AKSS: Software Ecosystems

Evolution of a platform -
Challenges inside a Software Ecosystem

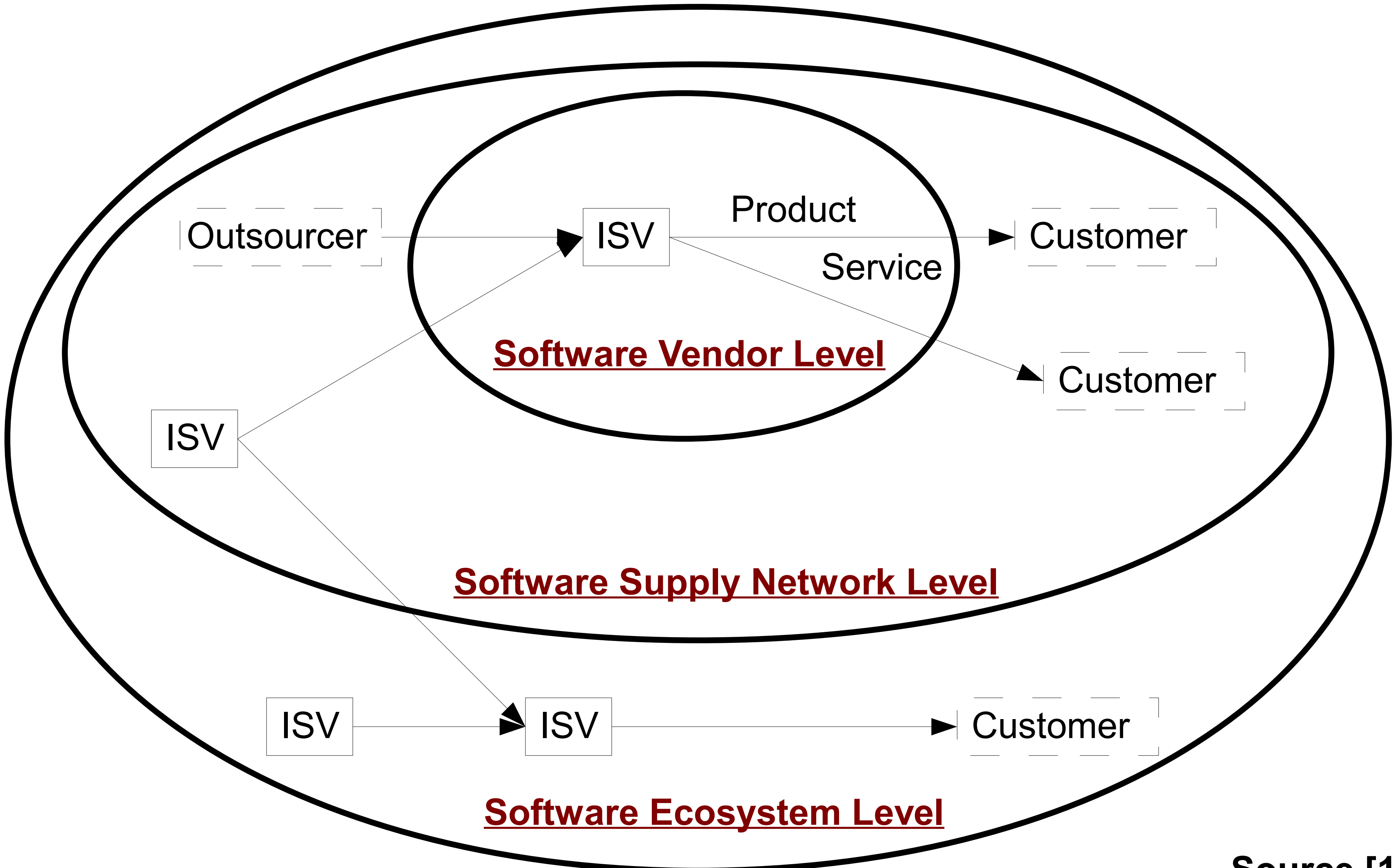
29.11.2012

Introduction

"What do you want to accomplish with a SECO?"

"What challenges have to be considered?"

Different Perspectives



Source [1]

Software Vendor Level

Own products and services only

- Product Line Planning, see also:

  "Software-Produktlinien-Entwicklung in
  Software-Ecosystemen" from Martin Russer
- Knowledge Management (e.g. guides, feedback, videos)
- Architecting for extensibility, portability and variability
- Development organization system integration

  (keep other interfacing systems in mind → automatization)

Software Supply Network Level

Include first-tier buyers and suppliers

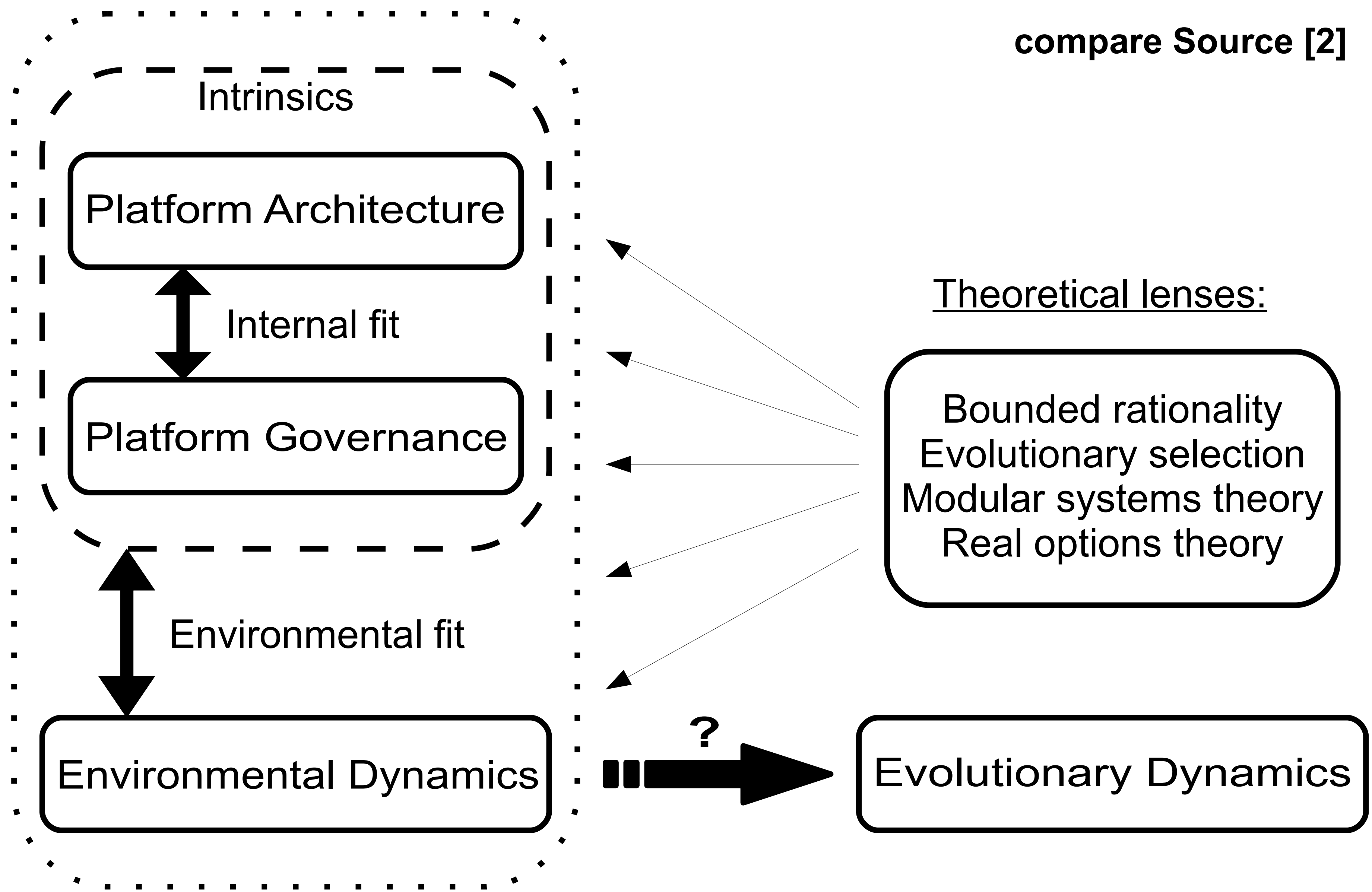
- Establishing relationships in a SSN
  - Meetings, workshops, different web portals
- Release heartbeat and release timing
  - Developer want to reuse the newest features
  - End-users demand a stable system
  - Common solution: beta-channels
- Managing quality in the SSN
  - Certification, testing

Software Ecosystem Level

All interacting business units

- Characterisation and modelling of SECOs
  - e.g. size, livelihood, presence of standards
  - Currently no modelling formalism
- Developing policies and strategies within SECOs for SECO orchestration
- Determining a strategy to thrive and make profit in an SSN
  - e.g. iOS App Store 30% apple, 70% developer, yearly fee

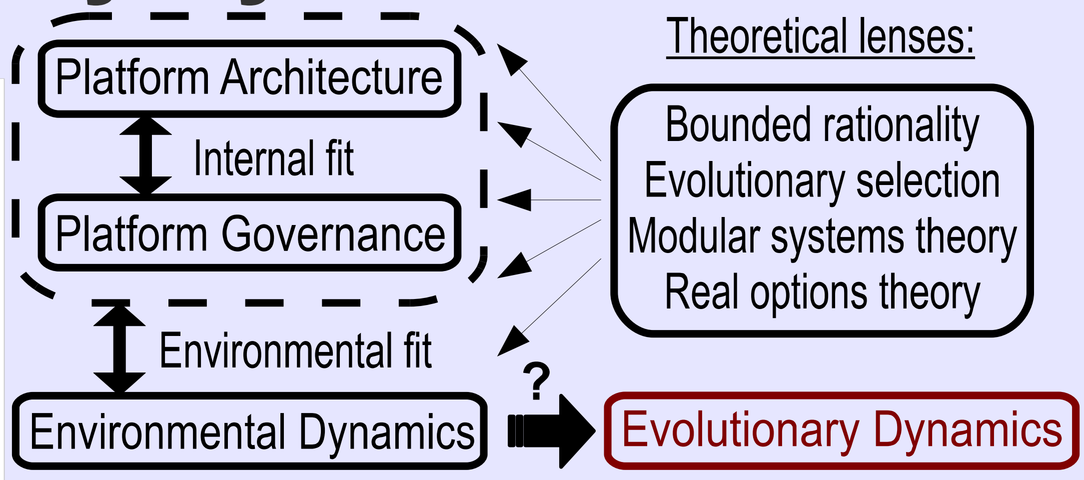
Overview


compare Source [2]
Intrinsics
Platform Architecture
Internal fit
Platform Governance
Environmental fit
Environmental Dynamics
Theoretical lenses:
Bounded rationality
Evolutionary selection
Modular systems theory
Real options theory
?
Evolutionary Dynamics

Slightly simpler definition

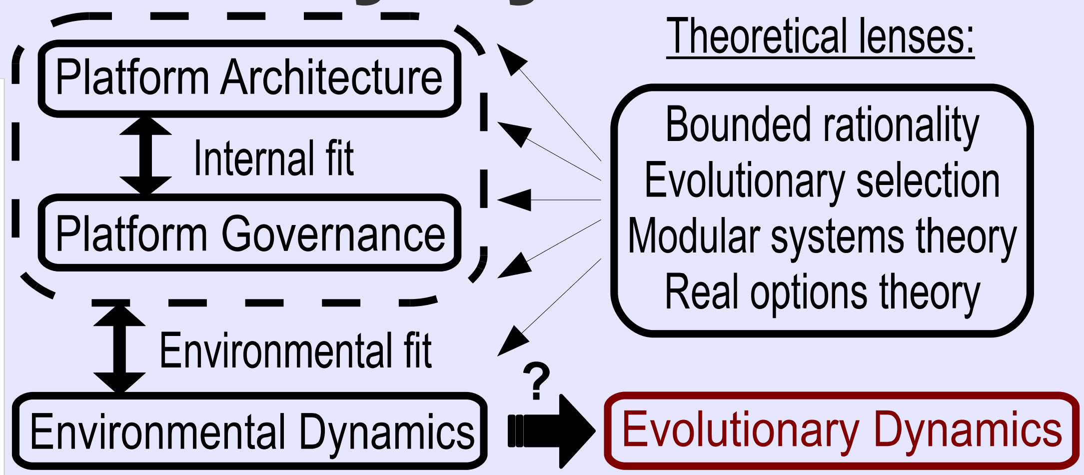
- SECO = collection of the software platform and the modules specific to it
- Two different levels of analysis
  - SECO level or
  - module/platform level
- Applicable to each area of challenges
- Potentially different causal explanations and contributions

Evolutionary dynamics



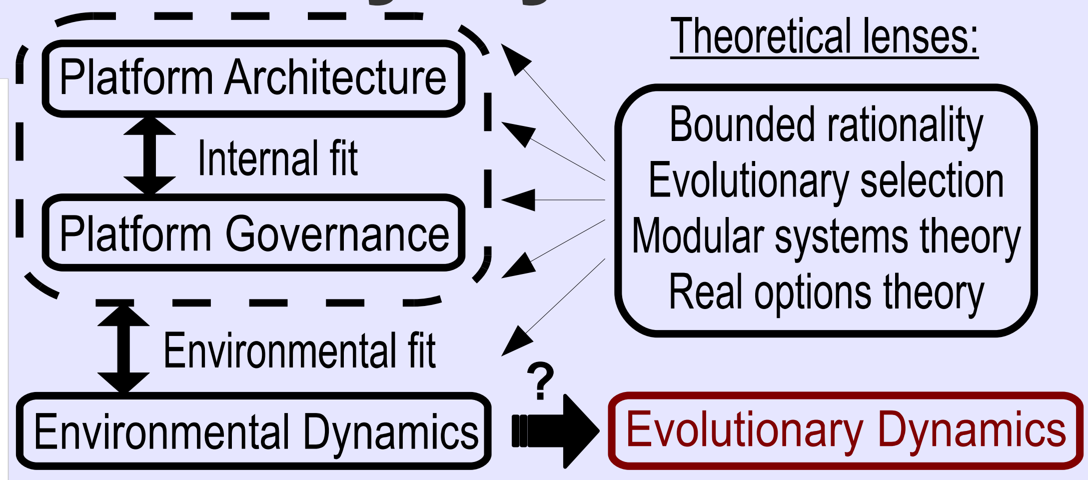
- Supplement pervasive, classical notions of performance (e.g. efficiency, effectiveness...)
- Temporal distinction in short and long term evolutionary dynamics helpful
- Relativ to the livespan of the SECO
  - Operating systems about 5-10 years
  - Smartphone Apps about 6-24 months

Long term evolutionary dynamics



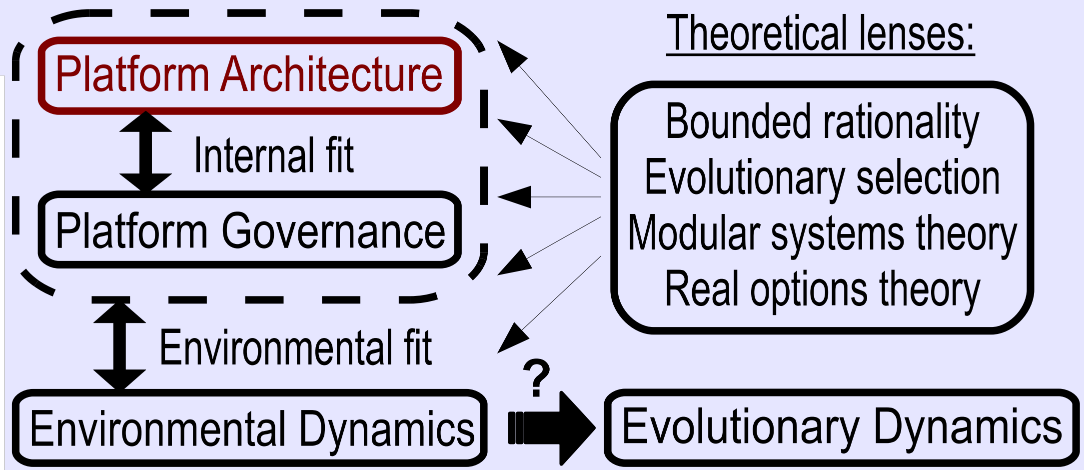
- Evolution rate
  - Android ~six months
  - iOS first ~yearly
- Envelopment
  - Integration of functionality from a different SECO
- Derivative mutation
  - Unanticipated creation of a spin-off
- Survival/mortality
- Durability
  - Persistence of market advantages and distinctiveness
  - e.g. Apple Siri

Short term evolutionary dynamics



- Composability
  - Ease with witch functionality-extending changes can be made to a platform/module
  - Without compromising integration or functionality
- Malleability
  - Ease with witch the platform/module can be reconfigured to refine/extend their behaviours

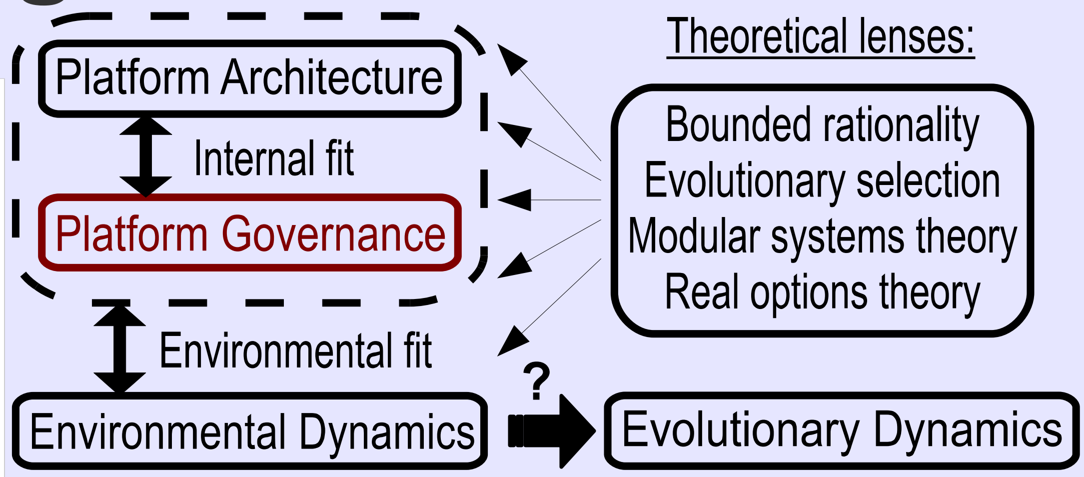
Platform architecture



- Decomposition
  - e.g. iOS four layers
  - Different modules
- Modularity
  - Avoid ripple effects between modules
- Design rules
  - Have to be stable and versatile at the same time
- Changes often irreversible or at least difficult to reverse

  → “Humpty-Dumpty” problem [2]
- see also: “Architektonische Herausforderungen in Software-Ecosystemen” from Michael Strotz

Platform governance



“**Who** decides

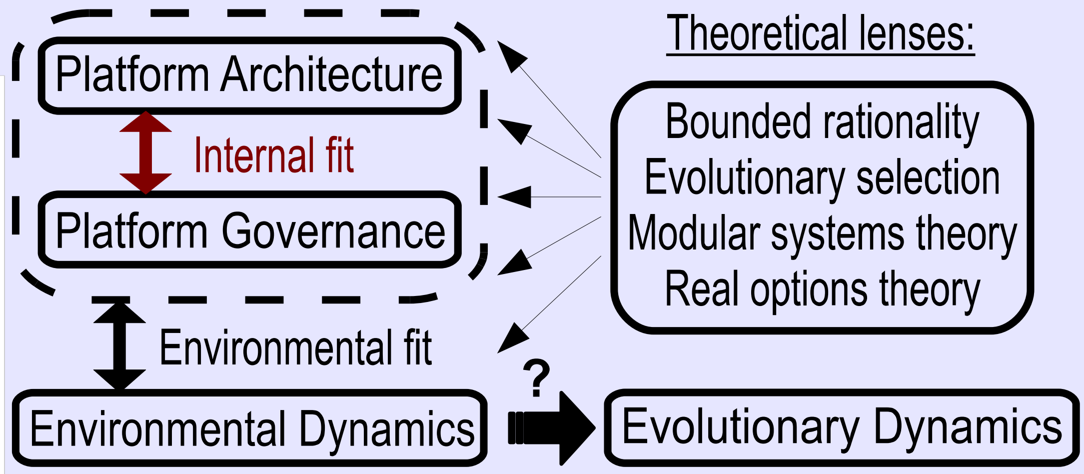
when what?”

- Control
  - Formal and informal mechanisms
  - Can be bidirektional: platform owner ↔ module developer
- Decision Rights Partitioning
  - what, how, who?
- Proprietary versus Shared Ownership

see also: “Architectural Guidance & Governance”

from Klaus-Benedikt Schultis

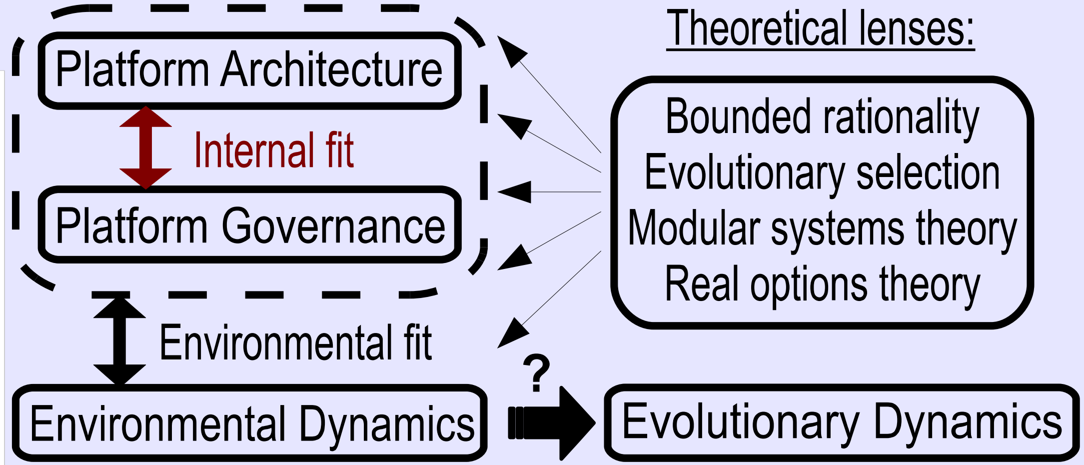
Internal fit



„How are evolutionary dynamics influenced by the interplay of platform architecture and governance?“

- Architecture changes over time
  → coevolution of governance beneficial
- Complementarities
  - Architecture reinforces/diminishes the influence of governance

Example for internal fit



- At the module level
- Modularity + control

  → better composability

  – Modularity decreases interdependencies

    → isolates ripple effects from errors

    → less coordination necessary

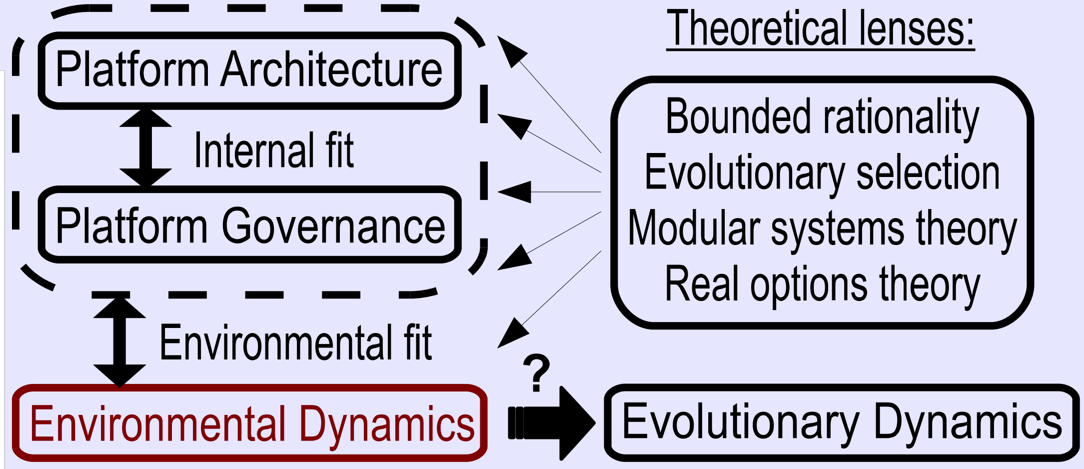
    → reduced module-to-platform integration effort

    → supports changes to single modules

    → better composability

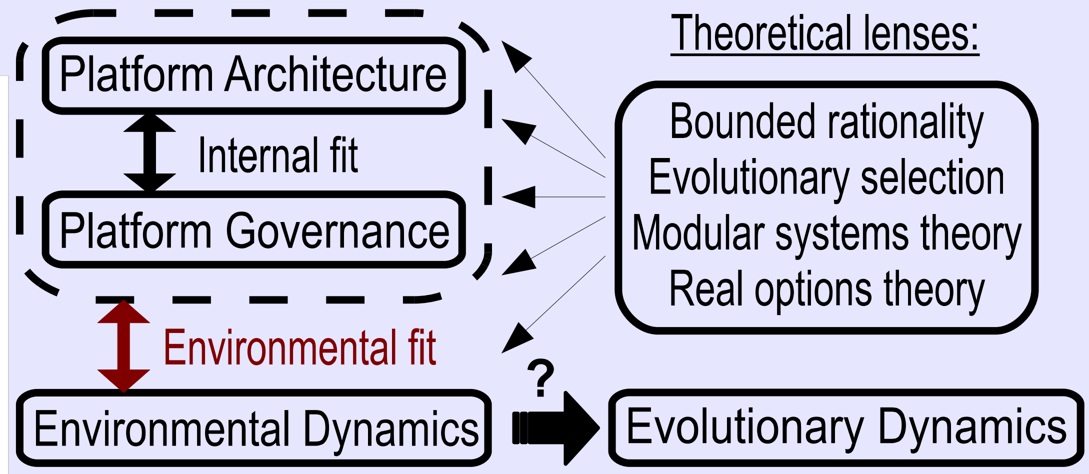
  – Output control sufficient, process control obstructive

Environmental dynamics



- Convergence
  - Emergence of complementary and substitutive technologies
  - Convergence of adjacent domains → envelopment
- Multihoming costs
  - Developer's costs of associating with multiple SECOs
  - Also consider documentation, toolkits, adapters...
- Influence exerted by complementors
  - influence/services from outsiders (e.g. AT&T→Apple)

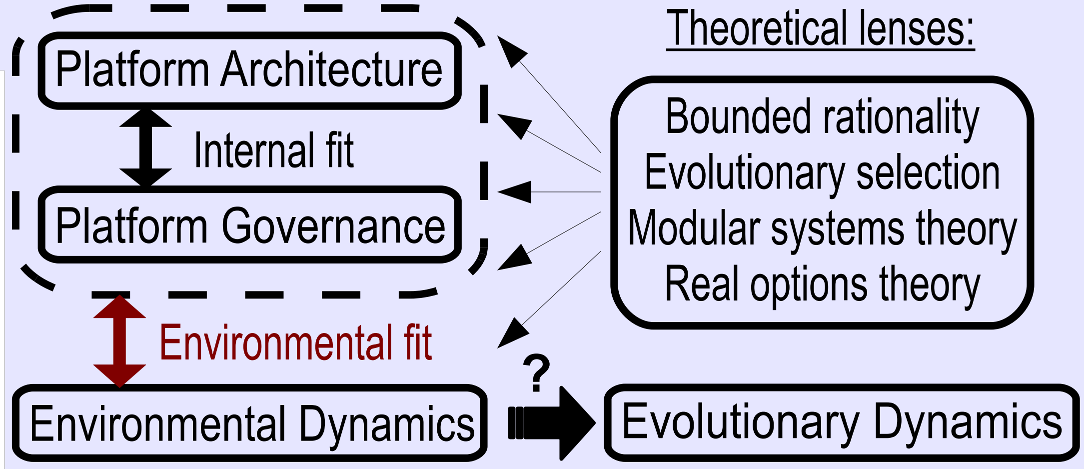
Environmental fit



„How does the interplay between the platform and its environment influence the evolutionary dynamics of the SECO?“

- “Hammer- and-nail-problem” [2]
  - Mutual interaction as choices influence expectations
- How fast can opportunies be exploited/recognized?
- When to make/announce decisions?

Example for environmental fit

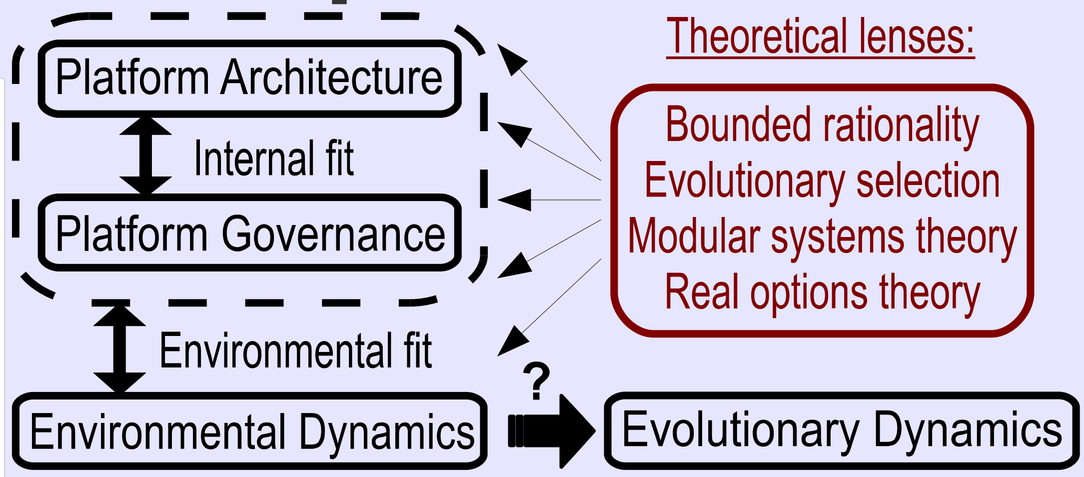


- At the SECO level
- Modularity + convergence → envelopment
  - Convergence leads to envelopment opportunity
  - Modularity allows to actually exploit this opportunity

  → Convergence and modularity cooperate
- Unflexible architecture obstructs envelopment

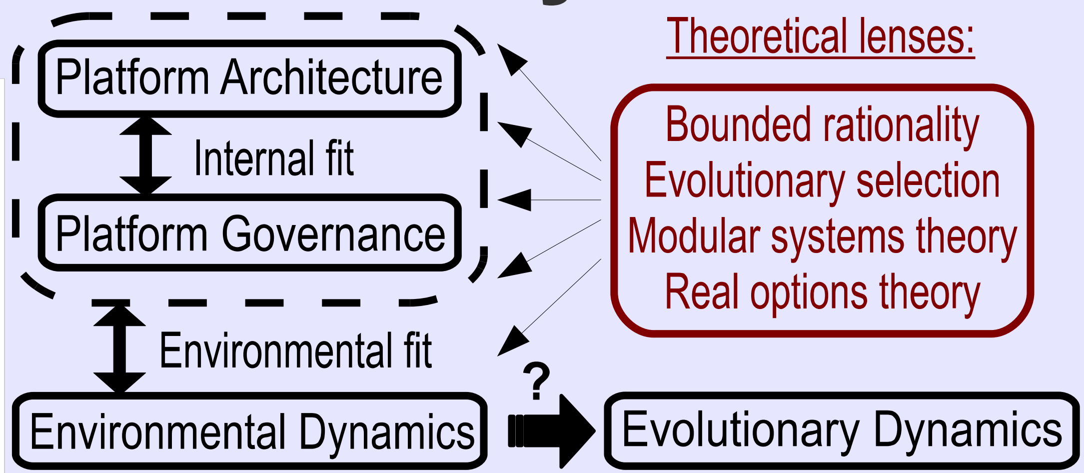
  (Regardless of existing opportunities)

How to find causal explanations?



- "Theoretical lenses"
- four not widely used ones
  - Bounded Rationality
  - Evolutionary Selection
  - Modular Systems Theory
  - Real Options Theory
- Could prove especially useful to find causal explanations

Bounded Rationality



Premise:

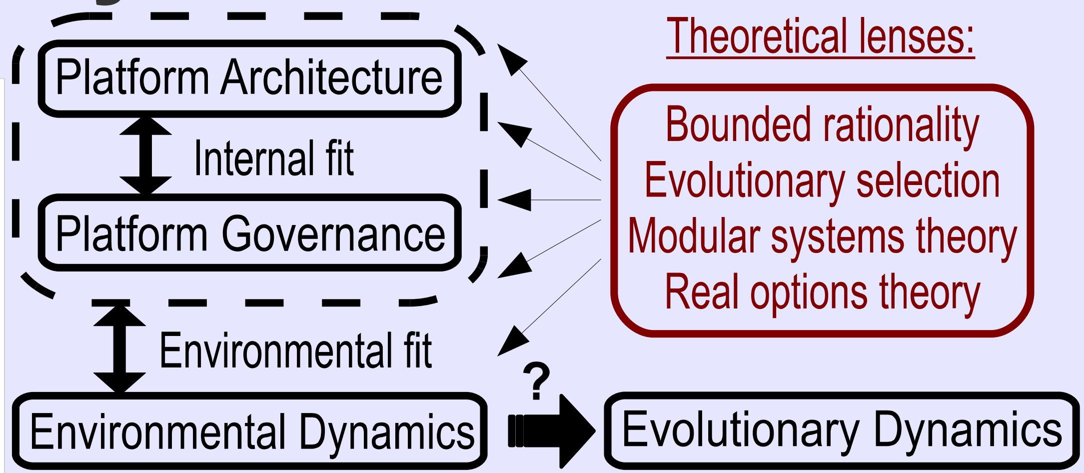
Developers only can process and interpret a bounded volume of information

→ leads to “good enough solution”

→ impact onto the evolution of the SECO

- Limit scope of information a developer must process
  - e.g. use stable design rules
- Contain ripple effects from errors
  - e.g. through modularization

Evolutionary Selection



Premise:

A higher evolution rate and diversity lead to a better environmental fit.

- Decomposition + influence of complementors → mortality
  - Higher grade of decomposition

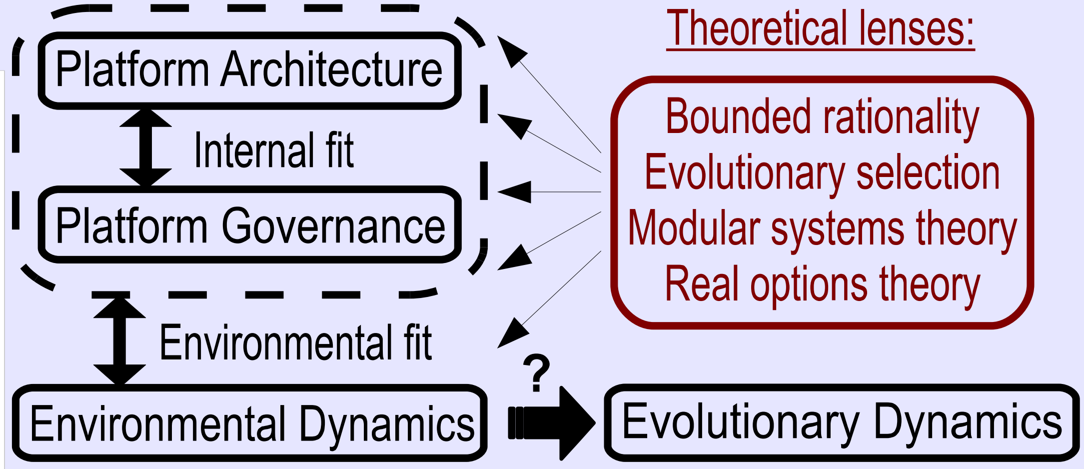
    → faster evolution through recombination

    → better chance of survival
  - In contrast: increasing influence of complementors

    → constrains or even cancels out benefits of decomposition

    → increases likelihood of the SECO's mortality

Modular systems theory

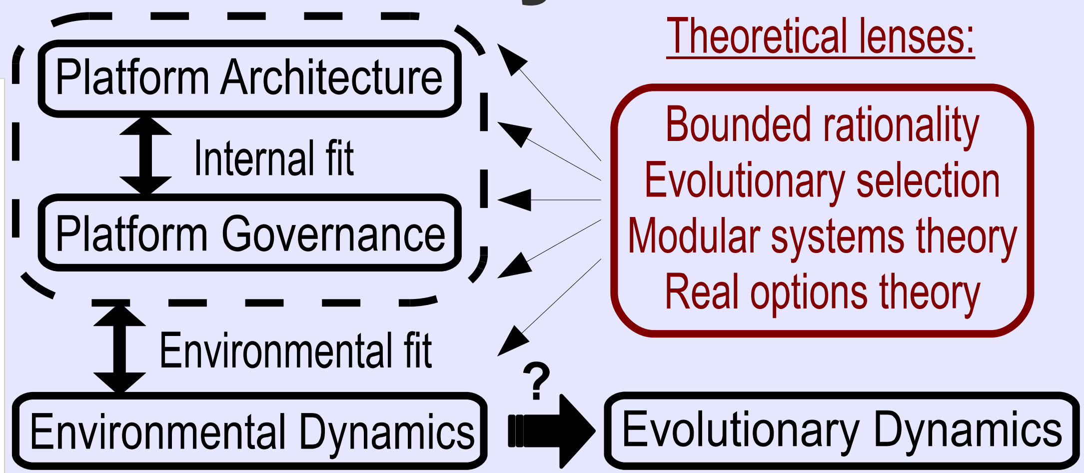


Premise:

A system, which is composable into smaller subsystems, which only interact only through predefined, stable interfaces is more amendable to changes.

- Ideas especially interesting in SECOs:
  - Decreased need for coordination
  - Less effort to manage dependencies
  - Can replace process control
  - Allows for deeper specialization

Real options theory

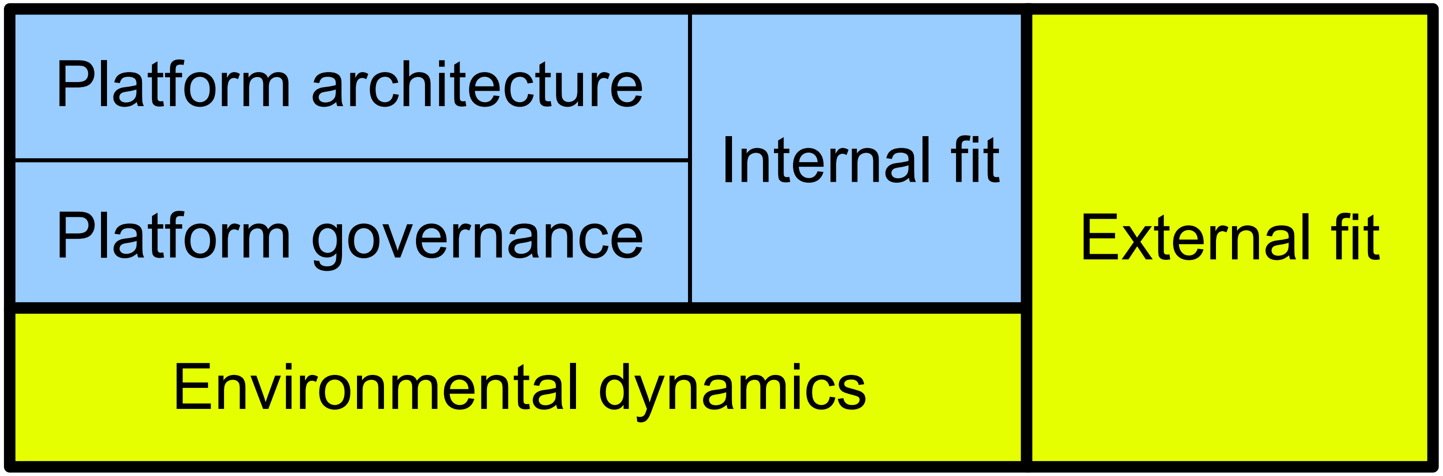


"The right to do sth. without the obligation to do it"

- Entails future flexibility
- Has to be consciously embedded within the architecture
  - Upfront option accquisiton cost
  - Opportunity to exercise option when beneficial
  - e.g. modular operators: splitting, substitution, augmentation, exclusion, inversion and porting
- More valuable with greater uncertainity in the environment

Conclusion

- Different perspectives (each with own challenges)
- Five big areas of challenges:



- Different theoretical lenses to deliver causal explanations

Underlying literature

- [1] S. Jansen, A. Finkelstein, and S. Brinkkemper, *"A sense of community: A research agenda for software ecosystems"*, in 2009 31st International Conference on Software Engineering - Companion Volume, 2009, pp. 187-190.
- [2] A. Tiwana, B. Konsynski, and A. A. Bush, *"Research Commentary--Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics"*, Information Systems Research, vol. 21, no. 4, pp. 675-687, Nov. 2010.

End of Talk

Time for questions