INFINITCODEX

White Paper v0.7.3

September 2018

Publish and flourish.

Bringing science and scholarly communication to everyone.

THE PROBLEM AND THE SOLUTION

Consolidation of scholarly communication industry resulted in a market with limited competition and with ever increasing profits for a few large players. Large profits are possible because the marginal costs of electronic publishing have no lower boundary (practically zero), and because paywalled or open access academic publishing stands on non-compensated work of researchers in three-fold roles: as authors, reviewers and editors. Major publishing companies have positioned themselves as oligopolists, as centralized authorities, gatekeepers of the quality of published research and providers of reputation for authors whose academic careers in turn depend on the very products these same companies provide.

The key problem we target is the lack of transparency and trust in the peer review process as currently implemented in traditional scholarly journals and in the decision making processes such as research project proposal calls. Peer review lies at the core of the scholarly communication and progress, but is currently flawed, non-transparent and inconsistent.

We seek to disrupt the current scholarly communication market with a distributed ledger – blockchain -- technology solution based on open science principles that provides users with tools and mechanisms for building trust and reputation, protects privacy and intellectual property, and operates with transparency and access through a decentralized peer-to-peer network. The immutability of the blockchain and decentralization of the network will prevent malicious behavior in form of fake reviews, trolling or Sybil attacks, bogus authorship and forming of citation cartels.

Our solution is open to everyone with an interest in science: citizens, students, young researchers at start of their careers, established researchers and academics, journalists reporting on scientific topics.

I8X - INFINITCODEX PLATFORM

INFINITCODEX (I8X) platform is a blockchain based technology (Figure 1) that enables and supports two core processes running on the platform:
- publishing and
- reviewing.

These two processes are embedded in the protocol and services layer of the I8X technology stack to support development of applications in the application layer. The infrastructure layer provides compute, storage, database and virtualization support, the protocol layer defines blockchain network participation requirement and rules, method and protocol of consensus, while the services layer contains blockchain services to enable development of applications and connections to other technologies. The details on the I8X technology will be published in the forthcoming I8X Technical Paper.

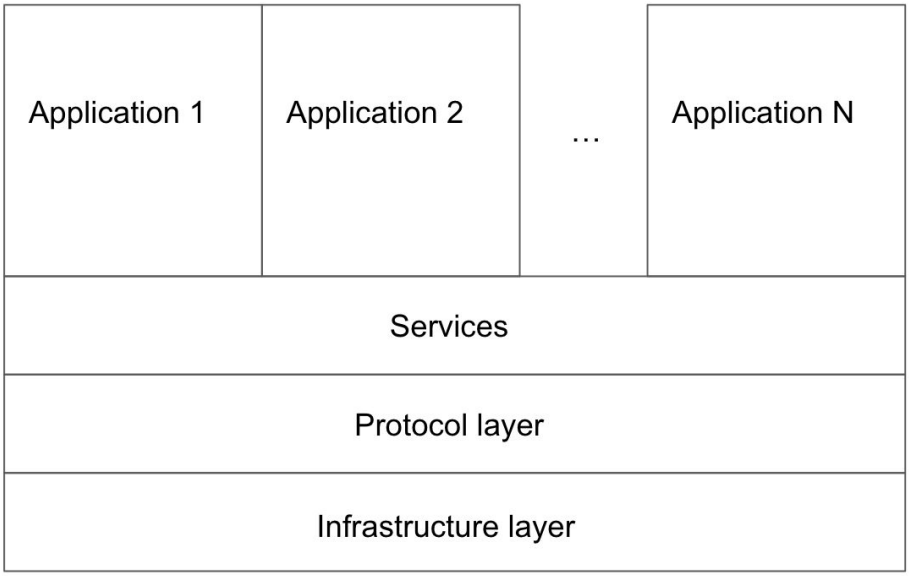

Figure 1: Technology stack of the I8X platform.

The two core processes were designed with three key principles in mind:
- transparency,

- integrity and
- engaging the members of the community.

Transparency and integrity are guarded by the protocol and network governance provided by the community members. I8X community blockchain protocol and developed services such as smart contracts contain incentives (societal and economic) to stimulate community engagement in all platform activities performed by community members. The functional overview of the interdependence of processes, user interaction and community is shown in Figure 2.

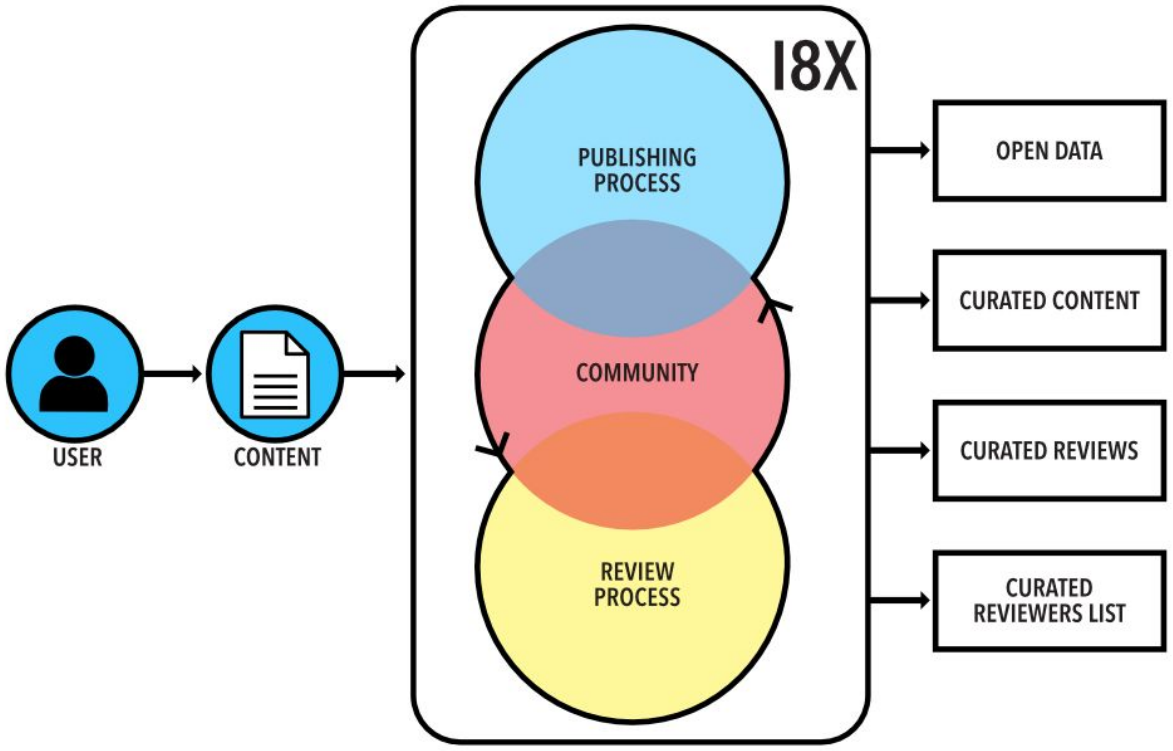

Figure 2: Functional overview of the I8X platform.

The main function of the I8X platform is to translate user generated content - scholarly communication (research paper, research idea, project proposal, ...) into curated and reviewed content. The output of the publishing and the review processes are curated reviews, curated list of trusted reviewers and open data access supported by I8X database of over 150 million metadata points on research papers and high quality index of keywords, authors, organisations and

citations. The data on authors, reviews, reputation indices are stored and generated in a decentralized network and accessible to everyone through Open APIs or interaction with smart contracts provided and supported with our I8X technology stack.

There are three types of community members, each with specific roles in I8X platform:
- users,
- peers and
- developers.

Users are members of the community that interact with I8X platform through the application layer that provides WebUI access and functionality. User actions include claiming existing research articles and other published content, adding new content, reviewing other content, commenting on other content, ...

Peers are trusted members of the community that form and secure the community blockchain network, execute transactions through consensus mechanisms and connect applications with the blockchain.

Developers are community members that use and/or build open APIs, data models and applications using I8X services. I8X applications are decentralized curated content collections. Some examples of applications are: a single research paper, decentralized journal, journal issue or book, decentralized conference proceedings, decentralized research project call.

The basic unit of content in these applications is a completed scholarly communication item such as a paper, a review, a chapter, a contribution, a proposal. We are introducing a new concept of such content, a content encoded in smart contracts that live as decentralized autonomous entities on the blockchain. Users can interact with these entities, perform actions and call functions that transform them or change their state.

THE PUBLISHING PROCESS

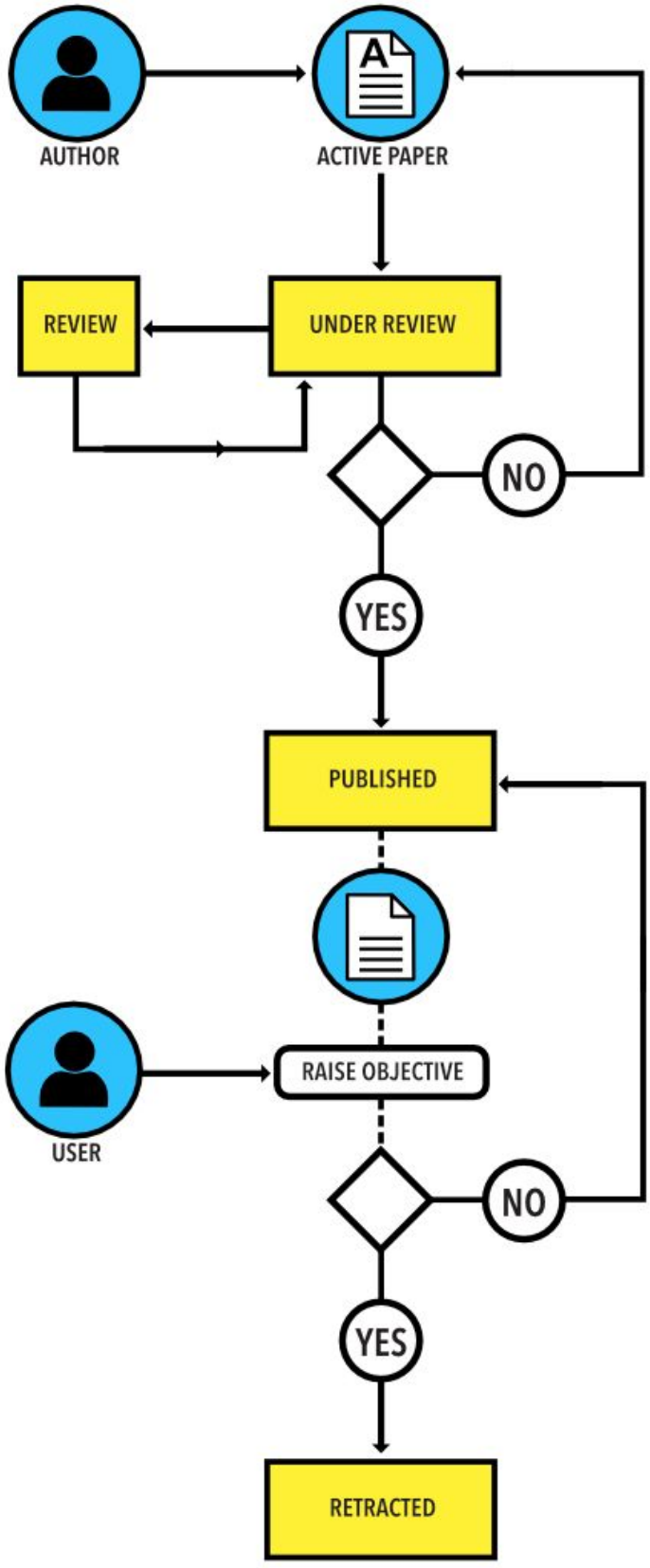

Figure 3: Schematic diagram of the publishing process

The flow of the publishing process on I8X platform is shown in Figure 3. Let's walk through the process using publishing a research paper as an example. The process is started by the user announcing the intent to publish a paper by submitting the (possibly yet unfinished) content to the platform using one of the applications. The subset of content data (for instance authors, institutions, title, abstract) is hashed and written to the blockchain to secure authorship to authors. The review process (described below) is initiated by the author(s). The outcome of the review process can transition the paper into a published one or return the paper to author(s) for further revisions and development. Community can act also on already published content by raising an objective and propose the retraction of the published content.

To stimulate good behavior of users, to foster integrity and transparency of the network and to engage community members into actively following publishing and review processes, we integrated several socio-economic incentives and deterrents into the publishing and reviewing processes. The I8X will issue a utility token (I8X token) that users can use for depositing in publishing and review processes. By successfully performing certain tasks on the platform such as publishing content, writing reviews and comments, users can earn tokens. The reputation of the user on I8X is a function of number of tokens the users holds at each instant of time. Since the number of tokens reflects the reputation of a user, a user can exchange tokens only with I8X platform and not with other users. The exact structure and mechanisms of I8X token economy will be described in the forthcoming I8X Technical Paper.

In a more detailed view, we can describe a paper as a finite state machine (FSM) with the following states (Figure 4): Active (A), Under review (U), Published (P), and Retracted (R).

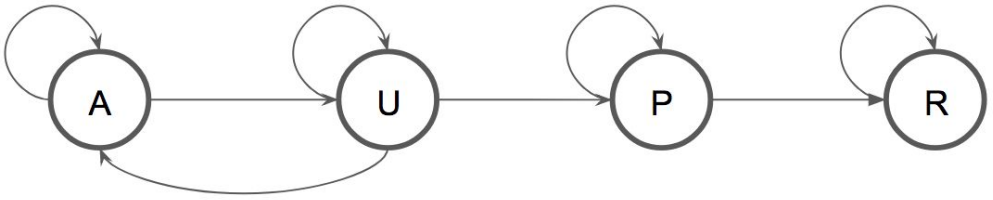

Figure 4: States and transitions in publishing process.

The FSM can change states with the transitions that are initiated by the community members. There are following transition in the publishing FSM:

A ==> A

In this state transitions are initiated by community comments which preserve the state. Community comments reflect expectations of the community about the research paper. There is no deposit required to submit comments in this state.

A ==> U

This transition is initiated by the author when the paper is completed and ready for review. The author deposits N_A > N_A_MIN tokens and this transaction triggers the start of the review process.

U ==> U

While the paper is in this state the review process is in progress. Community members can submit comments about the paper which preserve this state. Commenting in this state works like a prediction market where users buy or sell shares for the outcome of the review process (revise or publish). I8X platform sets up a prediction markets with an automated market maker of LMSR (logarithmic market scoring rule) type (see Technical Paper for details).

U ==> A

Initiated automatically by the platform as a result of reviewing process (with consensus by the listed reviewers), decision = revise. The author loses the deposited tokens, users that have bought revise shares receive reward.

U ==> P

Initiated automatically by the platform as a result of reviewing process (with consensus by the listed reviewers), decision = publish. The author is rewarded for successful publication by N_P > N_A tokens, and users that have bought publish shares receive reward.

P ==> P

In this state users can submit community comments without token deposit and reviews through review process (see below) that can influence reputation of the reviewer and authors.

P ==> R

Usually an exceptional transition initiated by community member with “raise an objective” mechanism (see Technical Paper) followed by a dispute/challenge. The outcome is decisioned by consensus of the peers (trusted community members).

R ===> R

R is a final state, users can submit comments without depositing tokens.

THE REVIEW PROCESS

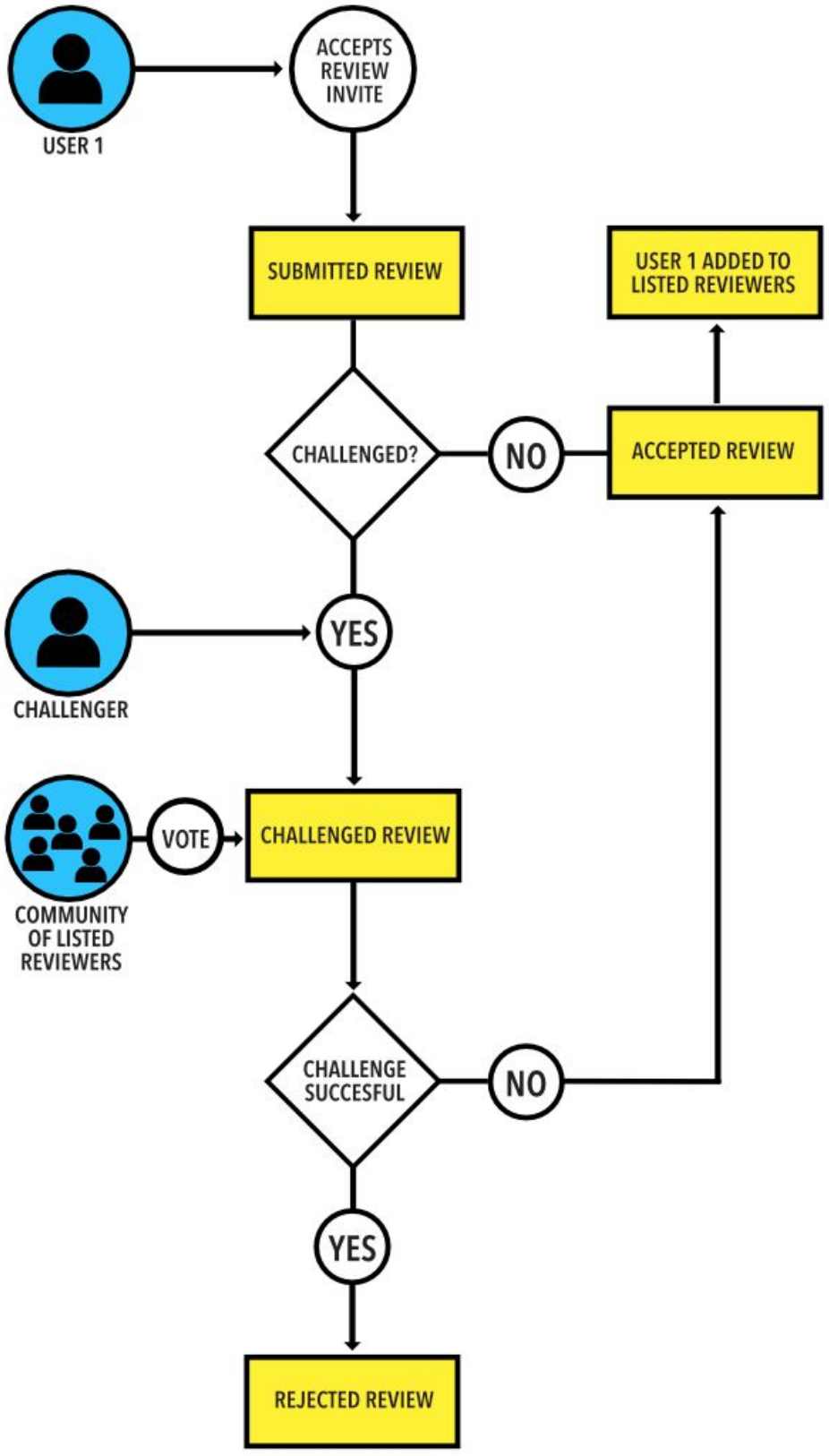

Figure 5: Schematic diagram of the review process

The flow of the review process is presented in Figure 5. The review process is triggered by the author (A ==> U transition in publishing process) or by user wishing to submit a review on an already published content. In the first case the reviewer can accept an invitation to review the content or apply for writing a review. In the second case the reviewer applies for writing a review.

Accepting an invitation to review or applying to write a review requires a deposition of N_R > N_R_MIN tokens from the user. The writing of the review is time limited, user loses the deposited tokens if the review is not submitted until the deadline. If the review is submitted on time and is not challenged, the review is accepted and listed on the curated review list and the reviewer receives the reward of N_L > N_R tokens. Also the reviewer is listed on the curated reviewer list.

The submitted review can be challenged by one or more trusted reviewers (users already listed on curated reviewer list). The challengers must deposit N_C tokens to initiate the challenge. The outcome of the challenge is subject to a voting protocol by community of listed reviewers. If the challenge was successful the review is rejected and the reviewer loses the N_R deposited tokens, the challengers are each rewarded by N_CS > N_C tokens. If the challenge was not successful the challengers lose their deposits and the reviewer is rewarded with N_L > N_R tokens, the review is accepted and listed on the curated review list, reviewer is listed on the curated reviewer list.

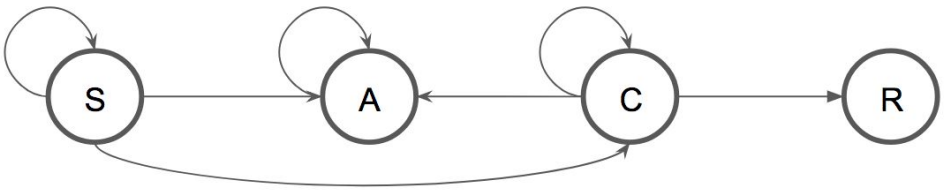

Figure 6: States and transitions in review process

As in the case of the publishing process, we can here represent the review process as a finite state machine (Figure 6). The reviews can have the following states: submitted (S), challenged (C), accepted (A), rejected (R). The transitions: S ==> A, S ==> C, C ==> A and C ==> R are described above. The transitions S ==> S and A ==> A that preserve the state are caused by community comments on the reviews. During the challenge, while in state S, the community can submit comments about the review. Commenting in this state again works like a prediction market where users buy or sell shares for the outcome of the challenge (accept or reject) and are rewarded accordingly upon known decision.

I8X PLATFORM DEVELOPMENT ROADMAP

2018 Q4: version 1.0, MVP, database, sign up, claiming papers, writing comments and reviews, testing, preparing pilots

2019 Q3: version 3.0, I8X + community ready release with Open APIs

2020 Q4 : version 5.0 -> full functionality, community supporting release

THE INFINITCODEX TEAM

Emilija Stojmenova Duh

(Communications & Product management)
PhD in Electrical Engineering (University of Maribor, Slovenia), Assistant Professor of Electrical Engineering at University of Ljubljana. She develops and coordinates EU projects in the field of digitisation. She is the Director of Digital Innovation Hub Slovenia and President of Management Board of EU Blockchain Hub.

Andrej Duh (R&D)

PhD in Physics (University of Ljubljana, Slovenia). He worked as a researcher and developer on a number of projects for companies from USA, Japan and Singapore. He worked as a researcher and lecturer at University of Ljubljana and University of Maribor, however his primary focus now is in business and development. Currently he is the head of development for an American startup company CloudMondo (www.cloudmondo.com). He co-founded tech company Percipio (percipio-big-data.com).

Dean Korošak (Communications & Product management)

PhD in Physics (University of Zagreb, Croatia), Full Professor of Applied Physics at University of Maribor, Slovenia. His research interest is in statistical physics and application of methods of mathematical physics. He is developing advanced algorithms for big data analytics. He co-founded tech company Percipio (percipio-big-data.com).

Iztok Peruš (Communications & Product management)

PhD in Civil Engineering (University of Ljubljana, Slovenia). He is an Assistant Professor of Mechanics at the University of Maribor. His research interest is in structural mechanics, intelligent systems and artificial neural networks. He worked and developed several blockchain projects and has experience in ICOs.

Igor Pernek (R&D)

PhD in Computer Science (University of Maribor, Slovenia) with specialization in machine learning. Collaborated and published articles with researchers from renowned universities such as UC Berkeley, Stanford University and ETH Zürich. Currently working as a backend developer on a low latency big-data platform.

Tim Kos (R&D)

Tim is finishing his PhD in Mathematics at the University of Maribor, Slovenia. He is an outstanding mathematician and developer. Currently he works as a junior researcher at the Institute of Mathematics, Physics and Mechanics in Ljubljana.

Dario Šnajder (R&D)

Dario is experienced full stack programmer, who covers the whole spectrum of development from mobile applications to service platforms. Currently he works in the CloudMondo company development team (www.cloudmondo.com).

Uroš Droftina (R&D)

PhD in Electrical Engineering (University of Ljubljana, Slovenia). He is outstanding and full stack efficient developer and problem solver with a wide knowledge of data management, advanced analytics and artificial intelligence.

Nejc Vidrih (R&D)

Nejc is finishing his Masters in Informatics at the University of Maribor, Slovenia. He is the intern at Percipio working as DevOps engineer. He is growing into wide spectrum developer and engineer.

Urban Duh (R&D)

Urban is studying Physics at the University of Ljubljana, Slovenia, and is an experienced blockchain programmer. He participated in European Union Science Olympiad (gold medal), European Physics Olympiad (bronze medal), International Physics Olympiad (two honorable mentions) and three times in International Olympiad in Informatics.

Blendor Sefaj (Communications & Product management)

Blendor is an experienced community manager, running and organising different events (Spletne urice Maribor, TEDx Maribor, TEDx University of Maribor). Former project manager at Creativio Development Lab, social media manager and interested in everything technology.

Mojca Tancer Verboten (Legal)

Mojca is finishing her PhD in Law at the University of Maribor, where she works as a teaching assistant. She is an experienced lawyer in Higher education law and she held a position of a General Secretary of the University of Maribor. She is interested in legal challenges of blockchain technology.

Tanja Simonič Korošak (Design)

PhD in Landscape Architecture (University of Ljubljana, Slovenia). She works in the Laboratory for Telecommunications at the Faculty of Electrical Engineering at University of Ljubljana. She is an Assistant Professor of Architecture and Spatial Planning at the University of Maribor. She is the owner and a CEO of design office Studio TSK (studiotsk.github.io) and recently interested in the fields of innovative co-creation, co-design and design thinking.