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An Exploratory Study on the Need for Modeling Software Ecosystems: The Case of SOLAR SECO



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Introduction and Motivation

Software-intensive systems have become increasingly ubiquitous, large, and complex, with dissemination in several domains and dependent upon different technologies



Suppliers Distributors Outsourcing companies Developers Technology providers Clients Users Software applications

These systems are usually centered in a software platform, in which diverse elements create a socio-technical network interplay between the social system and the technical system

Introduction and Motivation

Increasing attention has been paid to influence and interdependency in relationships among all the involved players within a competitive market that arises from those software

platforms

Jansen and Cusumano (2012)

Inspired by other areas, Software Engineering community tries to bring and adapt concepts and metaphors in order to tackle nontechnical aspects, e.g., software ecosystems (SECO) in the mentioned context

Dhungana et al. (2010)

Introduction and Motivation

Traditionally, a Software Ecosystem (SECO) refers to a collection of software products with some degree of symbiotic relationship

D. Messerschmitt and C. Szyperski 2003

Such relationships are often supported by a technology platform or by a common market, and they are carried out by information exchange, resources and artifacts However, few analytical models, case studies with real data, and integrated tool support exist





Objective:

To perform an exploratory study on the need for modeling in the SECO field

Secondary objectives:

- To investigate why SECO modeling is still immature as well as try to change this scenario through exploring real cases in industry
- To identify some modeling elements from the SECO literature and to explore them in the context of a real SECO in the educational domain
- To model a SECO using a specific notation to identify its elements and relationships
- To disseminate the relevance of SECO modeling and documentation

SECO Modeling Techniques



Company of Interest / Product of Interest (PoI): The product/company itself.



Supplier: Company or supplier of products and/or services.



Customer: PoI's direct customer.



Intermediary: A company, product or service that operate between two actors in order to distribute a product or service.



Customer's Customer: When PoI is a product or service that will be applied beyond the Customer's borders, it is interesting to know where his/her product will be used to plan future versions thinking about all clientele.

Trade Relationship: Indicates the type of exchange that happens between two actors. Additional details are described in the legend of the model.

Flow: Shows a relationship between two actors, regardless of the exchange that happens between them.



X.Y

OR Gateway: Allows execution of one or more streams between the inputs.



XOR Gateway: Allows execution of only one of the input streams.





SOLAR virtual learning environment



http://www.solar.virtual.ufc.br/

- SOLAR is a VLE designed to enable the creation of a virtual space to attend face-to-face or semi-presential courses
- Based on the use of free software and an architecture integrable with other environments
- 47.000 registered users, with an average of 2.000 daily accesses





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SOLAR SECO

- SOLAR SECO is composed of a set of elements that communicate at <u>different</u> levels
- SOLAR VLE is the <u>basis</u> of the ecosystem, being the <u>technological platform</u> that supports SECO
- These elements involve different institutions, producing or receiving information, supported by different technologies



Identification of SECO Modeling Elements

- Methodology:
 - Literature research to identify models that represent a SECO and initiatives for educational domain
 - SSN notation (mostly used to represent SECO nowadays)
 - Generation of a preliminary SSN model of SOLAR SECO
 - Identify each element of the MLES reference model based on SOLAR SECO
 - Verify if the reference model for MLES is appropriate for an e-learning ecosystem
 - Adjustments to SOLAR SECO and to the reference model







SOLAR SECO SSN Model

- Company of Interest
 - SOLAR community, supported by several types of <u>suppliers</u>: SW, HW, developers, and other systems
- Intermediary
 - SOLAR developers, applications stores, and research committee
- Customers
 - Institutions, platform users, researchers, management systems, external developers and <u>customers' customer</u>
- Aggregator
 - SOLAR Technical Coordinator
 - Managing the SOLAR platform development
 - Responsible to intermediate the trade of new products and services aligned with business needs



A Software Ecosystem for a Virtual Learning Environment: SOLAR SECO

Identification and Comparison of Elements

• Ecosystem roles

- Application developers (web and mobile)
- Domain Experts
- Instructors
- Learners
- Community



Identification and Comparison of Elements

• Ecosystem work products

- Tools
- HW and SW resources
- Activities related to functional requirements
- Intermediate elements were not so clear



Identification and Comparison of Elements

• Ecosystem activities

- Creation, reuse and deployment actions
- SOLAR SECO has an API for integration and access to its database
- SOLAR SECO deployment process is still dependent on the development team



Analysis

- MLES model
 - It is well aligned with the constituent elements of an e-learning environment
 - It allowed the identification of improvement and evolution points in the SECO
- SSN model
 - Better understanding of the relationships between platform, suppliers, customers, and intermediary elements
 - Critical points of the SOLAR SECO became clearer

Conclusion and Future Work



- Our intentions in modeling SECO are:
 - 1. To enable SECO documentation and its dissemination in the literature
 - 2. To identify potential problems
 - 3. To visualize how a specific SECO can evolve over time
 - 4. To allow comparison among different ecosystems
- Future work
 - To refine the SOLAR SECO's SSN model elements

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Questions



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