

Electronic Payment Frameworks

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INTRODUCTION

The use of electronic payment (e-payment) systems to make payments for the access to contents and services is more and more usual. Currently, for making e-payments we can use systems such as Paypal, Bitcoin, Ripple, Apple Pay, EMV. Indeed, the use of cryptocurrencies as Bitcoin has supposed a revolution in the e-payments arena (Hileman, 2014; Vigna & Casey, 2015).

This diversity of payment options with the support of different business models (pay-per-use, flat rate, the incorporation of discounts, tickets or loyalty information, etc) arises the need of systems that support different issues regarding the purchase such as the discovery of the payment information associated to the product/service with payment options supported, the negotiation of the payment option to make the payment, and the reception of a receipt of the transaction. To cope with these issues, the definition of e-payment frameworks has been proposed. These frameworks aim to facilitate, along the purchase process, the exchange of payment information and the use of different payment instruments in an easy way at the same time it guarantees interoperability, trust and security (Jaffe & Boyera, 2015; Ruiz-Martínez et al., 2012).

This article presents what an e-payment framework is, its main features and benefits, what the main e-payment frameworks proposed so far are and, the current initiatives that are being devel-

oped. For each framework developed so far, the article presents its key features and differences with previous works. The presentation of the different frameworks proposed so far will allow the reader to understand the evolution of these frameworks and how different features have been incorporated along the time. Once previous works have been presented, the article introduces the most recent work in this field, that is, the work that is being developed by W3C with its Web Payment Activity Initiative. Then, we present future research directions by indicating the main challenges to be addressed. Thus, the reader will have a broad vision of e-payment frameworks.

BACKGROUND

This section provides some information on the different phases that comprises a payment process. The knowledge of this process is fundamental to understand the different elements that are defined in an e-payment framework.

Payment Process

The process of making purchase on the Internet is divided into the following stages (Maes et al., 1999): need identification, product brokering, merchant brokering, negotiation, purchase and delivery, and product service and evaluation. Thus, once the user realizes that he/she has a need, it

gathers information regarding the product and the merchant, then, client can negotiate the conditions with the vendor. Once the conditions have been agreed, the purchase and delivery of the product is made. Finally, several processes related to user satisfaction could be performed.

Recently, the W3C's Web payments activity initiative (W3C, 2014) considered that the simplest purchase comprises four steps: publishing an asset, publishing a license, publishing an offer, and performing the purchase.

In both cases, we can point out that, in order to make a purchase, we have to manage two kinds of information: information describing the product/service and its merchant, and information regarding the payment process: payment systems available to perform the payment, receipts, etc.

ELECTRONIC PAYMENT FRAMEWORKS

This section aims to provide the definition of what an e-payment framework is, what its main features are and its benefits.

Definition

In the literature there are different definitions of what a e-payment framework is. Next, the most relevant are presented.

Fischer et al. (2002) consider that an electronic payment framework aims to integrate payment instruments into e-commerce applications and should, at least, address the specificity of the payment instrument and the underlying protocol.

In SEMPER Framework for Secure Electronic Commerce (Schunter, 1999; Lacoste et al., 2000), it is considered that, from a technical point of view, a payment framework describes a generic model for performing e-commerce transactions between two parties through a set of services (supporting, transfer, exchange, commerce services) enable the integration of any payment protocol and product in such as way that applications were not restricted

to the use of specific protocols or proprietary solutions or technology.

Ruiz-Martínez (2015) mentions that the purpose of a web payment framework is to facilitate the purchase process and the exchange of payment information, supporting that different payment instruments can be used and guaranteeing interoperability, security, and trust.

In this paper a payment framework is defined as a set of extensible elements and/or services, generally, organized within a set of layers and that is designed to facilitate the use of different payment systems in a unified manner during a payment process. Thus, for the developers of payment-based applications, the incorporation of new payment systems is easier, transparent and can enhance user's trust (Gefen et al., 2003; Wareham et al., 2005).

Main Features

The different features that an e-payment framework should offer are:

- *The support of different payment instruments and their underlying protocols.* It should support different kinds of payment models such as credit or debit, using different payment instrument such as credit cards, e-checks or digital cash, and different payment protocols (Bitcoin, EMV, etc). This support should be made through a generic Application Programming Interface (API).
- *The support of different kinds of devices for making the payment and storing payment information.* The payment could be made through desktop computers, smartphones, ebooks readers or automobiles. It should also support the use of different devices that could increase security, such as secure elements or secure storages.
- *The specification and exchange of the payment information associated to the purchase.* Payment information (prices, pay-

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