An empirical analysis of the openness dimension of OCPP standard

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An Empirical Analysis of the Openness Dimension of OCPP Standard

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Abstract

Open Charge Point Protocol (OCPP) is a widely used open communication protocol between a charging station and its managing network system. The central promising idea of the OCPP is that it is an open standard, which provides a standardized communication language with the flexibility of giving charging station owners right to switch network providers at their own will. This paper investigates the open standard concept with various aspects in the context of OCPP. By investigating the openness of OCPP across multiple dimensions, this paper represents, to our knowledge, the first attempt to unbox what an OCPP looks from an open standard perspective within the electric vehicle charging infrastructure.

Keywords: standardization; infrastructure; industry

1 Introduction

Interoperability lies in the heart of interconnected nature of global Information and communications technology (ICT) solutions. In order to achieve interoperability, standards act as a medium in connecting anonymous industry players, forming common expectation on the product performance, and shaping trust around product compatibility [1]. Achieving such interoperability, on simplistic terms, relies either on a proprietary standard or on an open standard. The main difference between these two types of standards is that open standard movement aims for establishing industry-wide or nation- wide interoperability among its stakeholders with preventing the rise of any monopolistic power in functioning the interoperability [2]. That way, the standardized knowledge about the interoperability technology will be diffused and facilitate competition in its context which results in variety end-users solutions with lower prices when compared with that of proprietary standards. The following figure represents the main causal model behind the open standards movement:

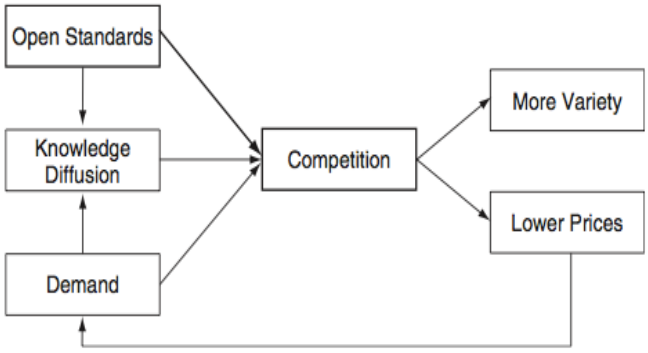

Figure1: Causal model behind the open standard movement (Adapted from [3])

In that paper, the definition that will be used to conceptualize an open standard view it as a technical specification with the following attributes [4]:

- Developed, approved, and maintained by a voluntary market-driven consortium
- Document that details the scope and purpose of the standard should be understandable
- Adoption and implementation of the standard should be publicly available with no-fees or reasonable cost
- Any patent rights should be freely accessible for those implementing the standard

However, when it comes to the realization of open standard concept, an open standard needs to be defined by the degree of openness across multiple dimensions [3]. Through its lifecycle, any standard goes through four main stages: specification, implementation, complement, and usage. Each phase has its own dimension that provides a degree of openness to its stakeholders. A typical process model for any given standard lifecycle can be depicted as follows:

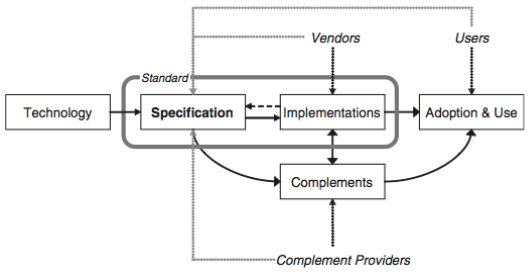

Figure 2: Process model for stakeholders in creation and adoption of standards (Adapted from [3]).

Specification process deals with the conversion of the foundational technology into set of rules for creating interoperability among the desired agents. In the development of non-proprietary standards, specification process shaped by who can participate and how the decisions are being made based on the interest of the participants. Main scenarios under who can participate consist of *fixed group* where founding members have the most power in terms of both deciding who to let in; *qualified members* where existing members of the group decide on the allowance of new firms based on who can bring the most to the development of the standard; *non discretionary membership* in which every single individual or institution can become a member of the development process by following simple steps, such as filling an application form and paying the membership fee; and lastly, *non-member organizations* which work free of any membership requirements and on societal community approach.

Implementation process concerns with making interoperability work in real-time settings. The process builds on the availability of the complete or incomplete specification of the standards in case. In some situations, the standard development organizations encourage interoperability only between the specified implementations. Such standards are called symmetric standards. On the other hand, asymmetric standards do not solely rely on interoperability among specified implementations, but also requiring interoperability among competing implementations and complementary good providers. In such situations, users of that particular standard can leverage on it to provide more customized and extended portfolio of good and services that its customers can reach on.

Usage rights relate to rights that is incorporated in the standards that user of that standards owns. These usage rights are defined by the implementing institution of that standard and include dimensions pricing and terms of usage.

Next session will give an overview of the Open Charge Point Protocol (OCPP).

2 Open Charge Point Protocol (OCPP)

OCPP is a widely used open communication protocol between a charging station and a managing network system. It is currently being adopted by more than 50 countries and 10,000 charging stations around the world with the highest adoption concentration in Europe [5]. It was initiated by the E-laad Foundation in the Netherlands and is mainly adopted across Europe. It allows charging station owners to mix-and-match any network provider in order to meet their unique business cases and requirements by avoiding lock-in to any specific electric vehicle charging station vendor. This increases the flexibility of choosing among various charging station vendors and any back-end IT system

vendor. Below figure shows the position of OCPP in regard to a typical electric vehicle charging model:

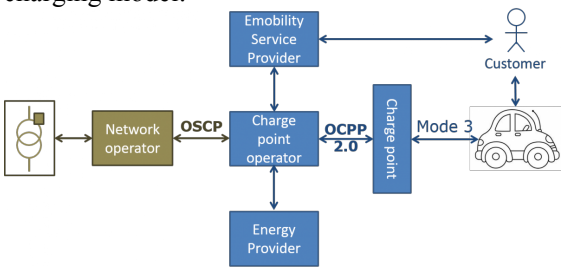

Figure 3: Position of OCPP in an EV charging model [6].

Even though it is widely adopted and used as a "de facto standard" across the world, OCPP is not yet an official standard being recognized by formal standard development organizations. There are some intensions to bring the OCPP into the level of SDOs, but the there are number of concerns related to the working logic of such SDOs that in return can decrease the dynamic development of the protocol [7].

3 Analysis

For the research purposes, I relied on the data available on the Internet from different sources, ranging from various articles, magazines, and official documents released by the Open Charge Alliance that is the development body for the OCPP standard and an interview with the principal designer of the initial version of the OCPP.

3.1 Specification/Creation Rights

At that dimension, two factors play at role. First role relates to the access level participation. The evolution of OCPP went from more closed state into a more open state. In the beginning, the founding bodies – E-laad Foundation, Greenlots, and ESB – were participating in the standardization process. The flexibility that the functionality of OCPP brings has been noted by the various electric vehicle charging industry participant and the demand for participating in the development of the protocol have been increased. Since then in order to respond to the increasing industry interest to the protocol, anyone is allowed to participate in the on-going development of the OCPP protocol given they pay the membership fee and position an interest within the EV charging space [7]. In other words, participation in the OCPP development follows nondiscretionary membership style. Second role relates to the competition among the members, in other words, how competing interests of members are reflected in the decisions of the OCPP development. Major participation goals of the members, in the case of OCPP, are alignment of technology, standardization pace, and learn about a nascent standard [3]. Especially in early phases of a technology standard, general availability of the work in progress documents represents an important measure for openness, but we don't see that in the case of OCPP. Only released versions can be accessed freely by general public. On the other hand, working group participants are provided a platform for discussion, development, and documentation of the OCPP specification. This indication confirms [8]'s finding about the actual level of openness across formal standards development organizations and informal ones, such as industry consortium where in many industry consortiums actual level of openness across the members in developing the standard specification tends to be higher opposite to the conventional thinking.

3.2 Implementation/Complementing Rights

The positioning of OCPP stands as a generic platform where any firm can access it to develop its own implementation as well as develop complementary offerings to their business operations. The specifications of the OCPP protocol are available but the protocol is not open source. This is a typical case in most modern complex systems where specifications of the systems are incomplete and various implementations and complementarities of the open standard may not yield the desired level of compatibility [3]. It is argued that developing reference implementations is more reliable and accurate if the source code is available rather than the written specification [9]. This could also limit the initial flexibility of switching across different network providers due to possible non-compatibility. Some of the biggest adopters of the OCPP noted the criticality and importance of the implementation process. It is empirically experienced by these electric vehicle charge point manufacturers that the promise of interoperability that is desirable by the OCPP is not guaranteed and organizations need to pay special attention to the implementation process in addition to the specification document [5, 10]. On the cost side,

the access to the specification of the standard is freely available under the IPR of E-laad Foundation [7]. From a competition perspective, given the various charging point provider members of OCPP protocol, it might be expected that these would consider to eliminate commoditization of their charging points by developing proprietary implementations of the OCPP protocol. This reflects the current dynamics of business ecosystems [11] where companies cooperate and compete with each other at the same time [12]. The development of the OCPP requires the cumulative effort of multiple parties altogether with a competitive approach between charging point vendors and back-end software firms to be adopted by the electric vehicle charge point operators.

3.3 Usage Rights

Users of the OCPP protocol have full rights to use the standard as the specification and description documents can be freely accessed for the finished protocol versions. Since the usage of the protocol is licensed royalty free under the E-laad Foundation, no additional payments by the end-users to are required to use the implementation based on the OCPP protocol [13]. In theory, "monopoly in the technology is accompanied by full competition in the market for products and services based on the technology, with no a priori advantage based the ownership of the rights for the rights holder" [14]. In other words, when access to the specification document is equally distributed among economic agents a standard tend to be a defined as an open. For example, for the access to the specifications documents with respective versions of the OCPP can be accessed on [15]. With the introduction of OCPP 1.6, there are two possible implementations of the standard, JSON and SOAP, respectively. Both implementation documents are made available by the OCA consortium for any industry participant to use.

4 Conclusions

The concept of openness has been receiving increasing attention especially from technology-driven industries. Given the pervasiveness and fast changing pace of information technology goods and services, companies are moving towards more collectively driven action in designing their businesses. This is not a surprise as new industries are emerging on the basis of the injection of digital technologies into the existing industries and this requires core competence of various actors. For example, electric vehicle charging industry is emerging on the basis of a "hardware-software" paradigm where charge points constitute the hardware part and the back-end systems with the ability of managing the hardware constitute the software part. We have already witnessed the failure of proprietary charging systems even though the industry is still a nascent one [16, 19]. When we look closer to these failures the reason tends to be a charging stations' inability to react to changes and needs of the industry at that particular given time due to specific lock-in effects they face. In that sense, OCPP represents an open standard, which aims to provide a standardized interoperability between the charge points and back-end systems used to manage these charge points. And, the criticality of OCPP for the further development of the charging market lies here. First, the non-discretionary membership style encourages different core competences for further development of the standard, which implies they are able to bring the latest technological advances from their fields to update the OCPP and make it very responsive to changing industry dynamics. Second, as most of the charge point manufacturers have started to produce charge points that are compatible with fast-charging standards available on the market [17], the further adoption of electric vehicles can be supported by the new charging infrastructures. As companies have flexibility to choose between various charge point and back-end software vendors by the help of OCPP, the complementary perspective between the electric vehicles and charging infrastructures can be strengthened.

In addition, the investigation of various openness degrees of OCPP shows that causal model depicted in Figure 1 is a useful conceptualization of further market ramp-up for the charging industry. Especially, the competition among the organizations within the charging industry will be of importance. It is much more easier to select among various vendors with the use of open standards, but this comes with a cost of differentiating yourself from your competitors. The Red Queen theory of competition [18] suggest that monopolists, with their proprietary solutions, may outperform their competitors in the short term, but organizations facing rivalry and competition from their competitors becomes more high-performing over time because the competition they face help

them to improve and become more capable in driving innovation in their respective industries. With the high number of entrants into the charging industry due to the high potential of leveraging such open technologies and standards will probably intensify the competition among the industry players, which will be beneficial to the development of the charging industry.

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