Your data on the Web

Solid & Linked Data

Ruben Dedecker

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Your data on the Web

Solid & Linked Data

The Web and universality
Origins and aims
Threats to universality

The Solid project
Separating applications and data
The Solid Pod

A Linked Data Web
CERN DD/OC

Tim Berners-Lee, CERN/DD

Information Management: A Proposal

March 1989

Abstract

This proposal concerns the management of general information about accelerators and experiments at CERN. It discusses the problems of loss of information about complex evolving systems and derives a
Before the Web

Exchanging information was hard
   different hardware
   different software

Innovation was hard
   For which machines do we build?
   For which operating systems do we build?
The Web strives to be *universal* through independence of many factors.

Anyone can use the Web, regardless of:

* **hardware**: desktop, phone, tablet, watch, ...
* **software**: operating system, browser, app, ...

Developers are free to innovate.

Build for the Web.

Standards provide interoperability.
"Individual links are allowed to break so the entire Web does not"

—Tim Berners-Lee
Released royalty-free in 1993
The Web brings *permissionless innovation* at a global scale

Anyone can build anything for any reason

The technologies are open

You don’t need anyone’s permission to join the Web and launch a new idea
The Web brings freedom of expression to everyone across the world

“Anyone can say anything about anything”

We can link to opinions of others to discuss about them

The “Web 2.0” ideas transition users from consumers to prosumers
The Web enabled unprecedented creativity
Your data on the Web: Solid & Linked Data

**The Web and universality**
- Origins and aims
- Threats to universality

**The Solid project**
- Separating applications and data
- The Solid Pod

**A Linked Data Web**
The browser wars
register an account

Sign in

Google Sign in with Google

or use your email to sign in:

Work email

Password

I forgot my password

Sign in

Sign in with Single Sign On
best viewed with

Twitter is better on the app
Never miss a Tweet. Open this in the Twitter app to get the full experience.
Our data has become stuck

Former personal blogs are now on Facebook and Twitter
  great user experience
  but we lost control
  and the Web lost its data

Data became stuck in silos
  not centered around the users that create it
  but centered on the platforms that use it
Within the walled gardens on the Web, you have to move either data or people.
Ironically, permissionless innovation even allows platforms that prevent it.

The Facebook founder has no intention of allowing anyone to build anything on his platform that does not have his express approval.

Having profited mightily from the Web’s openness, he has kicked away the ladder that elevated him to his current eminence.

—John Naughton, The Guardian
How dependent are you on the Google ecosystem?
The Guardian this weekend

"Rule One for any online venture is to acquire large numbers of users quickly so that you can harness the power of network effects to keep them inside your walled garden. These systems are not interoperable: you can’t easily take your “social graph” (your network of contacts) with you."

—John Naughton, The Guardian
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The Solid project

Spearheaded by Tim Berners-Lee as a way to take back control

Solid provides a way of building Web apps that let people keep control of their data

Solid builds on existing W3C standards

It is not a new Web: it builds on top of the existing Web.
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Separating applications and data

Typical platforms nowadays store data inseparably from an application.
If we need to access the data, we cannot choose our app.
If we need to use the app, we can’t choose our data source.

By separating data from apps, we create independent choices.
We can give data the portability that the Web enables for our documents.
User perspective: we can control and share our data

**Centralized Web applications**
- Facebook
  - my contact list 1
  - my pictures 1
  - my agenda 1
- LinkedIn
  - my contact list 2
  - multiple data silos
- Doodle
  - my agenda 2

**Decentralized Web applications**
- social feed
  - photo gallery
- meeting scheduler
- personal data pod
  - my agenda
  - my pictures
  - my contact list
Application perspective:
Innovation on a Web scale

THE FINITE DATA RACE

Tech Giants
harvest data

Current Challengers
lack data

Legal ceiling: GDPR, CCPA...
The data race ends for all, so nobody can ever win.

Failure to close the data gap leads to a competition gap.

THE INFINITE INNOVATION SPACE

Limitless creativity
Access more data, but control less.

Future Innovators
leverage data reuse

We need a course correction!

More data means a bigger innovation potential.

data controlled by company
innovation- and privacy-averse

data controlled by individual
innovation- and privacy-friendly

high access to data
innovation momentum

low access to data
innovation standstill
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A Linked Data Web
Where does this data go?

To separate applications and data ...

the user must have a space on the Web
The Solid Pod
Interoperability between Solid Pods is enabled through standardization

Solid builds on existing Web standards

The standards cover:
- data pods
- applications or services
- identity

Standards enable the interactions between data, apps, and identities
Your data pod can contain any data you create online

- profile
- media
- comments
- likes
- ...

Your data on the Web: Solid & Linked Data.
You control which applications can interact with your pod

You can give read and/or write permissions for specific pieces of data to:
- applications
- other people
- automated agents

Applications deliver an integrated experience
They can integrate your data, with other sources from all over the Web.
Any app you can envision, you can build with Solid

calendar

social feed

photo sharing

conference organization system

...
Applications can integrate data from many sources

- Author’s name and latest profile picture
  stored in author’s personal data pod

- Work-related opinion about an article
  stored in data pod of author’s company

- Discussed article title and photo
  stored in news website’s data pod

- Likes on this post
  each one in different individuals’ data pods

- Comments on this post
  each one in different individuals’ data pods
Interconnectivity is key
A point about trust

**Trust requires provenance of data**
- Apps can keep track of the source of data
- Apps can allow you to ignore untrusted data

**Verification enables trust in data**
- There is value in providing data verification
- Signatures provide trust in provenance
Your data on the Web

**Solid & Linked Data**

*The Web and universality*

*Origins and aims*

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*The Solid project*

*Separating applications and data*

*The Solid Pod*

*A Linked Data Web*
Our data needs to scale to the Web!

**centralized**: single app & back-end

- backend X
  - specific to X
  - app X

- backend Y
  - specific to Y
  - app Y

**decentralized**: multiple apps & back-ends

- data pod
  - app X
- data pod
  - app Y
- data pod
Interoperability challenges in Solid are solved through Linked Data.

If we all store our own data, how do we connect it to others’ data?

How can apps share data, without too many prior agreements?

How do we integrate data from multiple data pods?
I want to like a blog!

On Facebook?

On Twitter?

On Tumblr?

On the Web!
If I like your blog, I need a way to **connect** my like to your blog.

```json
{
    "@context": "https://www.w3.org/ns/activitystreams",
    "id": "#ruben-likes-blog",
    "type": "Like",
    "actor": "https://pod.rubendedecker.be/profile/card#me",
    "object": "https://ruben.verborgh.org/blog/",
    "published": "2019-04-25T08:00:00Z"
}
```
My like needs a *universal meaning* so different apps can reuse it

```
{
    "@context": "https://www.w3.org/ns/activitystreams",
    "id": "#ruben-likes-blog",
    "type": "Like",
    "actor": "https://pod.rubendedecker.be/profile/card#me",
    "object": "https://ruben.verborgh.org/blog/",
    "published": "2019-04-25T08:00:00Z"
}
```
Data from different sources can be easily be **combined**.

```
{
  "@context": "https://www.w3.org/ns/activitystreams",
  "@graph": [
    {
      "type": "Like",
      "actor": "https://pod.rubendedecker.be/profile/card#me",
      "object": "https://ruben.verborgh.org/blog/",
      "published": "2023-01-22T08:00:00Z"
    },
    {
      "type": "Like",
      "actor": "https://example.org/people/patrick#me",
      "object": "https://ruben.verborgh.org/blog/",
      "published": "2023-02-21T09:05:00Z"
    }
  ]
}
```
My data forms a graph on the Web

Ruben Dedecker
https://pod.rubendedecker.be/profile/card#me

Ruben Verborgh
https://ruben.verborgh.org/profile/#me

author
https://schema.org/author

Ruben's Blog
https://ruben.verborgh.org/blog/
Interactions create new connections

Ruben Dedecker
https://pod.rubendedecker.be/profile/card#me

actor
https://www.w3.org/ns/activitystreams/actor

Like
https://pod.rubendedecker.be/events/like2413

object
https://www.w3.org/ns/activitystreams/object

Ruben Verborgh
https://ruben.verborgh.org/profile/#me

author
https://schema.org/author

Ruben's Blog
https://ruben.verborgh.org/blog/
An ever expanding graph of data

Ruben Dedecker
https://pod.rubendedecker.be/profile/card#me

Ruben Verborgh
https://ruben.verborgh.org/profile/#me

Like
https://pod.rubendedecker.be/events/like2413

Ruben's Blog
https://ruben.verborgh.org/blog/

actor
https://www.w3.org/ns/activitystreams/actor

knows
http://xmlns.com/foaf/0.1/knows

object
https://www.w3.org/ns/activitystreams/object

author
https://schema.org/author
Take advantage of the Web!
Your data on the Web: Solid & Linked Data.
You can take part!

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Dexagod
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Google Scholar: 0000-0002-3257-3394

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**Education**

**Skills**

**Programming Languages**

Not authorized

**Languages**

Not authorized
Host your documents from your Pod

Community Solid Server

Contents of presentations

pod.rubendedecker.be > scholar > presentations

CERN2023/
QuWeDa2022/

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Empower your data on a Web scale
How does your data empower you?