Interledger: Creating a Standard for Payments

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ABSTRACT

The web has enabled free and open information exchange for a vast number of users around the world. However, it has so far failed to do the same for payments. Instead of finding the cheapest route for each payment from a competitive network of providers, we rely on a small number of proprietary operators with global reach.

The work happening at the Web Payments Working Group at W3C is attempting to remove some of the friction in performing payments on the Web by defining a standard payment API and messaging in browsers. This will make payments on the Web easier but not entirely frictionless or integrated.

As active participants in the W3C's Web Payments Working Group we present a browser polyfill[7] of one of the prosed payment APIs and will walk the audience through the goals of the WG and vision of how payments will work on the Web in the future.

Building on this, we will introduce the Interledger Protocol (ILP), a new neutral payments protocol being incubated in the Interledger Payments Community Group, also at the W3C. We will demonstrate how, in the future, the combination of the W3C's Web Payments APIs and the power of ILP payments will not only be frictionless but fully integrated into how we use the Web. Ubiquitous payments in an Internet of Value.

Keywords

Web Payments; Interledger Protocol; ILP; Internet of Value

1. THE INTERLEDGER PROTOCOL

The Interledger Protocol (ILP) is an open protocol for secure payments across disparate payment networks that is being developed in the W3C Interledger Community Group [3]. ILP is unique in that it is built on Web technologies, it provides a minimal standard to connect payment networks as disparate as banks and cryptocurrencies, and it enables users to automatically find the most efficient path to pay any given recipient. As it defaults to push-based payments, ILP gives users maximum control and allows merchants to be paid without needing to collect sensitive user information that is a target for hackers.

ILP provides a fundamental building block for the Web: where the internet protocols provide the functionality for relaying and routing information, ILP provides these functions for money. Ultimately, the goal is for ILP to be adopted by existing and new payment systems, merchants, websites and web browsers alike.

Digital payment systems use *ledgers* to track accounts and balances and to enable local transfers between their users. Today, there are few *connectors* facilitating payments between these ledgers and there are high barriers to entry for creating new connections. Connectors are not standardized and they must be trusted not to steal the sender's money.

ILP is a protocol for *interledger* payments that enables anyone with accounts on two ledgers to create connections between them. It defines a mechanism to achieve two-phase commit for financial transactions on a set of ledgers distributed across the Web.

To achieve the robustness of two-phase commit, ILP defines a mechanism for ledgers to stage the transfers using escrow and commit these transactions upon receipt of the cryptographically signed proof that a pre-agreed condition has been met. This allows secure payments through untrusted connectors.

Any ledger can integrate ILP simply by enabling escrowed transfers. Unlike previous approaches, ILP does not rely on any global coordinating system or ledger for processing payments—centralized [9] or decentralized [10, 11, 12].

ILP lowers the barriers to facilitating interledger payments. Connectors compete to provide the best rates and speed. The protocol can scale to handle unlimited payment volume, simply by adding more connectors and ledgers.

Composing connectors into chains enables payments between any ledgers and gives small or new payment systems the same network effects as the most established systems. This can make every item of value spendable anywhere—from currencies to commodities, computing resources and social credit.

The Interledger Protocol provides:

- Secure payments through any connector using ledger-provided escrow.
- The sender of a payment is guaranteed a cryptographically signed receipt from the recipient, if the payment succeeds, or else the return of their escrowed funds.

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- Two modes of executing payments: In the *Atomic* mode, transfers are coordinated by an ad-hoc group of *notaries* selected by the participants to ensure all transfers either execute or abort. The *Universal* mode instead uses bounded execution windows and incentives to remove the need for any mutually trusted system or institution.

For further details see the interledger whitepaper [13] or download the reference implementations from GitHub [1].

2. WEB PAYMENTS

Payments have been a high friction aspect of the Web experience for many years despite numerous efforts to improve the user experience. For the past few years the W3C has been exploring this topic, first through incubation of ideas in the Web Payments Community Group [4] and more recently through the formal creating of the Web Payment Interest Group [5] tasked with defining a vision for payments on the Web and the Web Payments Working Group [6] who are actively designing a payments system that can be integrated directly into browsers and the Web.

The goal of the Web Payments WG is to increase interoperability between payer and payee systems on the Web, producing benefits such as:

- A better checkout experience for users, particularly on mobile devices.
- Streamlined payment flow, which is expected to reduce the percentage of transactions abandoned prior to completion ("shopping cart abandonment").
- Easier adoption of payment instrument improvements (e.g. related to security) or new payment instruments.
- Added value through machine-readable digital payment requests and payment responses.

This will be achieved through the standardization of:

- The high level flow of a Web payment
- The programming interfaces between the various parties (such as between user agent and Web application)
- The messages exchanged between these parties over the Web.

2.1 The Web Payments API

There are currently multiple proposals [8][2] that the Web Payments Working Group is considering as the basis for a new payment API that will be integrated into browsers and other user agents.

The API will allow websites to request a payment from the user in a standardized way providing the details of the payment request including the amount requested, currency and the methods that can be used to make the payment.

In response the user agent will initialise a payment app (wallet) to execute the payment processing with the website. This automated exchange of payment data will allow for a more streamlined user experience and the introduction of complex interactions between the user's payment app and the website so that advanced new features can be introduced to the process such as sophisticated authentication and payment instrument encryption and/or tokenization.

We have developed a a browser polyfill[7] of one of these APIs[2] to demonstrate how the API might be implemented and how the payment experience will change when this API is rolled out across the Web.

2.2 Adding ILP payments

In the Web Payments flow ILP can be considered as a new payment method which does not rely on the payer and payee sharing a common payment network. Instead a path can be dynamically found that connects the flow of funds from the payer to the payee's account.

We have built a demonstration of a payment executed in the browser using the new Web Payments API but using ILP to find a path for the payment instead of requiring the payer to hold a payment instrument that is supported by the payee.

Through this demonstration we will show that with ILP there is no need for payers and payees to hold accounts with multiple service providers or hold multiple payment intruments. Instead ILP finds the best path for a payment through one or more connectors so that the payer is able to pay from the account of their choice in the currency of their choice directly into the account of the payee.

The implications of ubiquitous, real-time payments are far reaching for the Web. Integrating payments into the fabric of the Web is sure to revolutionize the business models that are possible in an ecosystem where advertising and paywalls are the most common mechanisms for generating revenue today.

3. REFERENCES

[1] Interledger reference implementation. https://github.com/interledger.

[2] paymentrequest proposal. https://github.com/WICG/paymentrequest/.

[3] W3C interledger community group. https://www.w3.org/community/interledger.

[4] W3C web payments community group. https://web-payments.org/.

[5] W3C web payments interest group. https://www.w3.org/Payments/IG/.

[6] W3C web payments working group. https://www.w3.org/Payments/WG/.

[7] Web payments api browser polyfill. https://github.com/justmoon/webpayments-polyfill.

[8] Web payments cg web payments browser api. https://github.com/WICG/web-payments-browser-api.

[9] D. W. Davies and W. L. Price. *Security for computer networks: and introduction to data security in teleprocessing and electronic funds transfer*. John Wiley & Sons, Inc., 1989.

[10] D. Mazières. The stellar consensus protocol: A federated model for internet-level consensus.

[11] S. Nakamoto. Bitcoin: A Peer-to-Peer electronic cash system.

[12] D. Schwartz, N. Youngs, and A. Britto. The ripple protocol consensus algorithm. *Ripple Labs Inc White Paper*, 2014.

[13] S. Thomas and E. Schwartz. A protocol for interledger payments. https://interledger.org/interledger.pdf, 2015.