The Evolution of A Digital Ecosystem

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ABSTRACT

I am studying the evolution of digital ecosystem, which is characterized as an ongoing recombination of heterogeneous digital components such as Application Programming Interface (API) provided by firms including a focal platform owner. I am focusing on the all versions of 23,985 WordPress plug-ins' source codes from 2004 to 2014. A generative model of network is applied to capture how network centrality and the hierarchical order of sub-network in a network change over time. The studies observe the distinct pattern of the co-evolution of digital ecosystems compared to other open systems. [1]

Categories and Subject Descriptors

D.3.3 [**Programming Languages**]: R, Python

General Terms

Management

Keywords

Digital Ecosystem, Digital Innovation, Complex Network

1. Essay one

Contemporary digital ecosystems are characterized by their generative nature, where third-party developers primarily drive innovations. However, the underlying generative architecture of a digital ecosystem is not well known. In this essay, I explore the structural underpinning of highly generative digital ecosystem and how it is being controlled. I used co-expression network and hierarchical clustering to analyze the data from WordPress. The results show that the way APIs are used to form complex and dynamic ecosystem follows a discernable pattern that is distinct from known Power-Law distribution, even though there is no

central designer who coordinates the design of all plug-ins and the overall growth of the entire WordPress ecosystem. The analysis further reveals that while the APIs created by the focal firm play a central role in shaping the architecture of the ecosystem, some of the external APIs developed by other players also have an important role in shaping the ecosystem, showing the distributed nature of the architecture of digital ecosystem.

2. Essay two

I built an econometric model to predict the pattern of evolution of WordPress plug-in ecosystem from the extracted information in a plug-in network analysis from 2004 to 2014. I hypothesize the impact of network properties on the evolution of digital ecosystem. Using the analysis, I discover a unique evolutionary pattern of the combination of digital components that drive the changes in the topological structure of digital ecosystem over time. My findings suggest that the evolution of topological structure represents a distinct structural interaction derived from the interaction between APIs that play different roles. Some APIs are used as a universal core to form the foundation of the entire ecosystem, while others are used to form the foundation of distinct clusters of Plug-ins and creating diversities within and across different clusters. Also, a structural analysis shows that the rate of innovation does not necessarily increase though the number of APIs in an open ecosystem increases.

3. Essay three

I statistically explore how a digital ecosystem evolves as new APIs appear over time. In particular, I look at the co-evolution of digital ecosystems that are interacting with other neighboring digital ecosystems. I observe that some of WordPress APIs is on the center of hierarchical order of sub-clusters in a network, however, few APIs from outside trigger the change of hierarchy over time from vibrant interactions with existing APIs. The results empirically address how a digital ecosystem can evolve in diverse ways with the combination of other digital ecosystem compared to only when a focal platform's APIs are used to increase platform functionality.