

Software Ecosystem Roles Classification

Eko Handoyo^{1,2}, Slinger Jansen¹, and Sjaak Brinkkemper¹

¹ Universiteit Utrecht, Utrecht 3584 CC The Netherlands
{eko.handoyo,slinger.jansen,s.brinkkemper}@uu.nl

² Universitas Diponegoro, Semarang 50275 Indonesia

Abstract. When studying software ecosystems, i.e., software-related organizations that collaboratively provide a market, it is difficult to identify the typical roles in that software ecosystem (SECO), and whether certain organizations belong to the ecosystem or not. The main aim of this research is to perform an independent literature review in order to create a classification of the typical roles named software ecosystem role classification (SERC). This research answered the research question, “How should a classification be formulated in order to provide the base for the software ecosystem roles?” The main result is a list of 5 major roles and 12 minor roles based on 9 papers that already discussed role identification in SECOs previously. The classification of these roles includes a description of the fundamental activities for each role. The classification enables those that model ecosystems and business models of software-related organizations to identify players quickly and their roles in ecosystems. Thereby furthering understanding of the underlying business models and value chains.

Keywords: software ecosystems, software industry, role classification, literature review.

1 Introduction

A software ecosystem (SECO) is defined as “*a set of organizations functioning as a unit and interacting with a shared market for software and services, together with the relationship among them*” [8]. SECO vision presents possible actors with the capability to observe moments and threats. SECO vision also approves actors to take on a role that influences the success of a SECO. In order to get a brief analysis of a SECO, several characteristics are already determined, i.e., composition of a SECO, entry barriers and stability. The composition of a SECO describes how it functions and how effectively it reacts to changes, i.e., what categories of actors occur, how broad they are, in what frequencies do they appear and what role do they take on [7]. The representatives of vendors are number, size and role. However, within such ecosystems, it is hard to differentiate these roles [4]. Presently, there exists a plethora of works describing the roles of actors in SECOs [15,14,10,13,3,11,6,12,1]. These works, however, do not claim to be comprehensive.

This paper develops a classification of SECO Roles. Such a classification helps SECO designers to identify typical roles in the SECOS. This led to the following research question, *How should a classification be formulated in order to provide the base for the software ecosystem roles?*

2 Role Classification

This study starts the role classification by reviewing two literature studies (i) a systematic mapping study on software ecosystems (SECOS), proposed by Barbosa and Alves [2], based on 44 papers (ii) a systematic literature review on SECOS, proposed by Manikas and Hansen [9], based on 90 papers.

Moreover, the second step of this study enhances the above-mentioned findings by doing an independent literature review. The literature review was directed at the topic of player roles in software ecosystems. The scope of the literature review was not limited exclusively to the literature published on software ecosystems, because of the robust analogy between the software industries and other business domains. To capture appropriate papers, books and articles, the following keywords were used: *software ecosystem, software ecosystems, software ecosystem roles, software ecosystem players, software ecosystem actors, software vendor, software supply industry, software producing organization*. The selection of these papers was rooted on the following various inclusion criteria (i) should discuss the business software ecosystem primarily (ii) should be written in English (iii) has been published and should be peer-reviewed (iv) has been already cited by other works (v) should be accessible (vi) should describe the role identification comprehensively. Regarding of the inclusion criteria, this study selects nine papers in established publications during the year 2000-2013.

2.1 Selected Papers

To facilitate discussions in the following sections, this section provide a short profile for each of the selected papers in the following paragraphs.

Digital Capital (DC). According to the book of *digital capital*, Tapscott et al. [15] differentiate between the following five classes of network participants: *customers, context providers, content providers, commerce service providers* and *infrastructure providers*.

Value Chain and Production Network (VN). In the paper of value chains and production networks, Sturgeon [14] mentions five types of network actors: *integrated firms, retailers, lead firms, turn-key suppliers* and *component suppliers*.

Software Value Chain (SC). In the book of *software ecosystem*, Messerschmitt and Szyperski [10] declare the decomposition of natural business functions consist of nine sources of values: *industry consultants, application software suppliers, infrastructure software suppliers, system integrators, infrastructure*

service providers, application service providers, information content suppliers, business consultants and end-users organization.

Business Webs (BW). According to the book of Steiner [13], he differentiates between two roles: *shapers* and *adapters*.

Web Service Ecosystems (WE). In the paper of Barros and Dumas [3], they describe the concept of web service ecosystems consist of five actors: *customers, providers, mediators, specialist intermediaries* and *brokers*.

Network Centric Innovation (NI). In the book of Nambisan and Sawhney [11], they propose three players: *architects, adapters* and *agents*.

Software Supply Network (SN). According to the paper of Jansen et al. [6], they recommend twelve lists of software supply network roles: *value-added resellers, resellers, software publishers, software designers, requirements engineers, software developers, product deployers, application service providers, independent software vendors, components-off-the-self vendors* and *original design manufacturers*.

Service Ecosystem (SE). Based on the paper of Riedl et al. [12], they state four network roles: *customers, platform providers, service providers* and *brokers*.

SaaS Ecosystem (Sa). A study of Abdat et al. [1] address the scope of a software ecosystem for five different key players: *SaaS vendors, SaaS providers, end users, resellers* and *integrators*.

2.2 Classification Development

This section describes the development of a new role classification, based on the nine selected papers that already exist in the previous sub-section. The development of a new role classification base on the following steps (i) list all the roles that already exist in the *selected papers* (ii) classify them into several general categories base on the activities, characteristics and the specific deliverables (iii) select the roles into the different-roles: unique elements (iv) develop a descriptive name for each category (v) classify the roles into major (bold) and minor roles. These steps propose a new role classification base on the two following principles (i) the roles should integrate and synthesize the earlier works in this domain (ii) the roles should be simple enough so that it can be easily understood, communicated and remembered. This section applies some symbols of Hong et al. [5], in order to classify the roles within the selected papers clearly: (i) the "=" symbol to indicate that the activities are the same (ii) the "<" or ">" symbols to indicate whether an activity in the major role comprises more or less than the activity in the concerning role, respectively (iii) the "><" symbol to indicate that the activity in the major role partly overlaps the activity of the concerning role (iv) in case a field in the *selected papers* is left blank it means that the activity is not present in the concerning role. Finally, this led to a software ecosystem roles classification (SERC), outlined in Table 1.

Table 1. Software Ecosystems Roles Classification

Role	Activity	Selected papers									
		DC	VN	SC	BW	WE	NI	SN	SE	Sa	
Software vendors	Evolve software										
-Commercial-off-the-self vendors	Build & sell	<	>				<	<			
-Original-design manufacturers	Design, develop & sell							=			
-Platform\SaaS providers	Provide environment	>			<	<	<		=	=	
-SaaS vendors	Provide software as a service									=	
Service providers	Contribute service	=		=	<	<	<		=		
-Product distributors	Deploy, implement & resell								=		
-Software developers	Develop & supply								=		
-Software designers	Supply design								=		
-Application service providers	Supply computer service	>	=						=		
-Requirement engineer	Supply requirement document								=		
-Integrators	Customize user			=				>		=	
-Content suppliers	Supply content			=							
Infrastructure providers	Provide infrastructure	=		=							
Resellers	Buy & resell		=				>		=	<	
-Value-added resellers	Add & resell								=		
Customers\End users	Request service\product	=		><			=		=	><	

3 Conclusion

This paper develops a classification of software ecosystem (SECO) roles. In order to build it, this study conducted an independent literature review, a body of 9 papers discussing upon the identification of SECO roles. This research determined a list of 5 major roles and 12 minor roles. Furthermore, this study completed a description of the fundamental activities for each role. Due to the fast growing of SECOs domain in the software industry, SECO roles are essential concepts to uncover the actor's strategies to play within its SECO.

4 Further Research

First, the new role classification is currently not validated. The classification can be taken a step further by confirming with industry experts.

Second, the inclusion criteria that applied in the paper selection might be extended further, i.e., included the open source software ecosystems to be discussed entirely. According to Barbosa and Alves [2], they stated that such ecosystem is the most areas that published in the SECO domain. Therefore, it would be a significant point to examine such ecosystems.

Acknowledgments. This research project has been supported and financed by the Indonesian PhD scholarship grant number: 3374.1/E4.4/2011.

References

1. Abdat, N., Spruit, M., Bos, M.: Software as a service and the pricing strategy for vendors. *AEBR Book Series*, pp. 154–192 (2010)
2. Barbosa, O., Alves, C.: A systematic mapping study on software ecosystems. In: *Proc of IWSECO* (2011)
3. Barros, A.P., Dumas, M.: The rise of web service ecosystems. *IT Professional* 8(5), 31–37 (2006)
4. Burkard, C., Draisbach, T., Widjaja, T., Buxmann, P.: Software ecosystems: Vendor-sided characteristics of online marketplaces. In: *Informatik* (2011)
5. Hong, S., van den Goor, G., Brinkkemper, S.: A formal approach to the comparison of object-oriented analysis and design methodologies. In: *Proc. of the 26th Hawaii Int'l Conf. on System Sciences*, vol. 4, pp. 689–698. *IEEE* (1993)
6. Jansen, S., Brinkkemper, S., Finkelstein, A.: Component assembly mechanisms and relationship intimacy in a software supply network. In: *15th Int'l EurOMA Conference* (2008)
7. Jansen, S., Brinkkemper, S., Finkelstein, A.: Business network management as a survival strategy: A tale of two software ecosystems. In: *1st IWSECO*, vol. 505, pp. 34–48 (2009)
8. Jansen, S., Finkelstein, A., Brinkkemper, S.: A sense of community: A research agenda for software ecosystems. In: *31st Int'l Conf. on Software Engineering-Companion*, pp. 187–190. *IEEE* (2009)
9. Manikas, K., Hansen, K.M.: Software ecosystems-a systematic literature review. *Journal of Systems and Software* (2012)
10. Messerschmitt, D.G., Szyperski, C.: *Software ecosystem: understanding an indispensable technology and industry*. MIT Press Books (2003)
11. Nambisan, S., Sawhney, M.S.: *The global brain: your roadmap for innovating faster and smarter in a networked world*. Wharton School Pub. (2008)
12. Riedl, C., Böhmman, T., Leimeister, J.M., Krcmar, H.: A framework for analysing service ecosystem capabilities to innovate. In: *Proc. of 17th ECIS* (2009)
13. Steiner, F.: Formation and early growth of business webs: modular product systems in network markets, vol. 8166. *Physica-Verlag HD* (2004)
14. Sturgeon, T.J.: How do we define value chains and production networks? *IDS bulletin* 32(3), 9–18 (2009)
15. Tapscott, D., Lowy, A., Ticoll, D.: *Digital capital: Harnessing the power of business webs*. Harvard Business Press (2000)