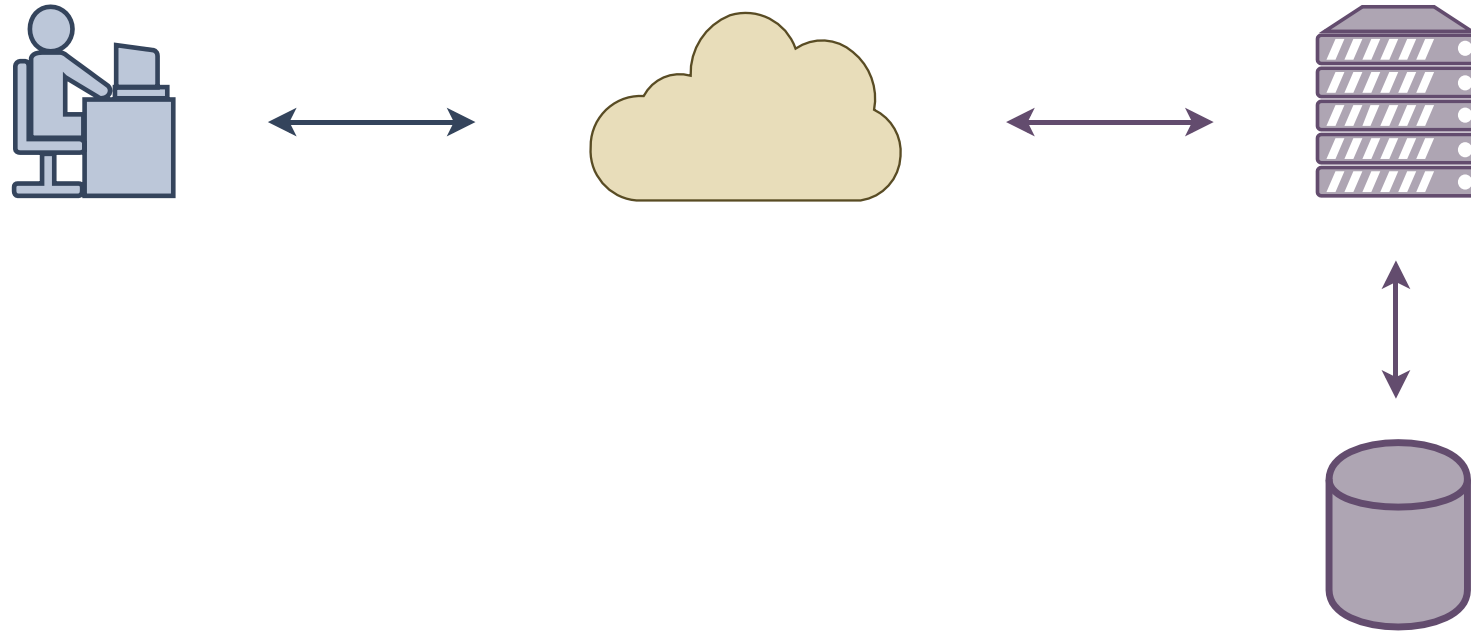


A Privacy-Preserving Social Networking Application

Cristian Grigoriu

Nikolai Maltsev



Introduction

- **Internet:** 3.4 billion users (2016)
- **WEB:** HTML, URI, HTTP (1990)
- **Centralized architecture**

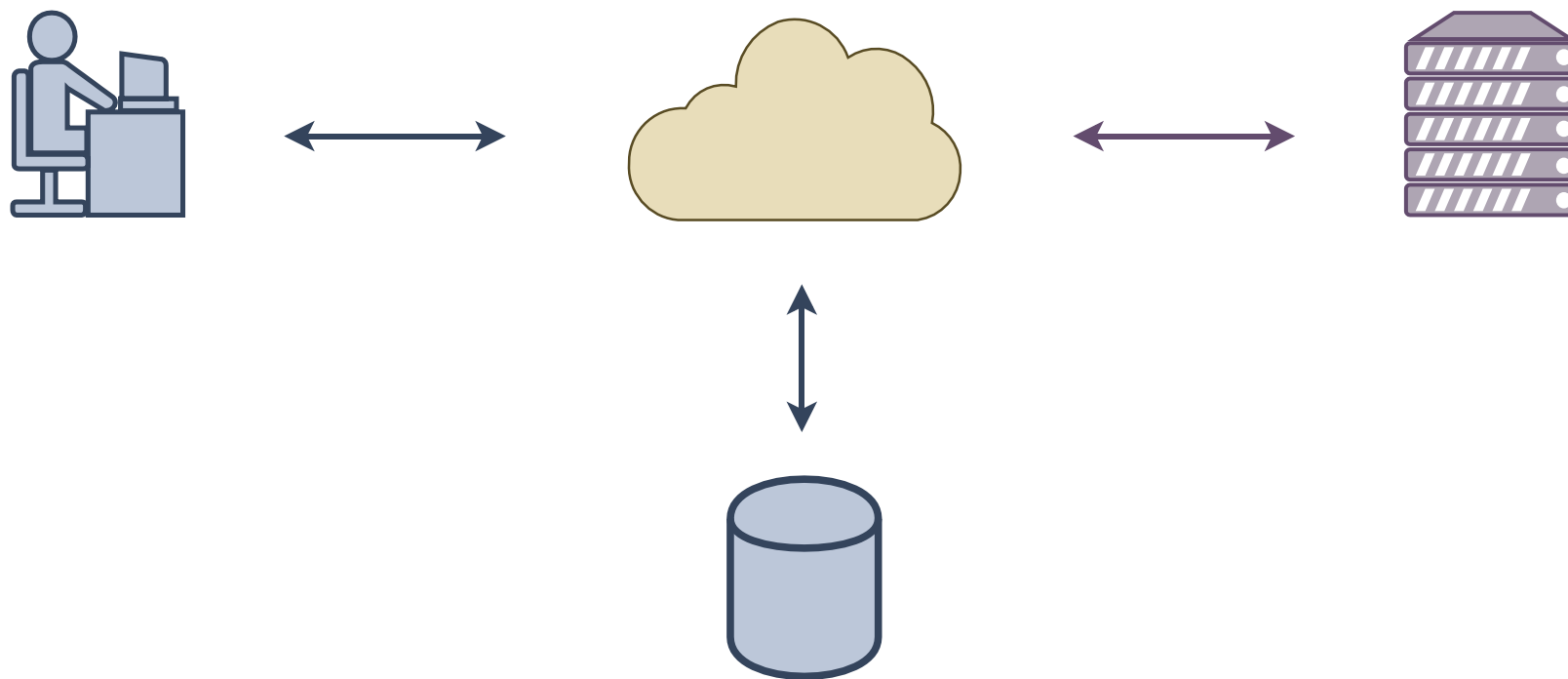
Privacy: having control over personal information

Problems

- Privacy issues
- Impossible to choose where to store data
- Constrained to use one application

Solid

- Launched by Tim Berners-Lee
- **Key Ideas:**
 - Users choose where to store data
 - Owner choose who has right to access data
- **Solid:** set of conventions and tools relying on Linked Data principles and W3C standards
- Ecosystem for developing decentralized web apps



Solid model

- **POD:** Storage space
- **WebID:** URI pointing to Agent's profile

POD FS

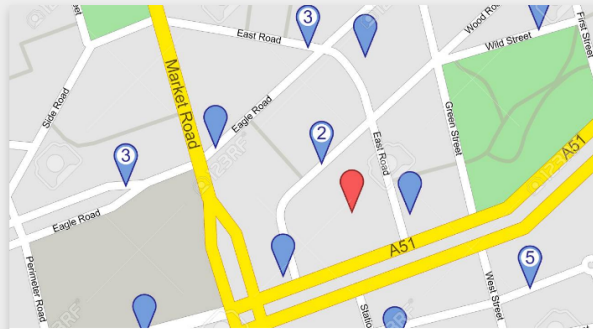
- Each resource can be accessible by HTTP(S) requests
- **Containers**
- **Resources**
 - Any type
 - *Resource Description Framework*
 - Additional resources: Access Control List (info about granted access rights)

WebID Profiles

```
@prefix : <#>.
@prefix solid: <http://www.w3.org/ns/solid/terms#>.
@prefix pro: <./>.
@prefix n0: <http://xmlns.com/foaf/0.1/>.
@prefix schem: <http://schema.org/>.
@prefix n: <http://www.w3.org/2006/vcard/ns#>.
@prefix ldp: <http://www.w3.org/ns/ldp#>.
@prefix inbox: </inbox/>.
@prefix sp: <http://www.w3.org/ns/pim/space#>.
@prefix digi: </>.
```

```
pro:card a n0:PersonalProfileDocument; n0:maker :me; n0:primaryTopic :me.
```

```
:me
  a schem:Person, n0:Person;
  ldp:inbox inbox;;
  sp:preferencesFile </settings/prefs.ttl>;
  sp:storage digi;;
  solid:account digi;;
  solid:privateTypeIndex </settings/privateTypeIndex.ttl>;
  solid:publicTypeIndex </settings/publicTypeIndex.ttl>;
  n0:name "User Name".
```



Munich



Germany



Hotel Koenigshof

Search

**Nikolai Malcev** rated [Hotel Koenigshof](#) in [Munich, Germany](#)

20 min ago

Excellent location for a hotel! We really like this hotel and are so sad to see they're completely tearing down and it will take approx. 3 years for new one to be built :-(We very much enjoyed staying here. Rooms were spac... [More](#)



Average: 4.6 ★

[4 friends were there](#)**Cristian Grigoriu** rated [Hotel Koenigshof](#) in [Munich, Germany](#)

1 month ago

Great location a short ride from the airport and in an ideal place to get around. It's a shoppers paradise if you turn right out of the hotel and just keep on walking there are shops aplenty and they keep getting bigger... [More](#)



Average: 4.8 ★

[7 friends were there](#)

Objectives

- To analyse Solid architecture
- To plan, design and develop a web application using Solid:
 - Users should be able to authorize with their personal WebIDs;
 - To manage a list of reviews that will be stored on one's personal storage (Solid POD);
 - To share reviews with a group of users.
- To describe the positive and negative aspects of Solid environment.

Contribution: development the application

Outline

- Project Bootstrapping
- Sitemaps
- Storing the data
- Create social relationships
- Management of sharing list

- Goal: give an overview of the application UI

Project bootstrapping

- The starting point was a sample Angular profile editor application
- (<https://github.com/Inrupt-inc/generator-solid-angular>)
- The bootstrapped project includes:
 - Login form and the authentication logic;
 - profile page;
 - the rdflib.js library.
- We have added bootstrap framework
- Achievements: we have decreased boilerplate code and saved time.

Creation sitemaps and page layouts

Pages:

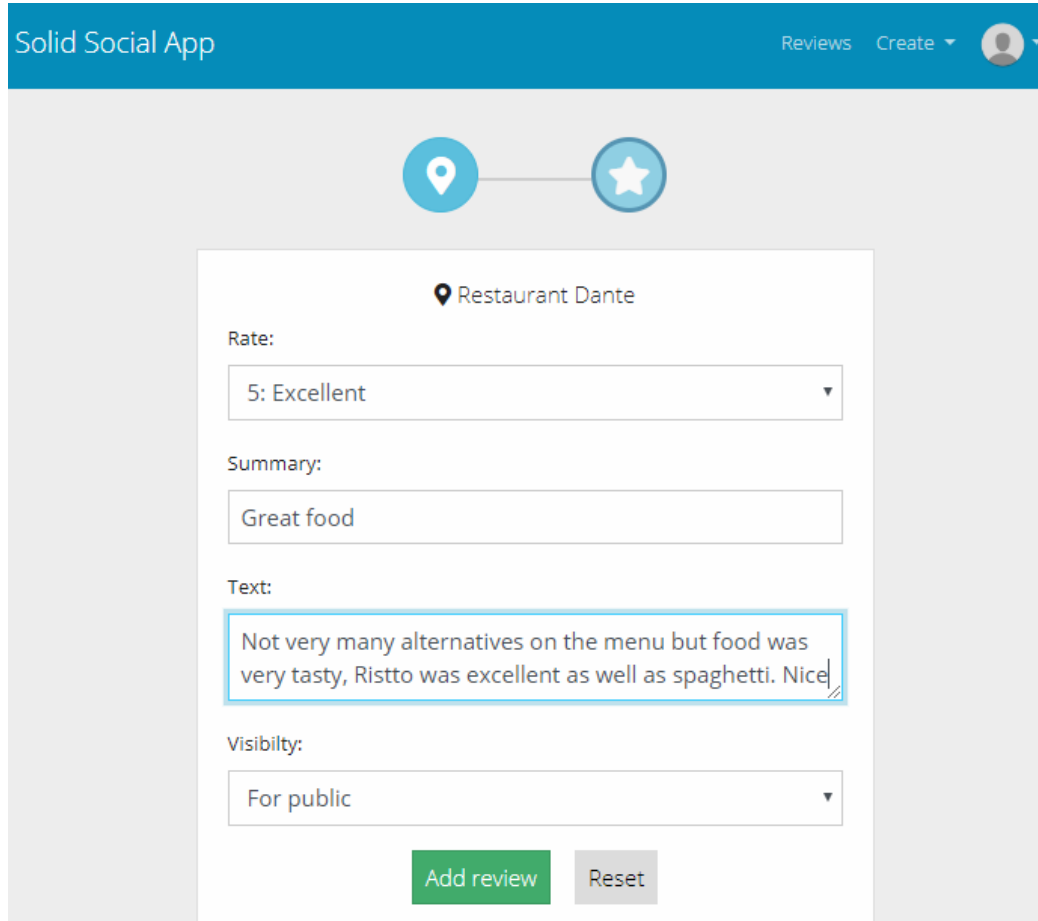
- Reviews - reviews from user's interest list
- My profile - page with user's reviews
- Create Hotel review and Create Restaurant review;
- Settings page;
- Following page;
- Friends management page.
- Achievements:
- clear view of UI;
- save development time.

Storing the data

Reviews are resources that:

- stores only on the author's POD;
 - described by well-known RDF vocabularies;
 - available for another applications.
-
- Each entry of this resource belongs to *"<https://schema.org/Review>"* class.

Review form



The screenshot shows the 'Solid Social App' interface. At the top, there's a blue header with the app name on the left, 'Reviews' and 'Create' with a dropdown arrow in the center, and a user profile icon on the right. Below the header, there are two circular icons: a location pin and a star. The main content area is a form for reviewing 'Restaurant Dante'. The form includes a 'Rate:' section with a dropdown menu showing '5: Excellent', a 'Summary:' section with a text input field containing 'Great food', a 'Text:' section with a larger text area containing 'Not very many alternatives on the menu but food was very tasty, Ristto was excellent as well as spaghetti. Nice', and a 'Visibilty:' section with a dropdown menu showing 'For public'. At the bottom of the form are two buttons: 'Add review' (green) and 'Reset' (grey).

Solid Social App

Reviews Create

Restaurant Dante

Rate:

5: Excellent

Summary:

Great food

Text:

Not very many alternatives on the menu but food was very tasty, Ristto was excellent as well as spaghetti. Nice

Visibilty:

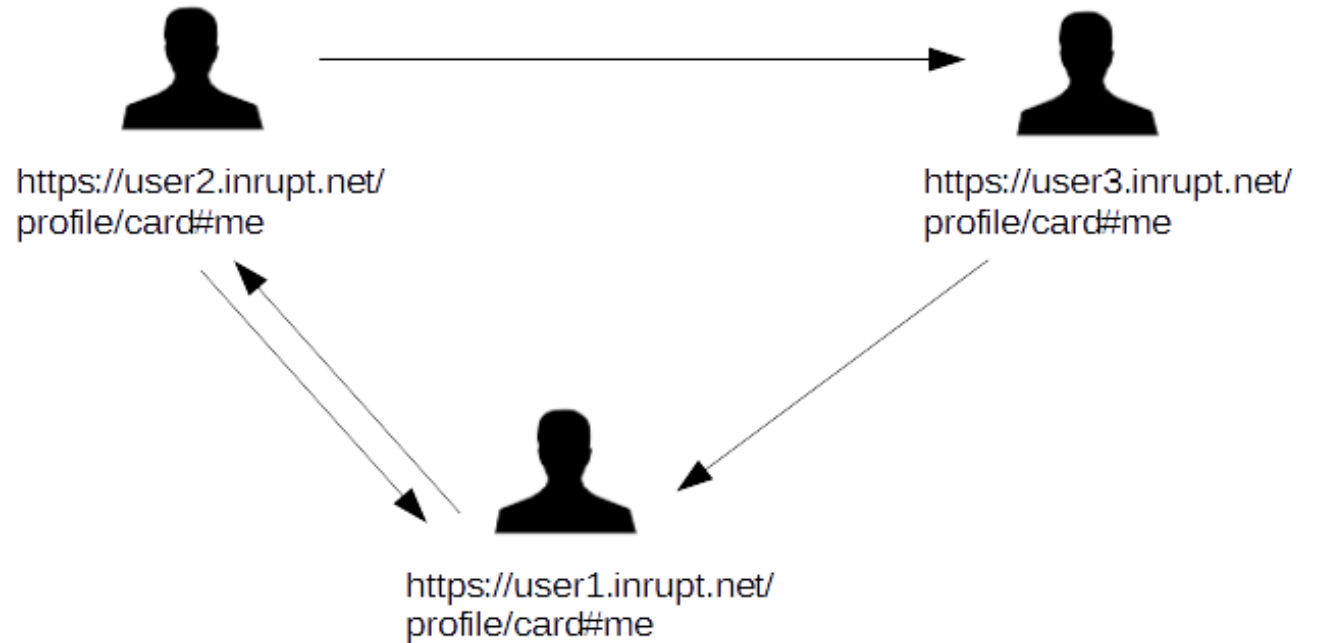
For public

Add review Reset

- User can:
 - rate the place;
 - choose visibility of review;
 - enter useful data about place.
-
- Data entered in form saves in:
 - **/public/reviews.ttl**
 - **/app.review.social-app/reviews4friends.ttl**


Social relationships


- The application shares reviews between **friends** and **followers**;
- Social relationships provide by SOLID;
- Each user profile contains the *foaf:knows* property - list of known persons;
- Relationships in *foaf:knows* can be represented as social graph;
- Each user knows who has share to him reviews, but he does not know who follows him.



How can I
became a
follower?
- User page

→ ↻ <https://solidsocialapp.herokuapp.com/usertimeline?webId=https:%2F%2Fgrigoriu.inrupt.net%2Fprofile%2Fcard>

Solid Social App Reviews Create ▾ 




Cristian Grigoriu

Student

[Follow](#) [Add in friend](#)

FOLLOWING 3 FOLLOWED 0




Cristian Grigoriu rated [Restaurant Dante in Nice, France](#)
1 month ago

Great food

Not very many alternatives on the menu but food was very tasty. Risotto was excellent as well as spaghetti. Nice surroundings and friendly service.

★★★★★

Average: [N friends were there](#)



Cristian Grigoriu rated [Brasserie Restaurant in Antibes, France](#)
2 months ago

How can I
became a
follower?
- Following page

← → ↻ 🔒 https://solidsocialapp.herokuapp.com/following-list?webId=https:%2F%2F

Solid Social App ☰

Web ID 🔍

Suggested friends:

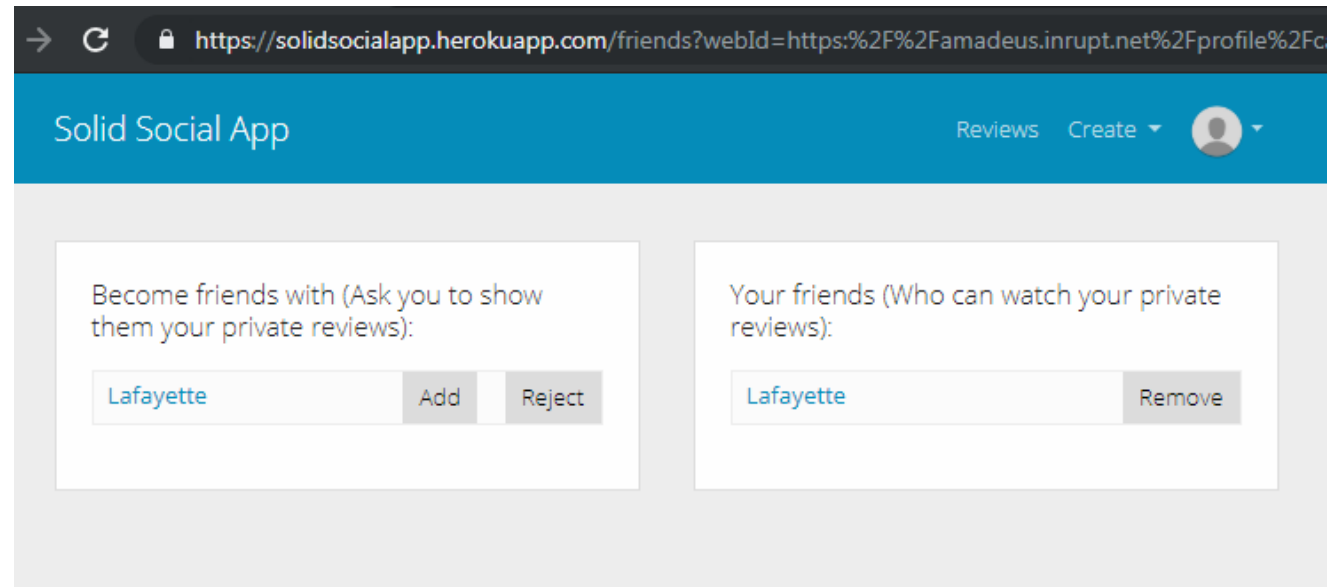
Philipp	Follow
Nikolai	Follow

Following list:

Amadeus	Unfollow	
Myosotis	Ask permission to read private reviews	Unfollow

Management of sharing list

- The *friends* page is designed to help users to manage their sharing list;
- `/app.review.social-app/queue.ttl` and `/app.review.social-app/friends.ttl`



Summary

We have:

- created UI of the application;
- designed clear navigation between page;
- created files required for storing data;
- added controls for creation social relationships.

Contribution: Privacy preservation

Achieves by separating the application data from user data:

- Provides by SOLID POD's:
 - Authorization supports by Access Control Lists;
- Provides by the application:
 - Users can select who can retrieve their data;
 - Two access modes available;
 - Reviews are stored only on the author's POD;

Created resources

The application creates 4 resources in user's POD:

- **/app.review.social-app/queue.ttl**
 - resource that stores incoming requests for reading user's private reviews;
 - readable for owner, writable for everybody
- **/app.review.social-app/friends.ttl**
 - store sharing list;
 - readable/writable for owner
- **/public/reviews.ttl**
 - resource that stores public reviews;
 - readable for everybody, writable for owner
- **/app.review.social-app/reviews4friends.ttl**
 - store private reviews;
 - available for members of /app.review.social-app/friends.ttl
 - readable for shared list, writable for owner

Issues of the SOLID's distributed storage

Found issues:

- Spam in shared resources;
- Impossible to find user's followers;
- Ownership not guaranteed for owner, possible to hijack resource;
<https://forum.solidproject.org/t/restoring-of-access-rights/935>
- POD is single point of failure, replication does not supported;
- You need control the server that host your POD to be sure that nobody screen your content;
- Poor documentation;
- You need to be interested in development and decentralized web to use SOLID

Achievements

We have:

- Created of privacy preserving social application;
- Written an overview of development decentralized application in the Solid's ecosystem;
- Created of debugging tool (<https://github.com/nmalcev/pod-explorer>)
- Published an announce about found security issue on project forum;
- Reviewed found issues.

Thank you for your attention

- Application: <https://solidsocialapp.herokuapp.com>
- Source code: <https://github.com/nmalcev/reviewapp>

- Contributors:

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- Cristian GRIGORIU

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- Philipp HOSCHKA