Adaptive 2020 Track

ESES: Evolving Software Ecosystems and Services

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Related background
- Head of research group: Software Engineering & Formal Methods
- Vice-head of research group: Security & Privacy
- Research areas:
  - Formal Methods in Software Engineering
  - Artificial Intelligence in Software Engineering
  - Reliable and Secure Data Ecosystems
  - Decentralized Systems Technology
  - Supply chains, Logistics, and FinTech

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Related background
- Research group: Sustainable Ecosystems Engineering
  [Link](https://www.isse.tu-clausthal.de/en/research/research-groups/sustainable-ecosystems-engineering)
- Co-Founder: Sense4Future
- Freelance lecturer: Software Engineering & IT Security
- Research areas:
  - Data- and Information Quality
  - Data- and Information Marketplaces
  - Circular Economy and Sustainability
  - Community Driven Ecosystems
Evolving Software Ecosystems and Services

• Everything is evolving, such as our society and software systems

• On the one hand, new requirements create the need for new technologies such as IoT, Blockchain, AI, AR/VR, 3D Printing

• On the other hand new technologies create new requirements

• An ecosystem is a heterogeneous, cooperative group of entities that are not just technical entities but also people and their relation

*Survival of the fittest – Herbert Spencer, 1864*
Kinds of Ecosystems

• Business ecosystems: centers on a firm and its environment
• Innovation ecosystem: focused on a central innovation and a set of components which support it
• Platform Ecosystems: here, all the actors are organized around a platform
• Software Ecosystems: Defined as the interaction of a set of actors on top of a common technological platform that results in a number of software solutions or services
• Digital Ecosystems: an open community-driven, loosely coupled union working towards a common goal.
Towards data vs service vs software SCM

Data/service/software supply chain management (SCM)
Interconnected, interrelated or interlinked networks, channels and node businesses combine in provision of products and services

Challenges:
• Uncertainty in demand and/or supply
• Changing customer requirements
• Decreasing product life cycles
• Fragmentation of supply chain ownership
• Conflicting objectives in the supply chain
• Conflicting objectives even within a single company
Governing the dynamic evolution of software ecosystems

- Interdisciplinary, systemic model for control for sustainable ecosystems
- Governance and policy, i.e., automated or manual
- Incentive models for participating and sharing resources
- Fairness, dependability, and trust in ecosystems
- Tension of openness in value creation and control of value capture
- Ecosystem properties, i.e., guarantees and emergent properties
- Technical and organizational decentralization
Future Challenges

• Finding the right balances
• Building new Business Models
• Legal and organizational challenges
• Semantic interoperability
• Governance and provenance models
• Building sustainable Ecosystems
• Balancing between technical progress and sustainability
Presentations

• Business Ecosystems:
  • Development of a digital ecosystem using the example of Amazon
  • Analysing the Impact of the Implementation of a Blockchain in an Existing Business Model
  • Anonymization of Transactions in Distributed Ledger Technologies

• Innovation Ecosystems:
  • Robot Cognition in Disassembly - Advanced Information Processing for an Adaptive Dismantling Ecosystem
  • Towards an Evolving Software Ecosystem in the Mining Industry
  • A Catalog-based Platform for Integrated Development of Simulation Models

• Software Ecosystems
  • Towards Improving Software Architecture Degradation Mitigation by Machine Learning
  • Automated Configuration in Adaptive IoT Software Ecosystems to Reduce Manual Device Integration Effort: Application and Evaluation of a Novel Engineering Method
  • Dynamic Adaptive System Composition Driven By Emergence in an IoT Based Environment: Architecture and Challenges