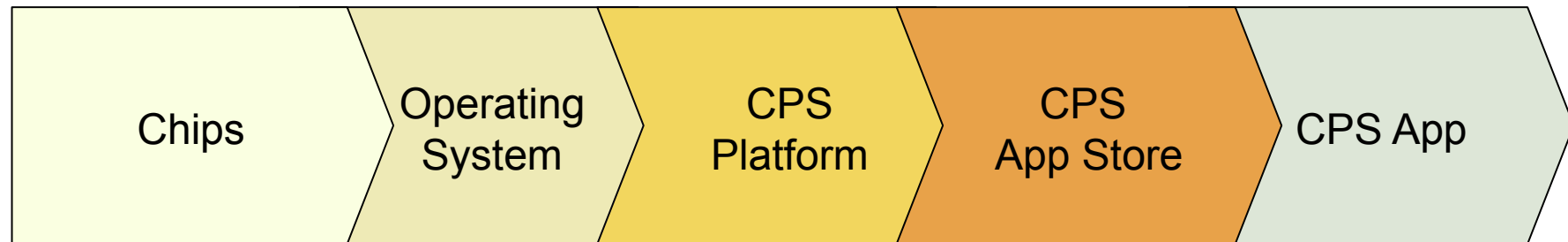
Who will own the platform leaderships?

Software as a Business, © Prof. Uwe Aßmann

It's kind of severe

Cyber-Physical Systems are the „the next big thing" in ICT and are of uttermost importance for the industrial evolution of Germany.
They form the basis of the 4th industrial revolution.

Prof. Wolfgang Wahlster (DFKI)

Software as a Business, © Prof. Uwe Aßmann

Role Model for CPS Ecosystems

► Should be an instance of the Popp/Meyer generic model

Role	Kind of Product			
	Financial	Physical	Intangible	Human
Creator	Entrepreneur	Manufacturer	Inventor	-
Distributor	Financial trader	Wholesaler, Retailer	IP distributor	-
Lessor	Financial lessor		IP lessor	Contractor
Broker	Financial broker		IP broker	HR broker

[Popp,Meyer; Wei05]

Software as a Business, © Prof. Uwe Aßmann

42.4 Lean Ecosystem Development

- White paper https://platformdesigntoolkit.com/platform-design-whitepaper/
- Tutorial https://stories.platformdesigntoolkit.com/introducing-lean-ecosystem-development-1aa76b4cead5

Lean Ecosystem Development

- A **seco (software ecosystem)** can also be developed with lean innovation.

- **Secolead (software ecosystem lean development)** is a very important business modeling process for scalable businesses

- Few people run it so far:

  - M. Cusumano. Staying Power. 2011.

  - **Platform design toolkit** helps to design secos
    https://platformdesigntoolkit.com/

  - https://stories.platformdesigntoolkit.com/introducing-lean-ecosystem-development-1aa76b4cead5

42.4.1 Lean Platform and Ecosystem Development for CPS

Hot Future CPS Ecosystems

Software as a Business, © Prof. Uwe Aßmann

- ▶ Lean Robotics Ecosystem Development

- ▶ Book [LeanRobotics] suggests the ecosystem of robotic coworking cells

  - ▪ Design coworking cells

  - ▪ Plan how many robots

  - ▪ Plan workflow

  - ▪ Teach robots by demonstration (see wandelbots.de)

  - ▪ Compare manual workflow with robotic cell workflow

  - ▪ Re-Target

  - ▪ How many coworking cells does a company need?

- ▶ Product is NOT the robot, but the robotic cell

Gigantic B2B ecosystem
And B2C too

Designed by Macrovector
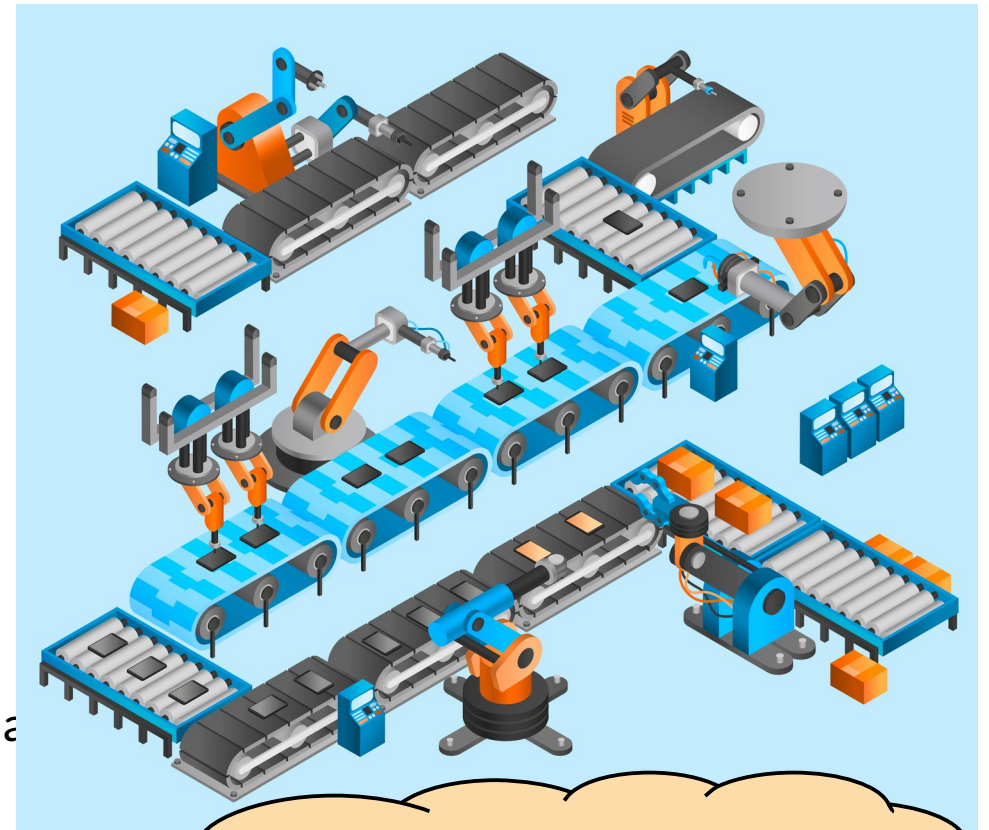
Teaching by Demonstration
Startup wandelbots.de

- ▶ 10 times faster programming of cobots

- ▶ Figures from wandelbots.de

DEMONSTRATION-BASED TEACHING

HUMAN-CENTERED PROGRAMMING OF ROBOTS.

Programming industrial robots is a complex, time-consuming and expensive tasks, done by experts. Today, most process or the surrounding changes. Wandelbots provides a solution for that. With Demonstration-based Teachi code. Now, the task experts are able to teach robots even in dynamic and complex environments. By showing the control program is learned and automatically generated.

Our solution is

EASY-TO-USE

Our solution requires no programming experience. You can teach to robot how a certain task shall be done. With an intuitive user interface the learned task can be refined and adapted.

HIGHLY FLEXIBLE

With demonstration-based teaching the time required to programm robots is reduced drastically. New tasks can be realized within minutes and no external experts or companies are required.

TEACHING ROBOTS MADE EASY

We re-thinking how industrial robots are programmed and taught. With cutting edge interaction technologies, we enable everybody to program their robots themselves.
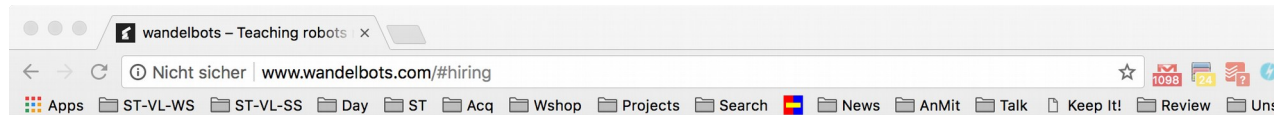
TechCrunch Disrupt Berlin Dec 2017

▶ Among best 5

Software as a Business, © Prof. Uwe Aßmann
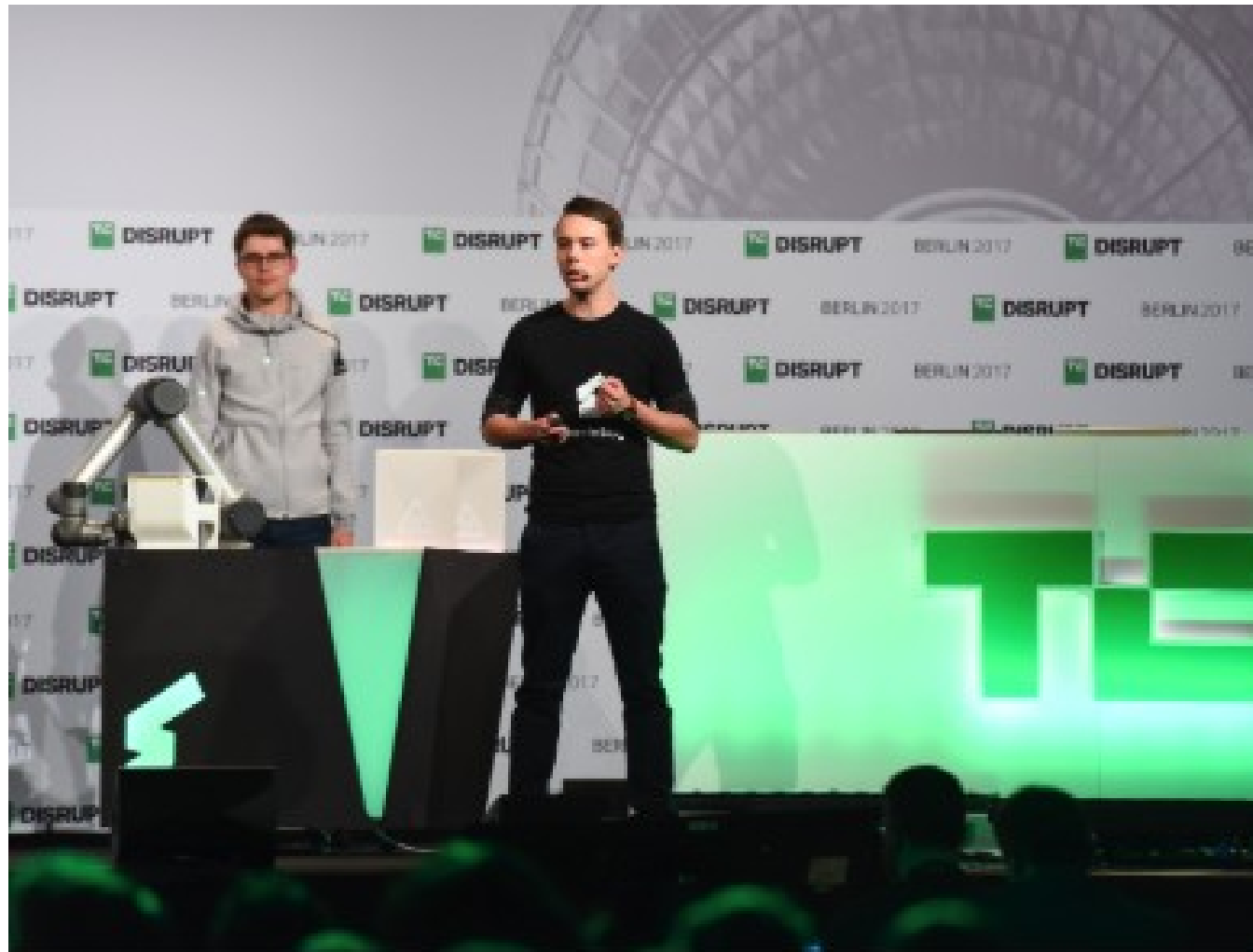
VW as Customer

Software as a Business, © Prof. Uwe Aßmann

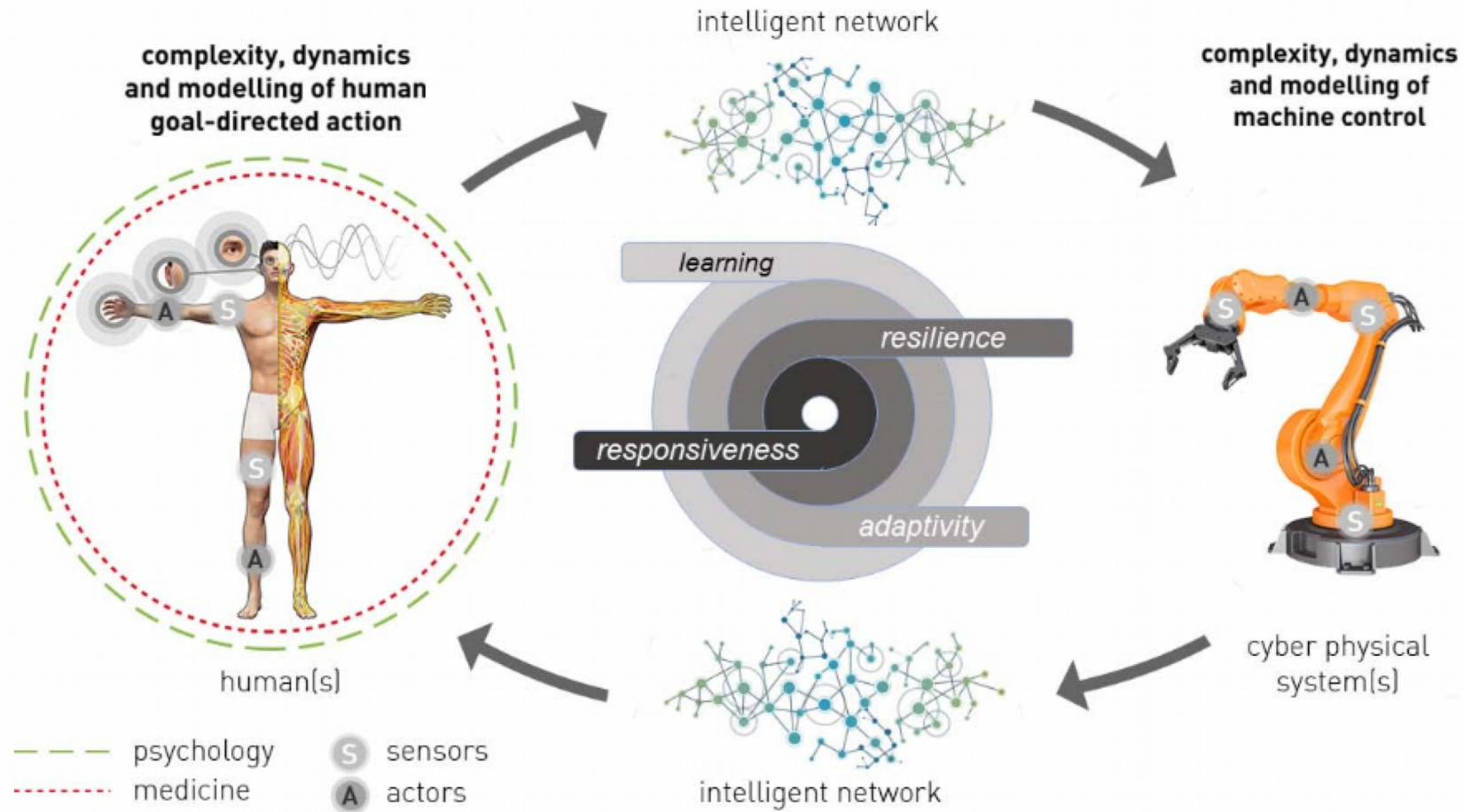# Excellence Cluster Project „Center of Tactile Internet (CeTI)"

Figure 1: Conceptual representation of the Tactile Internet with Human-in-the-Loop (TaHiL).

© F. Fitzek, J. Krzywinski, CeTI EXC, TU Dresden

Hot Future CPS Ecosystems

Software as a Business, © Prof. Uwe Aßmann

- ▶ Lean Cohabitation Ecosystem Development
- ▶ CeTI suggests the ecosystem of robotic cohabitation cells
    - ▪ Design cohabitation cells
    - ▪ How many cohabitation cells does a human need?
- ▶ Product is NOT the robot, but the cohabitation cell

Gigantic B2B ecosystem
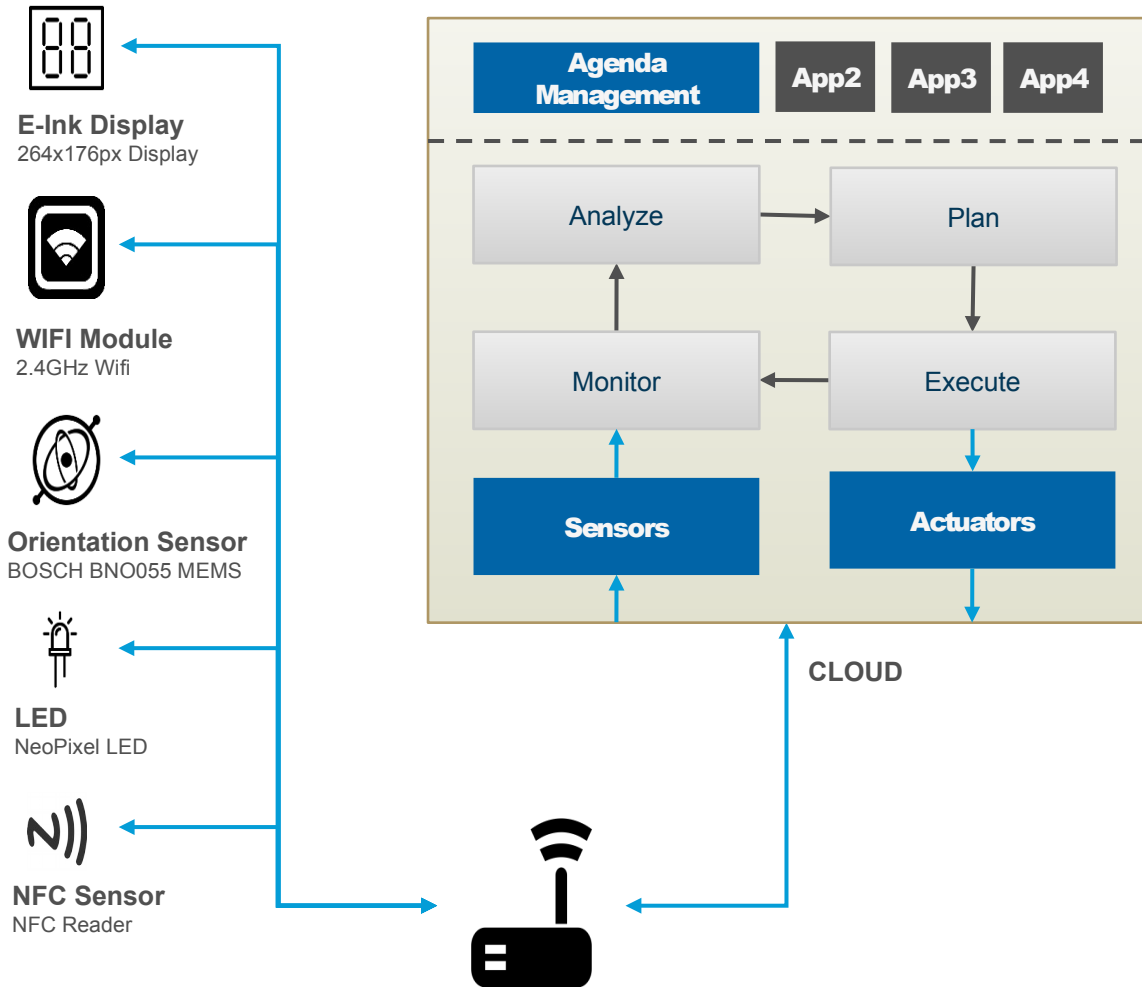And B2C too

Hot Future CPS Ecosystems

▶ Lean IoT Ecosystem Development

▶ Cyber-Medical Software Ecosystems Development (mit Zertifizierung)

▶ What We Really Have Tried in the Course

  ▪ To let you create a technical platform for a IoT seco and haco (ecosystem)

Software as a Business, © Prof. Uwe Aßmann

Cube-Its ("cube intelligent thing") – A Modular IoT Platform with Cloud Backend

https://woi.inf.tu-dresden.de/ideadetail/cube-its---issue-tracking

Software as a Business, © Prof. Uwe Aßmann

E-Ink Display
264x176px Display

WIFI Module
2.4GHz Wifi

Orientation Sensor
BOSCH BNO055 MEMS

LED
NeoPixel LED

NFC Sensor
NFC Reader

Agenda Management	App2	App3	App4

Analyze	→	Plan
Monitor	←	Execute
Sensors		Actuators

CLOUD

Navigation Cube-It [Lisa Schönbach]

- https://woi.inf.tu-dresden.de/ideadetail/wegweiser-togo

- Use Cube-It as Road Sign in a supermarket

- Navigation of Customers

- Information on Products

[drawing from URL]

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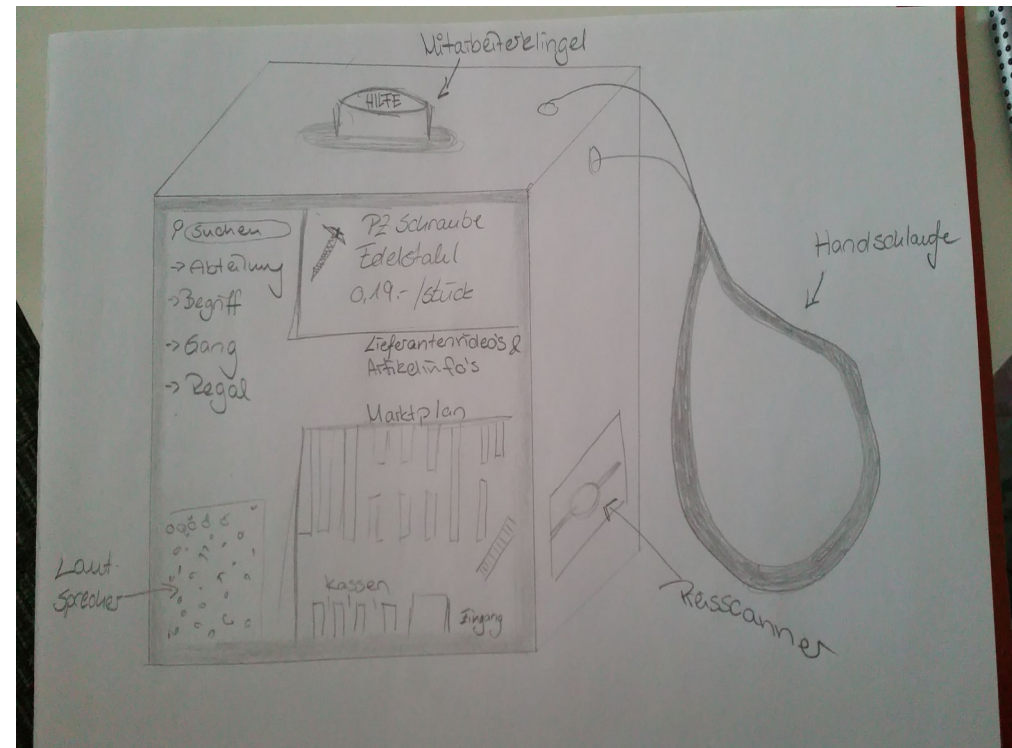
Cube-It for Robot Control

▶ Utilizing a Cube-It to control a robotic arm

- Gyroscopic sensor translates into movement
- Integrated into the IoSense Sensor Tool-Kit (STK)
- https://www.youtube.com/watch?v=GDY0dwD3ntU&t=114s

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The End

- ▶ Explain why software ecosystems create shared value
- ▶ Explain why platform owners get access to further user groups by opening their platform
- ▶ Which role in a CPS software ecosystem will be taken by the TüV?
- ▶ Why is Eclipse a good candidate for a platform leader in a CPS software ecosystem? Classify the Eclipse strategy according to Cusomano "Staying Power".
- ▶ For your own product line, can you explain how to develop a directed SECO?
    - ▪ An undirected SECO?
    - ▪ A market place?

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