

# MoralWeb: Reimagining the Web with Solid, Low-Code Tools, and Moral Codes for an Democratic and Equitable Future

Tobias Münch<sup>1,2</sup>[0000–0001–9424–6201], Andreas Schmidt<sup>3,4</sup>[0000–0002–9911–5881],  
Sebastian Heil<sup>2</sup>[0000–0003–2761–9009], and Martin Gaedke<sup>2</sup>[0000–0002–6729–2912]

<sup>1</sup> Münch Ges. für IT-Solutions mbH, Lohne(Oldenburg), Germany  
`to.muench@muench-its.de`

<sup>2</sup> Chemnitz University of Technology, Chemnitz, Germany  
`gaedke@informatik.tu-chemnitz.de`  
`sebastian.heil@informatik.tu-chemnitz.de`

<sup>3</sup> Karlsruhe Institute of Technology, Karlsruhe, Germany  
`andreas.schmidt@kit.edu`

<sup>4</sup> Karlsruhe University of Applied Sciences, Karlsruhe, Germany  
`andreas.schmidt@h-ka.de`

**Abstract.** The World Wide Web (WWW) was created as an open platform where individuals could freely create, share, and interact with information. However, the growing complexity of web engineering and the dominance of proprietary platforms have reduced non-specialist users to passive consumers. Challenges such as surveillance capitalism and disinformation further emphasise the need to restore openness and accessibility for everyday users. Building on our prior low-code web research, we propose a new vision of the web called *MoralWeb* inspired by Blackwell’s ‘More Open Representations, Access to Learning, and Control Over Digital Expression’ (Moral Codes). Therefore, *MoralWeb* combines decentralised ownership, intuitive low-code tools, and educational resources to empower non-specialists with Moral Codes in the WWW. *MoralWeb* provides learning and development environments directly in the browser, enabling users to create web applications with a shared state and identity and access management (IAM). With an wizard mode, users can create, share, and interact with decentralised data sources. We want to prioritise the user’s ability to act, comply with the General Data Protection Regulation (GDPR) and data sovereignty, and offer a pathway toward an equitable and participatory web.

**Keywords:** Web Architecture · Moral Codes · Human-centric AI · Web Development · User Participation

## 1 Introduction

Tim Berners-Lee designed the WWW as an open framework for democratising scientific knowledge and search efforts [1, 2]. It changed the way individuals

create and share content [1, 2]. However, the Web’s transformative potential was overshadowed by profit-orientated platforms, which prioritise monetisation over inclusivity [3, 5]. Therefore, Zuboff introduced the term *surveillance capitalism* [5]. The comfort of sharing content through social networks has been used to build substantial user bases, but it has been compromised by disinformation and advertising [6]. Simultaneously, the growing complexity of web development makes it difficult for non-specialist users to learn how to create web applications [7]. This development raises questions about the WWW ideals of equality and accessibility [8, 9]. In addition, this also brings to light issues about privacy and ethical dilemmas. With the increasing integration of AI and the Web, exchange with Human-Centric AI research becomes more relevant in Web Engineering. Therefore, democratising the WWW is urgent and important.

This situation requires solutions that go beyond proprietary systems and enable users to protect their autonomy while drawing on the school experience with HTML that they usually have [10]. For business developers, this means lowering development expenses [19]. For everyday users, it focuses on regaining control over personal data and digital interactions [5]. Addressing this broad spectrum of needs calls for a concept of a system that bridges the gap between existing technology, security, scalability, transparency and user-friendliness.

This vision paper outlines a vision of a web framework called ***MoralWeb*** that merges *Solid* principles [8] with low-code web development and ethically grounded design principles. Drawing on Blackwell’s Moral Codes [9], we sketch an ecosystem that foregrounds data sovereignty, human-centred interfaces, and educational accessibility. The *MoralWeb* tries to create a more inclusive and sustainable WWW landscape. Therefore, we try to answer our first research questions on this broad topic:

- **RQ1:** What should a web architecture look like that focuses on decentralised data ownership, transparency, and Moral Codes?
- **RQ2:** Which design principles and educational resources empower diverse stakeholders to participate in a future web?

At first, we will discuss and compare MoralWeb to the actual research state of the WWW with data sovereignty, frameworks and low-code tools, and educational resources. Afterwards, we present the core principles, key users and their use cases with a deep dive into a possible architecture. Our early vision closes with its limitations, challenges and strategies for future development.

## 2 Background & Related Work

**Evolution of the Web, Centralization & Decentralization:** Designed as an open platform, the WWW democratized access, creation and sharing of information [1]. The early versions focused on simple declarative HTML to be accessible to individuals with limited technical expertise [1, 7]. However, it became a battleground for commercialization as part of *surveillance capitalism* [5], and only a few influential players dominate this area and its development [7].

Therefore, the Solid project was introduced to restore control over user data even in third-party systems [8]. The goal is to protect user data while maintaining the open ethos of the WWW [8]. Data portability and interoperability are increasingly recognised as vital principles to maintain user autonomy in online ecosystems as part of the GDPR [15]. Also, industry practitioners such as Datev are implementing solutions to this approach [20].

**Ethics, Digital Well-Being, and Thoughtful Design:** The evolution of the Web is not profoundly ethically driven because of its commercialisation in the 2010s [18]. Currently developed systems include risks such as addictive user interfaces. [17]. As AI-driven algorithms mediate digital platforms, concerns over user attention and mental health have taken centre stage [13]. Moral Codes emphasises the need for tools that help users to shape their digital experiences actively, such as the famous Microsoft Excel [9]. In addition, the ICWE 2024 emphasized this by 'Ethical and Human-Centric Web Engineering: Balancing Innovation and Responsibility in Web Technology' [4].

**Bridging Education Gaps with Low-Code Solutions:** A challenge in web participation is the unequal distribution of informatics education across regions and demographics [10]. Studies highlight how differences in education limit many students to engage with web technologies [10]. Proprietary low-code platforms such as Bubble or Webflow address these barriers [11]. This is an evolution of the End-User-Development approach to empower individuals with limited expertise to create web applications [12, 11]. By abstracting configurations, such platforms open the door for citizen developers to engage in web development [14]. Schmidt and Münch demonstrate how free web components and generic RESTful services enable non-specialists to embed live database content into enterprise systems [19]. While traditional frameworks like htmx, Angular and React focus on experienced developers.

*MoralWeb* differs from previously approaches, which is shown in table 1. Unlike these traditional approaches, which focus solely on development tools for experienced users, *MoralWeb* combines a Learning and Development Environment with decentralized data ownership and DevOps systems like GitHub.

| Feature                | MoralWeb<br>(Solid, Low-Code) | Web Frameworks<br>(React, Angular) | Low-Code Systems<br>(Bubble, Webflow) |
|------------------------|-------------------------------|------------------------------------|---------------------------------------|
| <b>Openness</b>        | 5 (Fully open)                | 3 (Partially open)                 | 1 (Closed)                            |
| <b>Data Control</b>    | 5 (User-owned)                | 3 (Depends on hosting)             | 1 (Platform-controlled)               |
| <b>Ease of Use</b>     | 4 (Low/No-code)               | 2 (Coding)                         | 5 (No-code)                           |
| <b>Customizability</b> | 5 (Highly flexible)           | 5 (Full control)                   | 2 (Limited)                           |
| <b>Privacy</b>         | 5 (self-hosted)               | 3 (Depends on setup)               | 1 (Vendor-controlled)                 |

**Table 1.** Comparison of MoralWeb, Web Frameworks, and Low-Code Systems. The scale ranges from 1 (lowest) to 5 (highest)

### 3 The Vision of *MoralWeb*

In this section, we describe *MoralWeb*’s vision and core principles, key stakeholders, system architecture, and educational resources.

#### 3.1 Core Principles

**Decentralized Data Ownership & RESTful Abstraction:** Decentralized Data Ownership and RESTful Abstraction are built on the principle that users maintain complete control over their data [8]. Instead of relying on hand-coded endpoints, our approach provides a streamlined RESTful interface that includes service discovery, standardized schemas (such as OpenAPI), and token-based security. This layer automates IAM, allowing for secure, privacy-focused integrations. There is nearly no manual intervention needed.

**Low-Code Development & Educational Accessibility:** Based on our prototype [19], our low-code strategy empowers a wide audience to create web solutions. Recognizing that basic HTML is already part of many school curriculums [10], we offer user-friendly web components, visual configuration tools, discoverable RESTful web services with OpenAPI or *Solid* pods, and automated security setups. Therefore, we enable learners to move seamlessly to fully functional, secure, data-driven applications.

**Ethical Design & Moral Codes:** Based on Moral Codes, we weave privacy, equity, and agency into every layer of our concept [9]. Specifically, we prioritize More Open Representations by making system details transparent to users, Access to Learning by building on school-level HTML skills and low-code tools, and Control Over Digital Expression by enabling self-hosted pods for personal data ownership [8–10]. This approach ensures that novices can join the *MoralWeb*.

#### 3.2 Key Stakeholders

**Business developers** need tools that reduce development overhead and integration costs, enabling them to build dynamic, data-driven applications without extensive technical expertise. Intuitive visual configuration and discoverable data endpoints allow efficient customization.

**Learners** need accessible tools to advance from basic HTML to more complex technologies. *MoralWeb* provides educational materials and low-code environments that complement existing curricula.

**Platform operators** need observable, maintainable and scalable infrastructures that support applications with data privacy and security.

#### 3.3 Key Scenarios

*MoralWeb* aims to streamline key aspects of modern web development. Below, we outline our primary usage scenarios.

**Wizard Mode:** Users are familiar with modern Graphic User Interfaces with Drag-and-Drop functionality. Therefore, the framework should allow users to arrange content and components visually, similar to assembling LEGO pieces, with event-based interactions. Therefore, low-code tools should have mechanisms to wire components, forms, data models, and actions to relevant web services. Web browsers should allow direct editing within the browser. This way, changes can be saved to a hosting or local development platform.

**Data Connection and Shared State:** To integrate data, we must simplify the integration of services, using standardized interfaces like OpenAPI. Based on these data connections, the wizard provides an interface to design web applications for creating, reading, updating, and deleting data using these services. Additionally, IAM offers authentication mechanisms like OAuth2 to offer easy activation and configuration to reduce manual setup overhead.

**Learning Mode:** The learning mode is for teachers and students. It focuses on business, grammar school, or early university learners. A teacher-led curriculum will support educators in guiding students through hands-on exercises that reinforce fundamental web development principles.

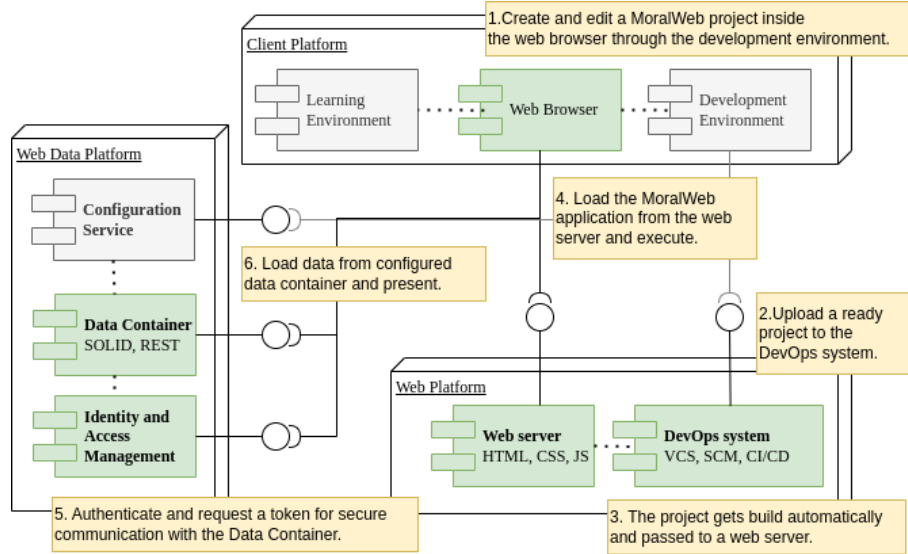
### 3.4 System Architecture

To answer RQ1, the architecture of *MoralWeb* consists of the core environments Web Data Platform, Client Platform and Web Platform (see Fig. 1). The Web Data and Web Platform could be hosted by providers or on-premise. Essential are the interfaces between these environments. Using existing technologies (see Fig. 1), such as common web servers like NGINX or Apache, enables the solution to be scalable in the WWW environment.

The user interacts with the web browser on the Client Platform extended by a Learning environment and Development environment (DevEnv) (step 1, Fig. 1). Inside the DevEnv, a local Git repository gets created for each project, and a local webserver is running so a preview can be displayed in the Web Browser. The DevEnv is connected to the Web Data Platform Configuration Service to select a specific Data Container like a RESTful Webservice with OpenAPI or a *Solid* Pod (see Fig. 1). After a project is ready to deploy, it gets transferred through Git into the web-based DevOps system (step 2). The used Web Data and Web Platform can be configured in DevEnv.

The DevOps system is used to host *MoralWeb* projects. The repositories are connected to Deployment Pipelines, which build, test and transfer the projects to a web server (step 3). Afterwards, the user can open the published project in the web browser (step 4). In the runtime phase in the browser, the user can authenticate against the IAM (step 5) and use a generated token to identify after the data containers (step 6). The data loading differs from traditional web applications where data is rendered on the webserver.

This system must cover the Moral Codes aspects of Open Representation through our low-code approach inside the browser and control over digital expression through *Solid* Data Pods or private RESTful Webservices with OpenAPI.



**Fig. 1.** The architecture of *MoralWeb* consists of a Web Data Platform, a Web Platform, and a Web Browser. The green components already exist, but the grey components have to be created.

### 3.5 Educational Resources

Educational materials play a major role in involving our stakeholders (RQ2). These materials should include documentation, tutorials, references, interactive learning, and videos. Each type caters to the distinct learning requirements of various groups, enabling them to successfully adopt and make use of the *MoralWeb*. To ensure broad accessibility and sustainability, *MoralWeb*'s educational content should be aligned with the principles of Open Educational Resources (OER). The content should be created with partners such as W3C, universities, schools, and private educational institutions.

Beginners benefit from guides, tutorials, and interactive tools, enabling self-paced learning or use in formal courses to master the basics. Practical guidance is for business developers. Tutorials and concise documentation will enable these users to quickly find solutions to their needs without requiring extensive technical expertise. For platform operators, detailed reference materials are crucial. These resources should provide in-depth information about the *MoralWeb*.

This approach aligns with the "Access to Learning" principle from Blackwell's Moral Codes, ensuring that *MoralWeb* remains inclusive and accessible.

## 4 Challenges, Limitations, & Future Directions

*MoralWeb* presents our vision of combining Moral Codes, existing web technologies, and areas for improvement to democratise the WWW. **Technically**, the

distributed data architecture builds on existing technologies such as Solid Pods and OpenAPI, which have been demonstrated to provide scalable and secure data ownership solutions [8]. In addition, adapting to evolving web standards (e.g., WebAssembly, HTTP/3) are significant hurdles. Security measures, such as automated CORS handling and IAM, are essential to control digital expression. **Socially**, resistance to new models and the need for culturally inclusive resources require collaboration with global stakeholders and targeted educational efforts. **Sustainability** is also challenging because maintaining an open-source system demands innovative funding models and partnerships with browser manufacturers to integrate native editing tools. *MoralWeb* aligns closely with the European Union’s strategic emphasis on digital sovereignty [16]. It enables citizens to retain control over their data and reduce dependence on centralised, non-European platforms - data privacy features position *MoralWeb* as a driving force for Europe’s digital independence. Therefore, EU funding through programs like Horizon Europe offers an opportunity to support its development and sustainability. Key open questions include:

- What funding mechanisms can support *MoralWeb* without introducing conflicts of interest? Can grants from organizations like the EU’s Horizon Europe or W3C partnerships provide long-term support?
- Should MoralWeb be managed by an open-source community, a nonprofit, or an academic-industry consortium?
- How can MoralWeb incentivize adoption by developers and businesses, given the dominance of existing web frameworks and low-code platforms?

Our strategy for future efforts will prioritise 1) partnerships with global stakeholders such as W3C and universities, 2) prototyping of a small-scale *MoralWeb*, 3) creating validation concepts and user studies, and 4) validating and refining through user studies *MoralWeb*’s impact.

## 5 Conclusion

Inspired by Solid, ”One Hundred Years of Web”, and Moral Codes the *MoralWeb* envisions a WWW grounded in ethical principles, empowering users to reclaim control over their data and shape their digital environments. Aligned with GDPR compliance and ethical design principles, *MoralWeb* advances user-centric technologies to create a more equitable, participatory, and humane web by mainly using existing technology. In the following steps, we aim to establish a collaborative group of researchers, developers, and stakeholders to refine our vision. To ensure sustainability, we will pursue funding opportunities through programs like Horizon Europe and partnerships with industry leaders committed to ethical and decentralized web development.

**Acknowledgements** This work is supported by the European Union’s HORIZON Research and Innovation Programme under grant agreement No 101120657, project ENFIELD (European Lighthouse to Manifest Trustworthy & Green AI).

## References

1. Berners-Lee, T. (1989). Information management: a proposal [J]. No. CERN-DD-89-001-OC.
2. Berners-Lee, T., Cailliau, R., Groff, J. F., & Pollermann, B. (2010). World-wide web: the information universe. *Internet Research*, 20(4), 461-471.
3. Martínez-López, F. J., Li, Y., & Young, S. M. (2022). Social Media Monetization. *Future of Business and Finance*.
4. Stefanidis, K., Systä, K., Matera, M., Heil, S., Kondylakis, H., Quintarelli, E. (2024). *Web Engineering: 24th International Conference, ICWE 2024*.
5. Zuboff, S. (2023). The age of surveillance capitalism. In *Social theory re-wired* (pp. 203-213).
6. Tucker, J. A., Guess, A., Barberá, P., Vaccari, C., Siegel, A., Sanovich, S., ... & Nyhan, B. (2018). Social media, political polarization, and political disinformation: A review of the scientific literature. *Political polarization, and political disinformation: a review of the scientific literature*.
7. Pemberton, S. (2023, April). The One Hundred Year Web. In *Companion Proceedings of the ACM Web Conference 2023* (p. 1).
8. Mansour, Essam, et al. "A demonstration of the solid platform for social web applications." *Proceedings of the 25th international conference companion on world wide web*. 2016.
9. Blackwell, A. F. (2024). *Moral Codes: Designing Alternatives to AI*. MIT Press.
10. Vahrenhold, J., Caspersen,... & Westermeier, M. (2017). *Informatics education in europe: Are we all in the same boat?*.
11. Luo, Y., Liang,... & Zhan, J. (2021). Characteristics and challenges of low-code development: the practitioners' perspective. In *Proceedings of the 15th ACM/IEEE ESEM* (pp. 1-11).
12. Chudnovskyy, O., & Gaedke, M. (2012). End-User-Development and evolution of web applications: the webcomposition EUD approach. In *Current Trends in Web Engineering: ICWE 2012*. (pp. 221-226)
13. Korte, M. (2020). The impact of the digital revolution on human brain and behavior: where do we stand?. *Dialogues in clinical neuroscience*, 22(2), 101-111.
14. Hartmann, B., Wu, L., Collins, K., & Klemmer, S. R. (2007). Programming by a sample: rapidly creating web applications with d. mix. In *Proceedings of the 20th annual ACM symposium on User interface software and technology* (pp. 241-250).
15. De Hert, P., ... & Sanchez, I. (2018). The right to data portability in the GDPR: Towards user-centric interoperability of digital services. *Computer law & security review*, 34(2), 193-203.
16. Ivic, S., & Troitiño, D. R. (2022). Digital sovereignty and identity in the European union: A challenge for building Europe. *European Studies*, 9(2), 80-109.
17. Ko, A. J., Myers, B. A., & Aung, H. H. (2004, September). Six learning barriers in end-user programming systems. In *2004 IEEE Symposium on Visual Languages-Human Centric Computing* (pp. 199-206)
18. Bell, J., & Loane, S. (2010). 'New-wave'global firms: web 2.0 and SME internationalisation. *Journal of marketing management*, 26(3-4), 213-229.
19. Schmidt, A. and Münch, T. (2024). Enable Business Users to Embed Dynamic Database Content in Existing Web-Based Systems Using Web Components and Generic Web Services. In *Proceedings of the 20th WEBIST*, 296-306
20. Both, A., Kastner, T., Yeboah, D., Braun, C., Schraudner, D., Schmid, S., ... & Harth, A. (2024). AuthApp-Portable, Reusable Solid App for GDPR-Compliant Access Granting. In *International Conference on Web Engineering* (pp. 199-214).