

A Payment Protocol of the Web, for the Web

Or, Finally Enabling Web Micropayments with the Interledger Protocol

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ABSTRACT

The history of the Web is full of attempts to enable micropayments for content and services. All have failed to achieve widespread adoption.[4][7][9] This has fueled recurring debates about the merits or fundamental flaws of the concept of asking users to pay small amounts for what they use online. As a result, however, of the Web's lack of native payment infrastructure, the only viable business models concentrate earnings and power in a small group of content and advertising aggregators and increase demand for privacy-infringing technologies. We need to learn from the failures of previous micropayment schemes and we need to create a payment protocol that is of the Web, for the Web.

We present a demo browser extension¹ that uses the new Interledger Protocol (ILP) to demonstrate how payments and micropayments can be seamlessly built into the Web. ILP is an open payment protocol for payments across different payment networks that is being developed in the W3C Interledger Community Group. It enables new possibilities for developers and a better experience for users of the Open Web Platform.

Keywords

Interledger Protocol; ILP; micropayments, HTTP 402

1. WHY MICROPAYMENTS ON THE WEB?

The Web connects people, breaks down information silos and embodies the principles of decentralization and bottom-up design. However, the current business models of the Web and lack of native payment infrastructure encourage centralization and the trampling of user privacy. In order to support themselves, content creators and developers currently have three options, none of which are ideal: advertising and tracking, paywalls, or relying on aggregation sites. Giving out credit card details is inconvenient and insecure, so relatively few websites can convince users to pay, and those that can take a significant cut of the proceeds.

Building payments and micropayments into the Web would enable users to frictionlessly pay any creator, website owner

¹Code available at <https://github.com/interledger/http-ilp-extension>

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or developer. This would provide viable alternatives to advertising, paywalls, and aggregation. Additionally, developers could build new open source, peer-to-peer or privacy-protecting services that support themselves with direct payments from their users.

2. 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 [1]. 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 can automatically select the most efficient path for the user to pay any possible recipient.

ILP defaults to push-based payments, meaning that users can send money to merchants' accounts without the merchants needing to collect and store sensitive payment details. In contrast, credit card numbers are used pull from users' accounts and are thus a target for hackers.

Exchanging value is as fundamental as exchanging information so ILP provides an important 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. For further details see the Interledger whitepaper [8].

3. MICROPAYMENT HISTORY LESSONS

Many critics of micropayments have highlighted the unwillingness of users to pay for content and services on the Web. However, the successes of Spotify, Netflix, Blendle, and ApplePay for in-app purchases show that at least some users do pay for some experiences – and that this can be enough. Arguably, users are more willing to pay for convenient, high quality experiences when the price is right and the payment experience seamless. Furthermore, critiques of advertising and tracking-based business models are growing and ad-blockers are becoming increasingly popular as users become more concerned about privacy and less tolerant of interruptions of their browsing experience.

With this understanding we can draw lessons from previous micropayment schemes to begin designing a payment experience that benefits both users and merchants.

3.1 One Neutral Scheme

One of the key ingredients missing from previous micropayment approaches was a scheme with broad enough reach to connect all payers and payees while being open and neutral enough to be adopted as a standard and built directly into the Web. New payment methods built specifically for micropayments face adoption problems and competition with existing payment schemes [4]. Credit cards and alternatives such as PayPal have wide reach but lack universal connectivity because they are controlled by individual companies. Some have argued that Bitcoin offers a decentralized alternative [3][5], but it requires the entire world to adopt a single currency and the financial interests of its early investors mean that it lacks the neutrality of a web standard. Earlier W3C work attempted to support multiple schemes to achieve the necessary neutrality [9], but that path has led to overcomplicated standards that still do not ensure that there is overlap between the payment methods of payers and payees.

A native Web payment scheme such as the Interledger Protocol that is secure, built on Web technologies, open and neutral would connect any user with any website or content creator they may wish to pay. ILP furthermore offers a standard that can be adopted by banks, other payment service providers and cryptocurrency proponents alike.

3.2 User Control and Automation

A second reason for the demise of previous micropayment schemes has been their failure to eliminate the mental transaction costs of making payment decisions while inspiring sufficient user trust. [7] To date, people have tended to prefer subscription payments over small variable payments because of their predictability. [2] However, this underestimates the power of automation and people's willingness to trust algorithms to make decisions on their behalf, for everything from investing their retirement funds to navigating safely in self-driving cars. Furthermore, people are becoming aware of and unhappy about the hidden costs of "free" Web services and subscriptions are losing their promise of user control as they proliferate across many different services.

The second key ingredient for payments and micropayments on the Web is giving users the right balance between control and automated convenience. Micropayment clients can offer users maximum spending limits, dashboards and fine-tuned controls that can be used if desired, and algorithms that learn and reflect users' preferences. The browser extension presents a first attempt at illustrating such a seamless yet trustworthy payment experience. Ultimately, standardizing the low-level payment protocols will provide developers with opportunities to continuously and creatively improve the payment experience.

3.3 Micropayments Are Not for Everything or for Everyone

Micropayments should not be expected to immediately replace all other business models on the Web. Advertising provides an important cross-subsidy for "free" content and there will still be plenty of money in tracking users. Subscriptions and aggregation services are useful for offering normalized pricing for frequently used content. But micropayments and automatic payments can provide a viable alternative for the long tail of websites, artists, writers and developers.

Micropayments can be added in the background so that

users who support them will see the content they want without paywalls, credit card forms or ads while the experience remains unchanged for others. Users who opt for ILP micropayments will have a streamlined experience across the Web and greater control and security than if they gave out their credit card details to every website. In the future, payments would ideally be built directly into web browsers.

Even without micropayments gaining mass adoption, ILP payments can be used for APIs and services whose customers are developers or power users more willing to use a new payment method.

4. IMPLEMENTATION, IMPLICATIONS AND FUTURE WORK

We have added ILP functionality to the browser with an extension and built a number of example websites to demonstrate the functionality. At the time of writing the extension implements the HTTP/ILP Payment Protocol [6] and automatically manages payments based on simple user configuration and usage-based limits for websites.

The HTTP/ILP protocol demonstrates how easy building payment functionality into transport protocols and data formats can be with ILP. The server or payee needs to communicate little more than their account address and a price. The client sends their payment request to an ILP library or service provider, which automatically finds the best path for their payment, and the rest appears to work like magic.

ILP provides an important building block for the Open Web Platform. Payments can be made to be technically required (e.g. returning HTTP 402 errors for unpaid request), legally required but technically optional (e.g. licenses that specify payment information), or optional (e.g. rewarding users that pay with premium experiences or status). As the user experience is separated from the protocols, developers will be able to continuously improve on the algorithms and interfaces for managing payments. Finally, ILP can be used with open source, peer-to-peer and privacy-protecting services to build new functionality that would not have been feasible without universal payments enabled by a payment network for the Web, of the Web.

5. REFERENCES

- [1] W3C interledger community group. <https://www.w3.org/community/interledger>.
- [2] D. Ariely. *Predictably irrational*. Harper, 2008.
- [3] S. Nakamoto. Bitcoin: A peer-to-peer electronic cash system. *Consulted*, 1(2012):28, 2008.
- [4] A. Odlyzko. The case against micropayments. In *Financial Cryptography*, pages 77–83. Springer, 2003.
- [5] J. Poon and T. Dryja. The bitcoin lightning network: Scalable off-chain instant payments. Technical report, <https://lightning.network>, 2015.
- [6] E. Schwartz. HTTP/ILP protocol specification. <https://github.com/interledger/http-ilp-spec>.
- [7] N. Szabo. Micropayments and mental transaction costs. In *2nd Berlin Internet Economics Workshop*, 1999.
- [8] S. Thomas and E. Schwartz. A protocol for interledger payments. <https://interledger.org/interledger.pdf>, 2015.
- [9] W3.org. Common markup for micropayment per-fee-links: a w3c public working draft. <https://www.w3.org/TR/Micropayment-Markup/>, 2016.