



FOSDEM'23

Brussels / 4 & 5 February 2023

Noel De Martin

From Zero to Hero with Solid

Hello, my name is Noel



- Developer & Entrepreneur.
- 4-day workweek @ [Moodle](#).
- Making Solid Apps on the side.
- Working in the Open.

noeldemartin.com | noeldemartin.social | [@NoelDeMartin](https://twitter.com/NoelDeMartin)



What is Solid?



The World Wide Web (1989)

- Created by Tim Berners-Lee.
- Technologies:
 - Web Browsers
 - HTTP
 - HTML

The Semantic Web (2001)

- An extension to the original web with Linked Data.
- Technologies:
 - RDF
 - JSON-LD, Turtle, etc.

The Solid Protocol (2016)

solidproject.org

- Brings decentralized storage to the web.
- Web 3.0, by the creators of the web.
- Not to be confused with Web3.

“Web3 is not the web at all”

– [Tim Berners-Lee @ Web Summit 2022](#)

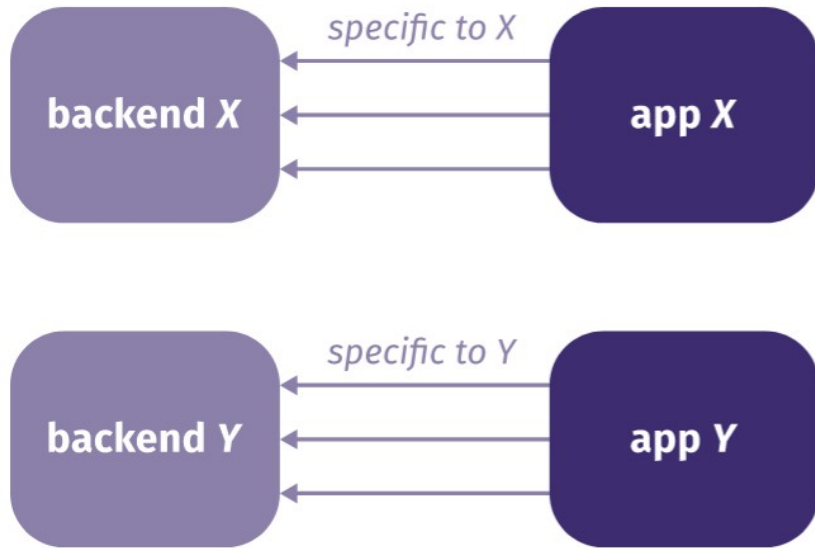
The Solid Protocol (2016)

- Apps & Services store data in your POD.
Personal **O**nline **D**atastore

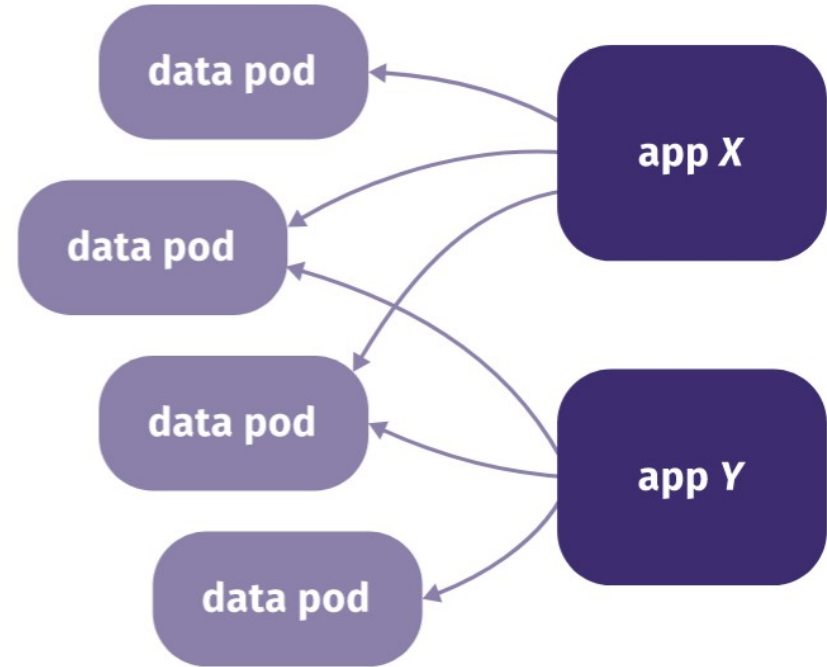


The Solid Protocol (2016)

centralized: single app & back-end



decentralized: multiple apps & back-ends



From Zero to Hero



Ref: [Superman](#)

noeldemartin.com/fosdem

From Zero to Hero?



About this talk

- There are infinite ways to use Solid, just like the web.
- We'll focus on Solid Apps.
- Lessons learned from 4 years of side-projects.
- Broad strokes, but we'll get into the weeds.



Solid Focus

November 2018 – August 2019



Inbox

+ Create list

ADD

Go shopping



Give FOSDEM talk

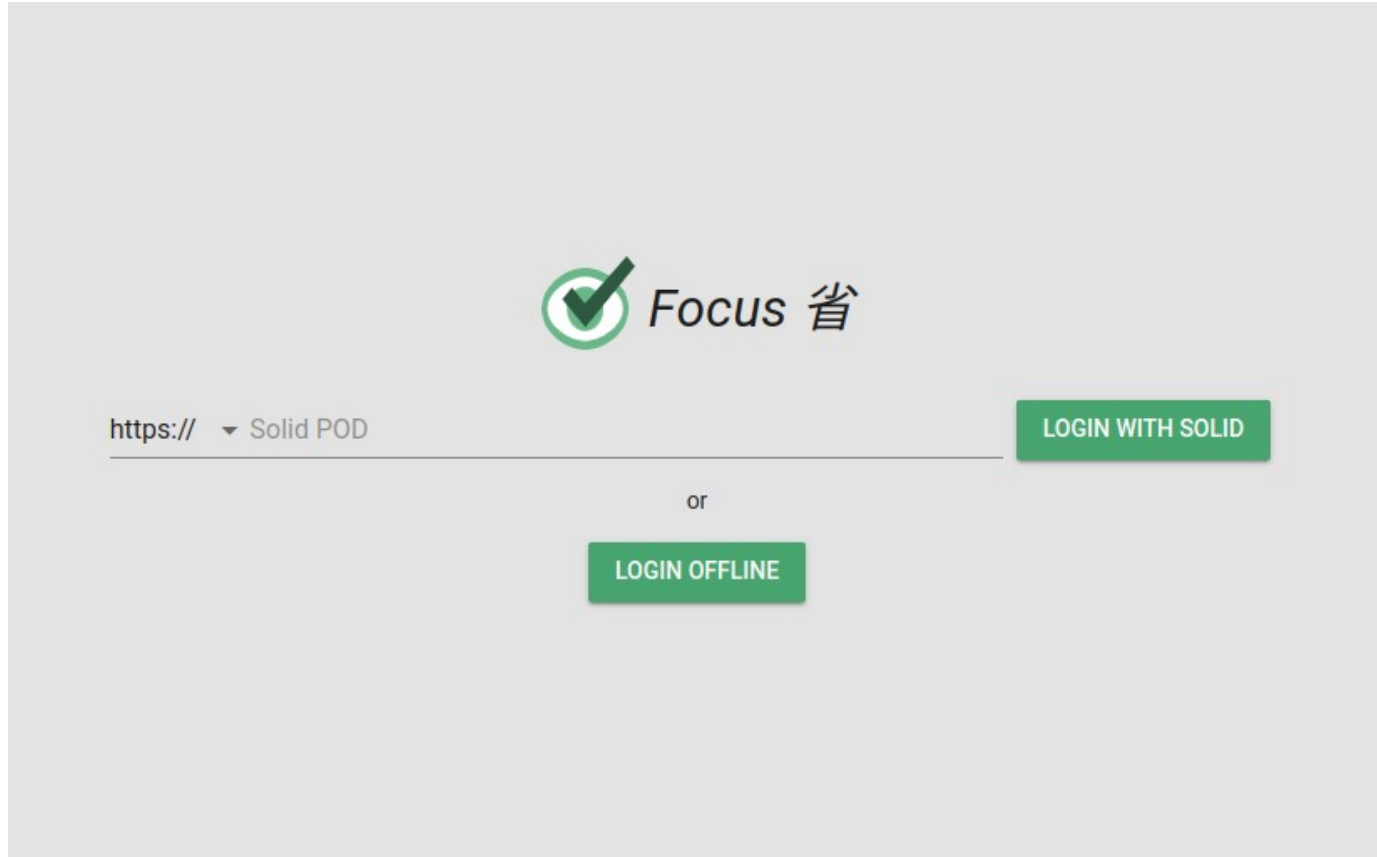


HIDE COMPLETED

Prepare FOSDEM talk

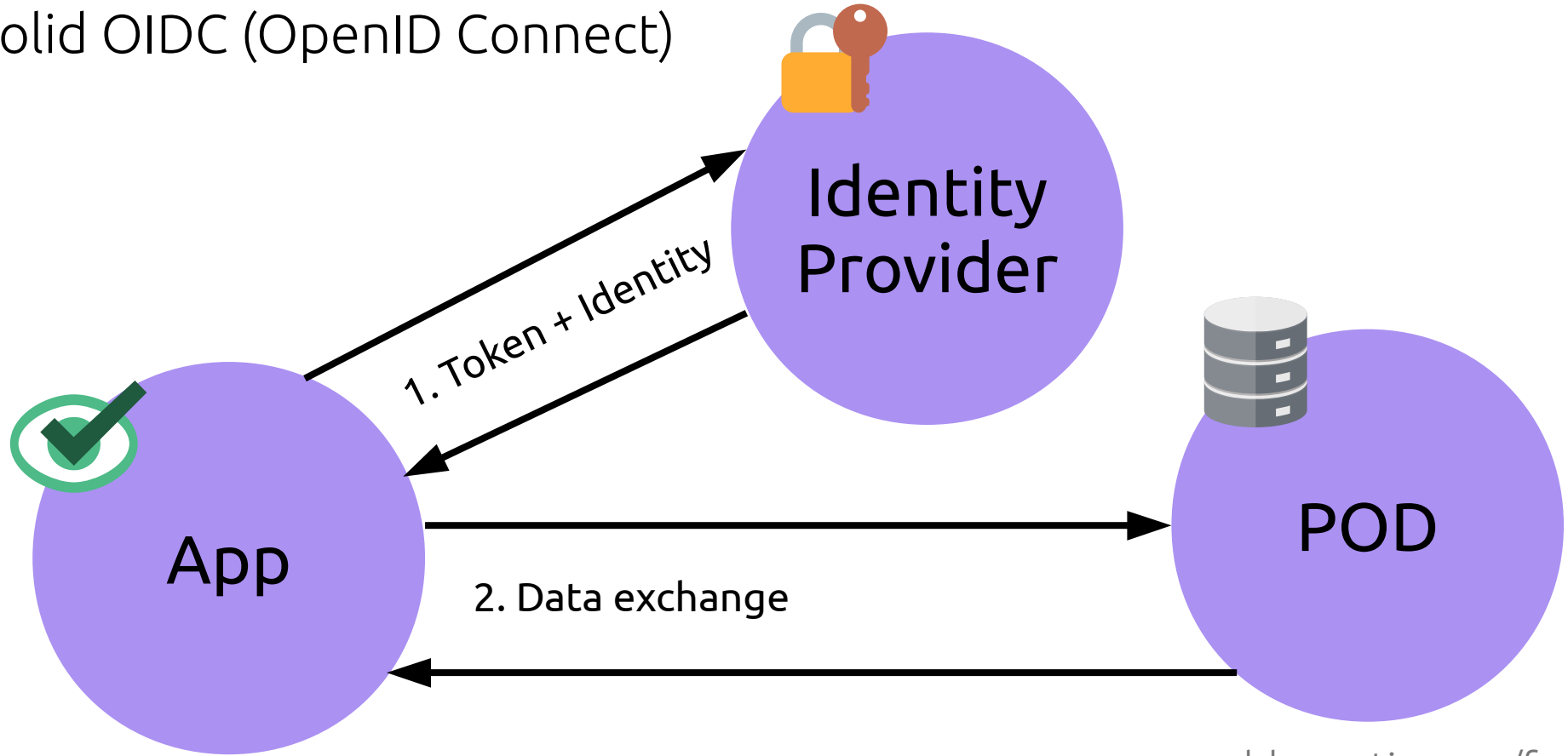


Solid 101 – Authentication



Solid 101 – Authentication

Solid OIDC (OpenID Connect)



Solid 101 – Authentication

```
import { login, handleIncomingRedirect } from '@inrupt/solid-client-authn-browser';

// When you log in...
login({
  oidcIssuer: 'https://pod.alice.com',
  redirectUrl: window.location.href,
});

// After redirect...
const session = await handleIncomingRedirect();

alert(`Hello, ${session.webId}!`);
```


Solid 101 – RDF

Plain JSON (not RDF)

```
{  
  "id": 1,  
  "description": "Go shopping",  
  "done": false  
}
```

Solid 101 – RDF

JSON-LD

```
{
  "@context": "https://schema.org/",
  "@id": "https://pod.alice.com/tasks/1#it",
  "@type": "Action",
  "description": "Go shopping",
  "actionStatus": {
    "@id": "https://schema.org/PotentialActionStatus"
  }
}
```

Solid 101 – RDF

JSON-LD

Vocabulary / Ontology: describes what the properties mean

```
{  
  "@context": "https://schema.org/",  
  "@id": "https://pod.alice.com/tasks/1#it",  
  "@type": "Action",  
  "description": "Go shopping",  
  "actionStatus": {  
    "@id": "https://schema.org/PotentialActionStatus"  
  }  
}
```

Solid 101 – RDF

JSON-LD

Id: URIs (usually document URLs)

```
{
  "@context": "https://schema.org/",
  "@id": "https://pod.alice.com/tasks/1#it",
  "@type": "Action",
  "description": "Go shopping",
  "actionStatus": {
    "@id": "https://schema.org/PotentialActionStatus"
  }
}
```

Solid 101 – RDF

JSON-LD

Type: describes what the resource is

```
{
  "@context": "https://schema.org/",
  "@id": "https://pod.alice.com/tasks/1#it",
  "@type": "Action",
  "description": "Go shopping",
  "actionStatus": {
    "@id": "https://schema.org/PotentialActionStatus"
  }
}
```

Solid 101 – RDF

JSON-LD

Some properties have literals values (string, number, etc.)

```
{
  "@context": "https://schema.org/",
  "@id": "https://pod.alice.com/tasks/1#it",
  "@type": "Action",
  "description": "Go shopping",
  "actionStatus": {
    "@id": "https://schema.org/PotentialActionStatus"
  }
}
```

Solid 101 – RDF

JSON-LD

Other properties reference other resources

```
{
  "@context": "https://schema.org/",
  "@id": "https://pod.alice.com/tasks/1#it",
  "@type": "Action",
  "description": "Go shopping",
  "actionStatus": {
    "@id": "https://schema.org/PotentialActionStatus"
  }
}
```

Solid 101 – RDF

Turtle

```
@prefix schema: <https://schema.org/> .  
  
<#it>  
  a schema:Action ;  
  schema:description "Go shopping" ;  
  schema:actionStatus schema:PotentialActionStatus .
```


Solid 101 – CRUD

Solid POD

Container

RDF Document

RDF Resource

...

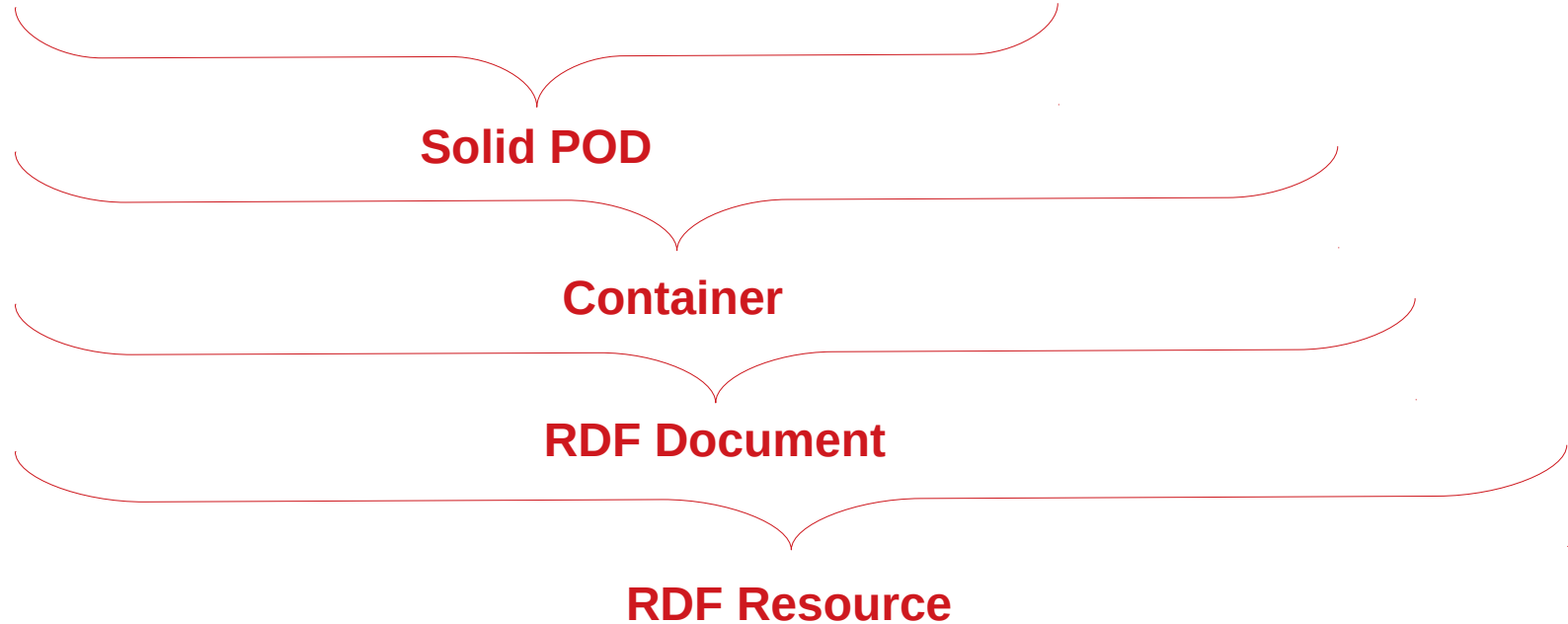
Binary (image, video, etc.)

...

...

Solid 101 – CRUD

`https://pod.alice.com/tasks/1#it`



Solid 101 – CRUD

Just use HTTP verbs!

- Create one task → POST <https://pod.alice.com/tasks/1>

```
@prefix schema: <https://schema.org/> .  
  
<#it>  
  a schema:Action ;  
  schema:description "Go shopping" ;  
  schema:actionStatus schema:PotentialActionStatus .
```

Solid 101 – CRUD

Just use HTTP verbs!

- Create one task → POST <https://pod.alice.com/tasks/1>
- Get one task → GET <https://pod.alice.com/tasks/1>
- Delete one task → DELETE <https://pod.alice.com/tasks/1>
- Get list of all tasks → GET <https://pod.alice.com/tasks/>
- ...

You just built your first Solid App!



Learn more

- [Introduction to Solid](#) (FOSDEM 2019).
- [Solid Hello World](#): With a task manager!
- [Solid Protocol](#): THE Solid spec.
- Other specs:
 - [RDF Primer](#)
 - [RDF Schema](#)
 - [Turtle](#)
 - [LDP Primer](#) (containers/documents)

Read the full story

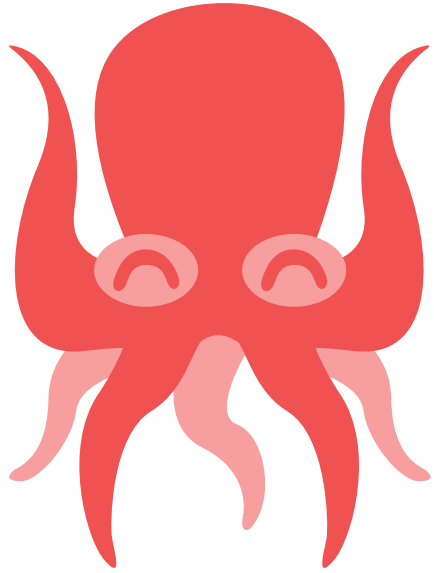
- [Implementing a Task Manager using Solid](#)
- [Improving Solid Focus Task Manager](#)
- [Working on Solid Focus Task Manager](#)

Takeaways

- Learned Solid basics.
- No server headaches.
Because the app lives in the frontend.

Challenges

- Onboarding UX.
- Page speed.
- Interoperability.
 - How do I structure my data (which vocabulary)?
 - Where do I store my data (which container)?



Media Kraken

January 2020 – July 2020

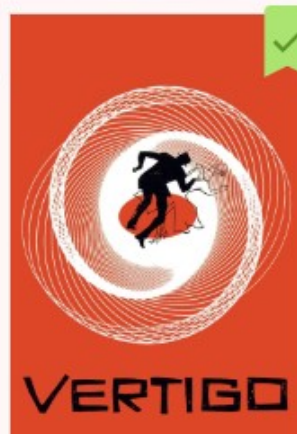
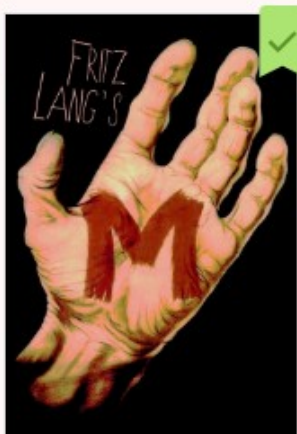
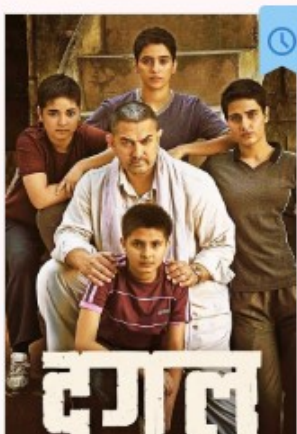
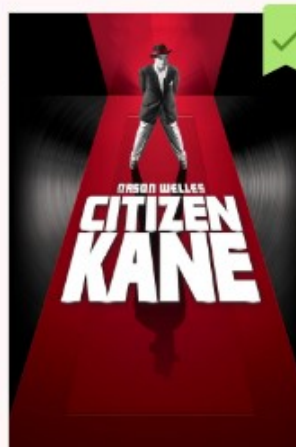
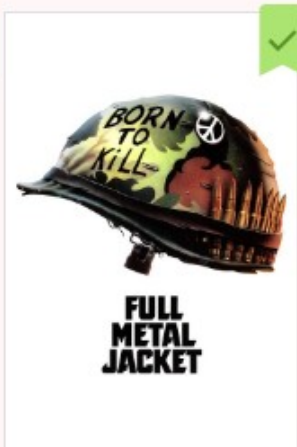


Q Press "s" to start searching

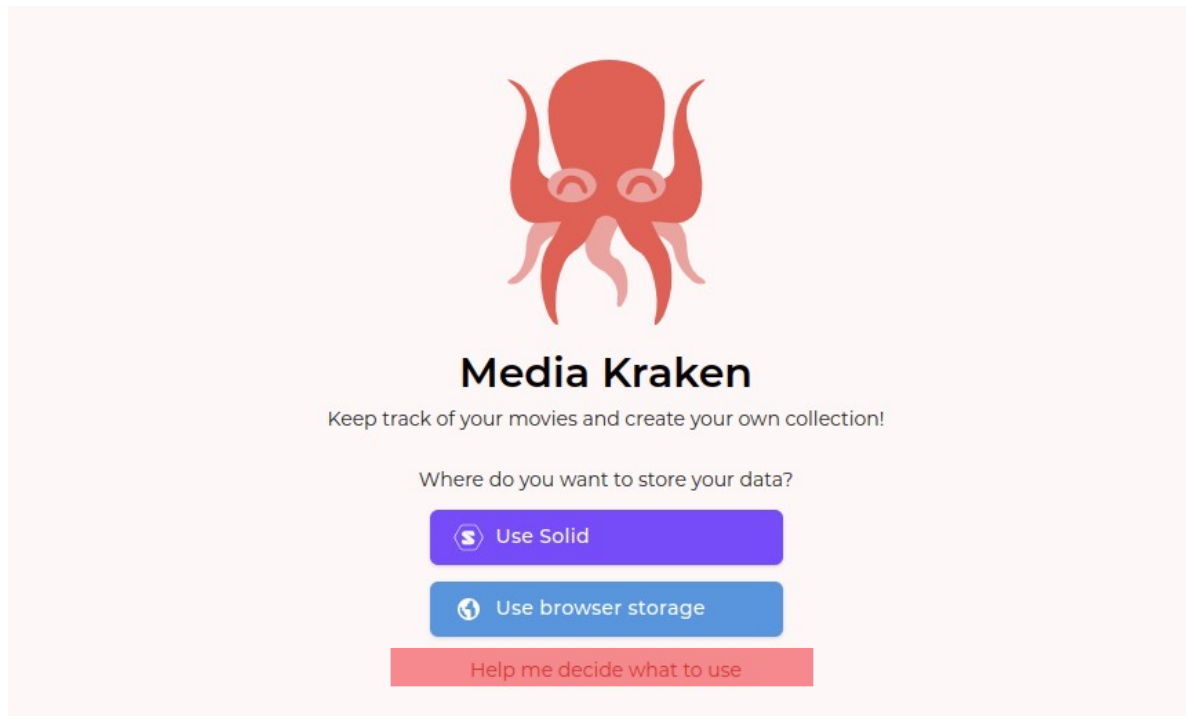
[My Collection](#) ⚙️

⋮ Collection (100)

All movies ▾ 🔍



Onboarding UX



Onboarding UX

⋮ Collection (36)

↑ Import to collection

↓ Export collection

Import Movies

✕

You can import movies from the following sources:



IMDb



JSON-LD



TMDb



GOOD
FILMS

If you can't import your movies with any of these options, please [let me know](#) and I'll help you.

In the meantime, you can probably find your movies [using the search in the header](#).

Page Speed



Total HTTP requests: $N+1$ 🤯

Page Speed



Loading movies metadata...

- Movies cache (IndexedDB).
- GET only updated movies.
using `http://purl.org/dc/terms/modified`
- Still not great for big collections.

⋮ Collection (2239)



Interoperability

- How do I structure my data (which vocabulary)?
- Where do I store my data (which container)?

PS: [Interoperable Serendipity](#)

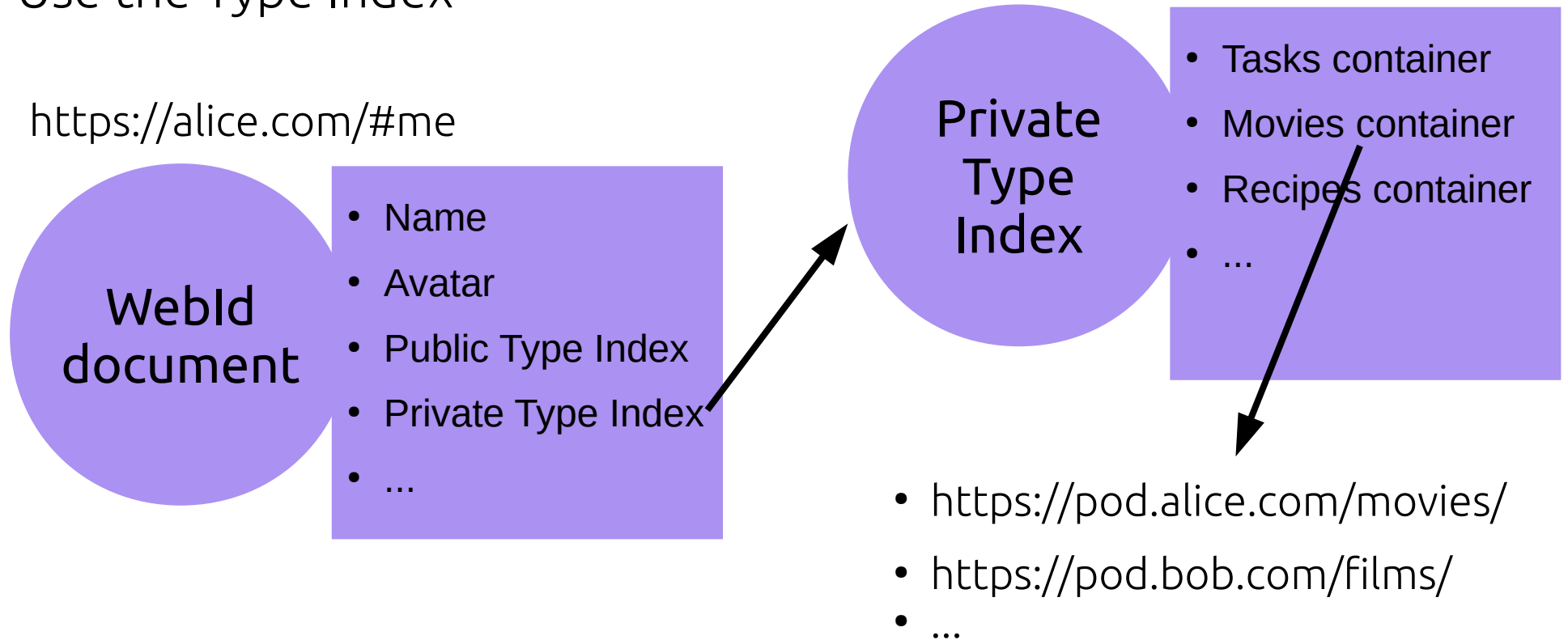
How do I structure my data?

- Use an existing vocabulary.
<https://lov.linkeddata.es>
- Create your own vocabulary.
- Mix and match.
 - See “Bag of Chips” ([text](#), [video](#))

Where do I store my data?

Use the Type Index

<https://alice.com/#me>



Where do I store my data?

Use the Type Index

- If it doesn't exist, just create it!
- Disclaimer: The [Type Index spec](#) is still a draft.
Client-Client standard
- See also the [Solid Application Interoperability spec](#).
Client-Server standard

Data sources



A screenshot of the TMDB website showing search results for the query "pirates". The search bar at the top left contains the text "pirates". Below the search bar, a list of movie results is displayed. Each result includes a small thumbnail image, the movie title, and the release year. The results are as follows:

Movie Title	Year
Pirates of the Caribbean: At World's End	2007
Pirates of the Caribbean: On Stranger Tides	2011
Pirates of the Caribbean: Dead Man's Chest	2006
Scooby-Doo! Pirates Ahoy!	2006
Pirates	1986
Pirates of the Caribbean: The Curse of the Black Pearl	2003
Pirates of the Caribbean: Dead Men Tell No Tales	2017
The Ice Pirates	1984

TMDB

<https://themoviedb.org>

Read the full story

- [Implementing a Media Tracker using Solid](#)
- [Housekeeping](#)
- [Media Kraken @ Solid World](#) (video)

Takeaways

- Type Indexes are nice.
- Caching is nice.

Challenges

- ~Onboarding UX.
- ~Page speed.



December 2020 – January 2023



✓ online



Here's your cookbook

+ NEW RECIPE



Onboarding UX



With **Umai** you'll be able to collect and share all your precious recipes, start now your culinary adventure!

How would you like to begin?



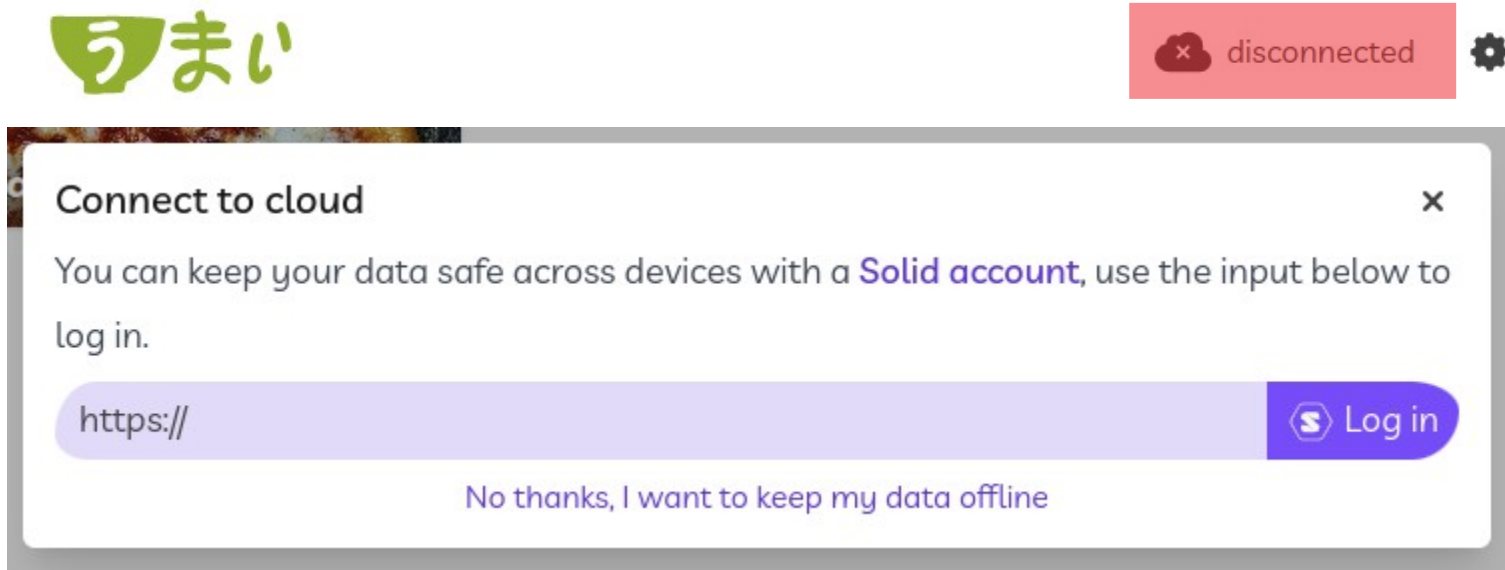
Create your first recipe



Connect your Solid POD

What is Solid?

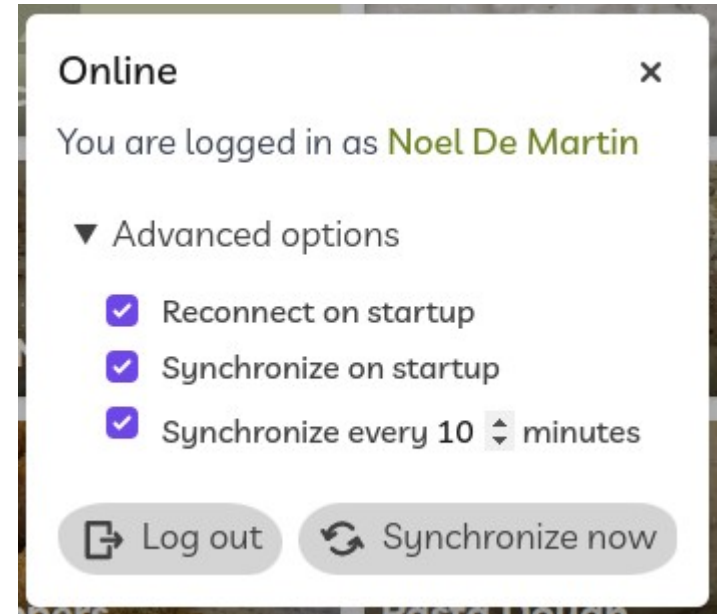
Onboarding UX



It's Offline First!

Offline First – Authentication

- [Authenticating Offline-First Solid Apps](#) (forum thread)
- TLDR:
 - Web Apps shouldn't store Solid authentication tokens.
 - Logging in requires a browser redirect.



Offline First – Synchronization



Ramen is awesome

SHARE

EDIT

Offline First – Synchronization

T0: Recipe exists in both devices and Solid POD

Mobile

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Desktop

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Offline First – Synchronization

T1: Recipe is updated in Mobile

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Desktop

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Offline First – Synchronization

T2: Recipe is updated in Desktop

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

Offline First – Synchronization

T3: Desktop synchronizes with the POD

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

(no updates)

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

Offline First – Synchronization

T3: Desktop synchronizes with the POD

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

Solid POD

Ramen

Ramen is life

createdAt T0
updatedAt T2

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

(1 update)



Offline First – Synchronization

T4: Mobile synchronizes with the POD

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1



(1 update)



Solid POD

Ramen

Ramen is life

createdAt T0
updatedAt T2

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

Offline First – Synchronization

CRDTs

- CRDTs = **C**onflict-free **R**eplicated **D**ata **T**ypes.
- [Request for Comments: CRDTish approach to Solid](#)
(forum thread)
- Custom vocab.
<https://vocab.noeldemartin.com/crdt/>

Offline First – Synchronization

CRDTs

T0: Recipe exists in both devices and Solid POD

Mobile

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Desktop

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Offline First – Synchronization

CRDTs

T1: Recipe is updated in Mobile

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

--

T1: update name

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Desktop

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Offline First – Synchronization

CRDTs

T2: Recipe is updated in Desktop

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

--

T1: update name

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

--

T2: update description

Offline First – Synchronization

CRDTs

T3: Desktop synchronizes with the POD

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

--

T1: update name

Solid POD

Ramen

Ramen is awesome

createdAt T0
updatedAt T0

(no updates)

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

--

T2: update description

Offline First – Synchronization

CRDTs

T3: Desktop synchronizes with the POD

Mobile

Ramen!!!

Ramen is awesome

createdAt T0
updatedAt T1

--

T1: update name

Solid POD

Ramen

Ramen is life

createdAt T0
updatedAt T2

--

T2: update description

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

--

T2: update description

(1 update)



Offline First – Synchronization

CRDTs

T4: Mobile synchronizes with the POD

Mobile

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--

T1: update name

T2: update description

Solid POD

Ramen

Ramen is life

createdAt T0
updatedAt T2

--

T2: update description

(1 update)



Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

--

T2: update description

Offline First – Synchronization

CRDTs

T4: Mobile synchronizes with the POD

Mobile

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--
T1: update name
T2: update description

(1 update)



Solid POD

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--
T1: update name
T2: update description

Desktop

Ramen

Ramen is life

createdAt T0
updatedAt T2

--
T2: update description

Offline First – Synchronization

CRDTs

T5: Desktop synchronizes with the POD

Mobile

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--

T1: update name
T2: update description

Solid POD

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--

T1: update name
T2: update description

(1 update)



Desktop

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--

T1: update name
T2: update description

Offline First – Synchronization

CRDTs

T5: Desktop synchronizes with the POD

Mobile

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--
T1: update name
T2: update description

Solid POD

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--
T1: update name
T2: update description

Desktop

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--
T1: update name
T2: update description

(no updates)



Offline First – Synchronization

CRDTs

T6: Everything is up to date!

Mobile

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--

T1: update name
T2: update description

Solid POD

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--

T1: update name
T2: update description

Desktop

Ramen!!!

Ramen is life

createdAt T0
updatedAt T2

--

T1: update name
T2: update description

Offline First – Synchronization

CRDTs



Data Sources



How do you want to create your recipe?



Import from
the Web



Create from
scratch



Upload
JsonLD file

Data Sources

The Web itself!



pizza recipes



Shopping

Books

More

Tools

```
381 </div>
382 <script type="application/ld+json">
383 {"@context":"http://schema.org", "@type":"Recipe", "image":["https://
384
385 <section id="recipe-single" class=" family-food-inspiration-page
386
387 <div class="container recipe-container">
388
389 <div class="row">
390 <div class="single-recipe-details-mobile_col-xs-12 w
```

<https://schema.org/Recipe>

(Thanks, Semantic Web!)



Homemade Pizza Recipe

The Food Charlatan

4.9 ★★★★★ (35)

55 min

Pizza dough, pepperoni, pizza sauce, mozzarella cheese,



Homemade Pizza & Pizza Dough

Simply Recipes

4.8 ★★★★★ (86)

2 hr 30 min

Italian sausage, pizza dough, pesto, feta cheese, bell peppers



Pizza Margherita in 4 easy steps

BBC Good Food

5.0 ★★★★★ (511)

35 min

Cherry tomatoes, bread flour, mozzarella, olive oil, instant



Data Sources

The Web itself!

Import recipes from the Web ×

If there is a recipe online that you want to save in your cookbook, just paste the url below. We will look into that page and find all the relevant information like instructions and ingredients.

If don't know where to start, just open your favorite search engine and type away! Even if the website you find doesn't look like a recipe, give it a try. You may be surprised to see what you get.

▶ Advanced options

Data Sources

The Web itself!

- CORS :/

Import recipes from the Web ×

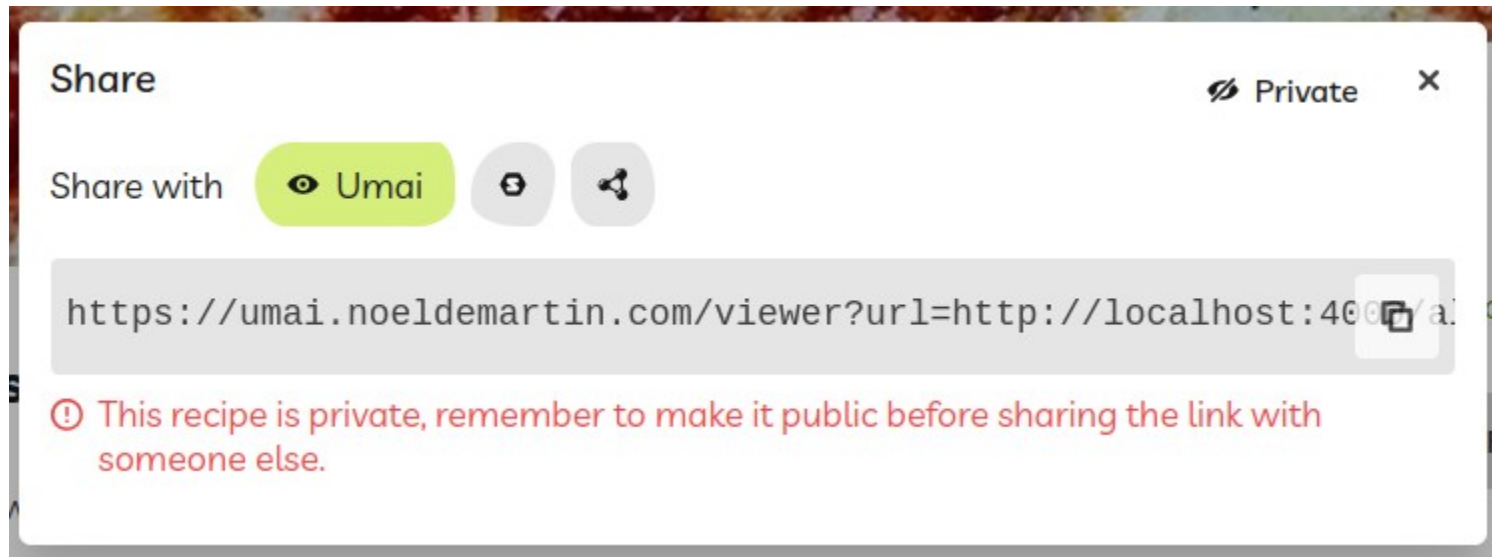
If there is a recipe online that you want to save in your cookbook, just paste the url below. We will look into that page and find all the relevant information like instructions and ingredients.

If don't know where to start, just open your favorite search engine and type away! Even if the website you find doesn't look like a recipe, give it a try. You may be surprised to see what you get.

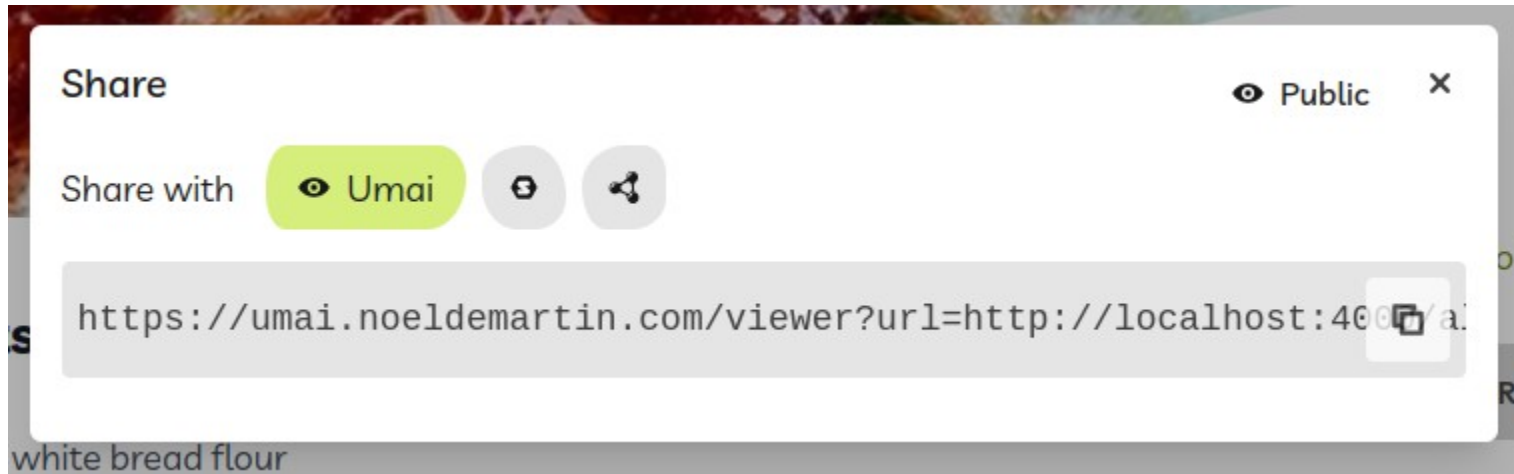
▼ Advanced options

Use a proxy: <https://proxy.noeldemartin.com/fetch>
what does this mean?

Sharing



Sharing



Sharing

<https://umai.noeldemartin.com/viewer?url={documentUrl}>



Pizza

🍴 Servings ▼ 8

🕒 Cooking time 1 hour 20 min

🔗 [recipe on jamieoliver.com](#)

+ Save in my cookbook

Recipe created by 🌍 [Noel De Martin](#)

[View all their recipes](#)

Ingredients

- 800g strong white bread flour
- 200g fine ground semolina flour or strong white bread flour
- 85g mozzarella cheese
- 2 x 7 g sachets of dried yeast
- 1 bunch of fresh basil

Sharing

- Visitors don't need a Solid account.
- You can make your own Viewer App:
 - Cooking Assistant
 - Meal Planner
 - Shopping List
 - ...

Learn more

- offlinefirst.org
- [Instant Loading: Building offline-first PWAs](#)
- [CRDTs for Mortals](#)
- [Local-first software](#)
- [WAC](#) & [ACP](#) (Solid permissions)

Read the full story

- [Implementing a Recipes Manager using Solid](#)

Takeaways

- Offline First is the way!
- Sharing is caring.
- Keep It Simple.

Challenges

- Onboarding UX
 - What is Solid?
 - Where do I get a POD?
 - Why isn't your app working with my POD?
- CORS

Thank you!



- Follow my work
noeldemartin.com/now
- Check out my apps (all GPL!)
noeldemartin.com/projects
- Join the community
forum.solidproject.org