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Solid Web Monetization

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Abstract. The Solid decentralization effort decouples data from services, so that users are in full control over their personal data. In this light, Web Monetization has been proposed as an alternative business model for web services that does not depend on data collection anymore. Integrating Web Monetization with Solid, however, remains difficult because of the heterogeneity of Interledger wallet implementations, lack of mechanisms for securely paying on behalf of a user, and an inherent issue of trusting content providers to handle payments. We propose the Web Monetization Provider as a solution to these challenges. The WMP acts as a third party, hiding the underlying complexity of transactions and acting as a source of trust in Web Monetization interactions. This demo shows a working end-to-end example including a website providing monetized content, a WMP, and a dashboard for configuring WMP into a Solid identity.

Keywords: Web Monetization · Solid · Micropayments · payment processing · Interledger · Open Payments.

1 Introduction

Solid is a research project initiated in 2016 by Prof. Tim Berners-Lee, which aims to overcome issues with the current internet which sees data harvesting firms (e.g. Facebook, Google) capitalize on data originating from their users. The Solid decentralization effort decouples data from services, so that users are in full control over their personal data [1, 2]. This decoupling means services cannot depend on data collection as a primary business model anymore. As a result, alternative forms of monetization, such as micropayments via Web Monetization are essential for incentivizing application development. With Web Monetization, paying for content is seamlessly integrated into the browser. While a user is consuming content, they stream micropayments to the content creator using the browser. This makes it easy to create pay-per-view business models for web content.

The goal of this research is to integrate Web Monetization with Solid applications. This will enable users to consume monetized content from Solid enabled applications without needing to rely on browser extensions. Although commercial products like Coil [3] already offer Web Monetization, they do not integrate with the Solid ecosystem and rely on non-standard browser extensions. The Interledger protocol (ILP) seems like a natural fit in order to achieve this objective: it is an open protocol for secure payments across disparate payment networks [4, 5]. The ILP STREAM protocol [6], specifically, makes it possible to reliably stream payments from one payment provider to another. However, implementing extension-less Web Monetization on top of ILP is not an easy task because of a number of challenges.

1. The heterogeneity of Interledger (ILP) wallet implementations makes it difficult to encapsulate the logic required for streaming payments between wallets because they use different protocols and different authentication schemes.
2. There is a lack of mechanisms for reliably and securely performing these payments on behalf of the user.
3. There is an inherent issue of trust, by requiring the client to orchestrate the payment setup and thus determining the rate and the amount of the payment stream.

To solve these challenges, we introduce a *Web Monetization Provider (WMP)*. This is a third party between the content consumer and the content creator that hides the underlying complexity of ILP wallets and acts as an independent source of trust. In this demo, we present a full end-to-end implementation of extension-less Web Monetization using a WMP.

2 Solid Web Monetization provider (WMP)

A Web Monetization Provider (WMP) is a standardized third party between the content consumer and the content creator. The WMP acts as an authority, sending micropayments to the content creator in name of the content consumer. Adding this third party into the transaction makes it easy for content creators to receive micro-payments in a generic way and avoids vendor lock-in by allowing content consumers to freely choose which WMP to use. Specifically, the WMP solves the challenges described in Section 1 in the following way.

1. The complexity of dealing with the heterogeneity of Interledger wallet implementations is handled by the WMP. This makes it easier for client developers to create Web Monetization enabled applications without having to write code for every single possible wallet implementation.
2. The WMP handles streaming payments for monetized sessions. In exchange, the user subscribes to the WMP by paying a monthly fee, or funds the WMP for a predetermined amount using transaction-based charges like debit card payments. The WMP is free to choose its revenue model and spending strategy. This loose coupling adds a lot of flexibility to the Web Monetization model and again helps to reduce client-side complexity.
3. The WMP API is an open specification, enabling different parties to compete in providing WMP services. This benefits the users as they can now choose which WMP to trust as their Web Monetization agent, and can easily switch providers at any time while still being able to consume the monetized content in the same way. This model perfectly aligns with the Solid philosophy where you as a user are in full control of your data, including sharing and using.

Figure 1 shows an overview of how the WMP interacts with other actors in the context of Web Monetization. A consumer registers with the WMP in order to set up a subscription payment from the consumer's wallet to the WMP Wallet. When the consumer uses a Monetized Solid App, it reads the WMP reference from the consumer's pod. The app uses this reference to contact the WMP to start a monetization session. Using this session, the app streams consumer interactions with the content. The WMP uses this information to stream micropayments from the WMP Wallet to the Content Provider's wallet. With the goal of furthering the discussion around Solid Web Monetization, the Solid Web Monetization Provider W3C Editor's Draft [7] was created.

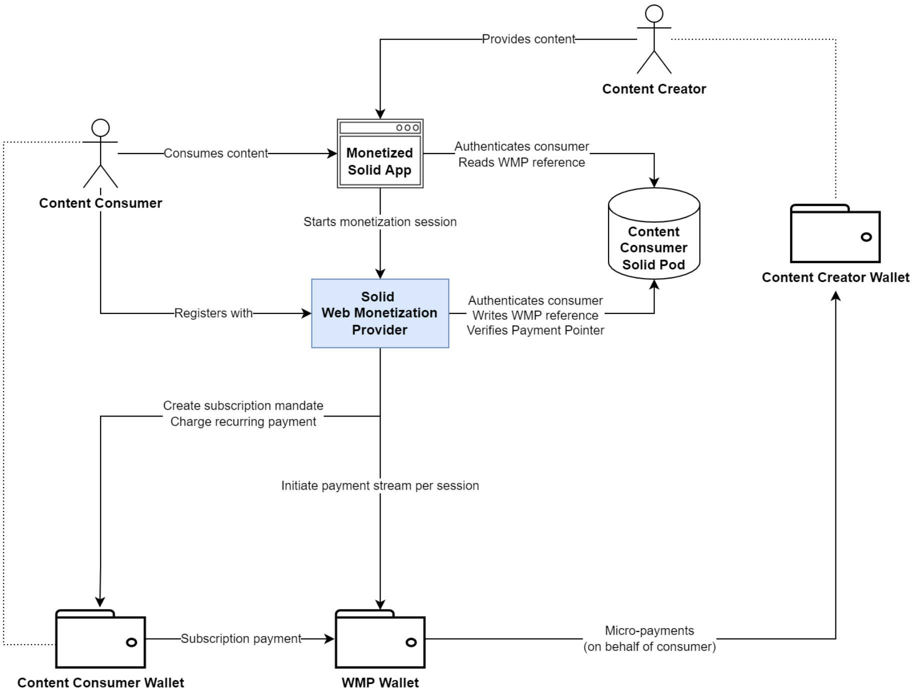


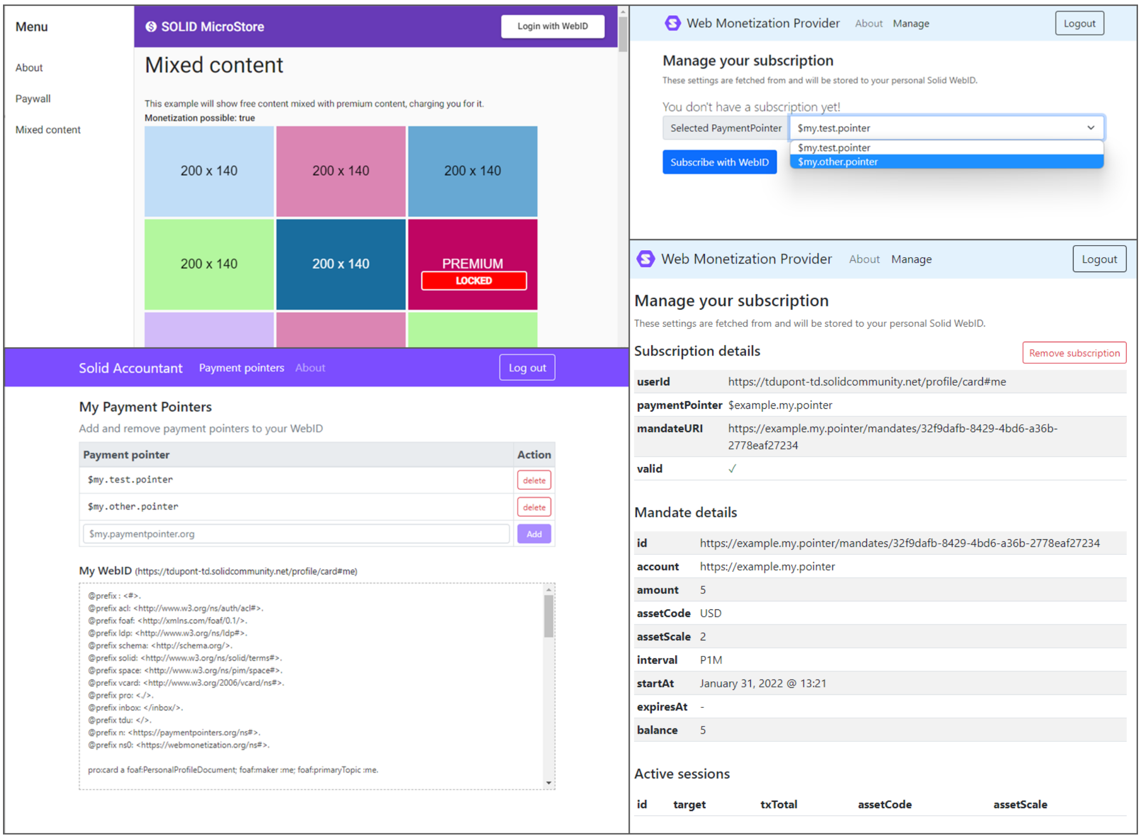
Fig. 1. Overview of interactions in a Web Monetization use case.

3 Demonstration

The demo [1] shows a complete end-to-end working example of a Solid Web Monetization app. A content-creator hosts web monetized content that visiting users pay for through micropayments. These micropayments are sent over the interledger network from the visiting user's wallet to the content creator's wallet, using the WMP. Aligning with Solid's vision, all required data is stored in the visiting user's Solid pod. The demo consists of three applications shown in Figure 2:

– The Solid Accountant allows to configure a Web Monetization wallet into a Solid identity. This is a browser application written in Angular 13 and TypeScript.
– The Solid MicroStore is an example Web Monetized Solid application. This is a browser application written in Angular 13 and TypeScript.
– The Solid WMP is a Web Monetization Provider with a fake currency. It performs micropayments to payment pointers on behalf of a user. That user trusts the WMP and has an active subscription with it. This is a server application written in Kotlin 1.6.10 on top of JDK 16. The Vert.x toolkit is used as a Web/Micro-service framework.

This demo allows a user to log in to their personal Solid pod and register a personal payment pointer. Afterwards they can subscribe to the Web Monetization Provider that will manage micropayments on their behalf. The user can then visit the MicroStore component to showcase how the registered WMP can be requested from a Solid WebID and instructed to pay micropayments to the content provider's payment pointer embedded in the web page.



Mixed content

This example will show free content mixed with premium content, charging you for it.
Monetization possible: true

Manage your subscription

These settings are fetched from and will be stored to your personal Solid WebID.

You don't have a subscription yet!

Selected PaymentPointer: $my.test.pointer

My Payment Pointers

Add and remove payment pointers to your WebID

Payment pointer	Action
$my.test.pointer	delete
$my.other.pointer	delete
$my.paymentpointer.org	Add

My WebID (https://tdupont-td.solidcommunity.net/profile/card#me)

```
@prefix : <#>.
@prefix acl: <http://www.w3.org/ns/auth/acl#>.
@prefix foaf: <http://xmlns.com/foaf/0.1/>.
@prefix ldp: <http://www.w3.org/ns/ldp#>.
@prefix schema: <http://schema.org/>.
@prefix solid: <http://www.w3.org/ns/solid/terms#>.
@prefix space: <http://www.w3.org/ns/pim/space#>.
@prefix vcard: <http://www.w3.org/2006/vcard/ns#>.
@prefix pro: <./>.
@prefix inbox: </inbox/>.
@prefix tdu: </>.
@prefix n: <https://paymentpointers.org/ns#>.
@prefix ns0: <https://webmonetization.org/ns#>.

pro:card a foaf:PersonalProfileDocument; foaf:maker :me; foaf:primaryTopic :me.
```

Manage your subscription

These settings are fetched from and will be stored to your personal Solid WebID.

Subscription details

userId	https://tdupont-td.solidcommunity.net/profile/card#me
paymentPointer	$example.my.pointer
mandateURI	https://example.my.pointer/mandates/32f9dafb-8429-4bd6-a36b-2778eaf27234
valid	✓

Mandate details

id	https://example.my.pointer/mandates/32f9dafb-8429-4bd6-a36b-2778eaf27234
account	https://example.my.pointer
amount	5
assetCode	USD
assetScale	2
interval	P1M
startAt	January 31, 2022 @ 13:21
expiresAt	-
balance	5

Active sessions

id	target	txTotal	assetCode	assetScale

Fig. 2. Demonstration of a proof of concept monetized web-app interacting with WMP and Solid. Clockwise: The Solid MicroStore hosts Web Monetized content. The Web Monetization Provider is used to create and manage a subscription. The Solid Accountant is used to configure the WMP in a user's Solid Pod.

[1] https://knowledgeonwebscale.github.io/solid-web-monetization/demo/intro/

4 Conclusions and Future Work

The Web Monetization Provider makes it possible for content providers to implement a seamless and extension-less Web Monetization experience. The WMP also allows content consumers to easily set up micropayments in order to access and seamlessly pay for content. The WMP addresses a number of challenges; specifically, the heterogeneity of the Interledger wallet implementations, the lack of mechanisms to perform payments on behalf of users, and the issue of trust in Web Monetization micropayments. This demo shows a working end-to-end example including a website providing monetized content, a WMP, and a dashboard for configuring WMP into a Solid identity. With the goal of furthering the discussion around Solid Web Monetization, we created the Solid Web Monetization Provider W3C Editor's Draft [7].

Important future work in this area includes working with the Web Monetization and Interledger ecosystems to align these standards to enable standards-compliant Solid Web Monetization. Moreover, investigating a plugin-based approach to support different Wallet providers will make it easier to implement Solid Web Monetization and WMPs.

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