



Whole Earth Foundation
We Democratize Infrastructure Management



Problem Statement	04
Approach	07
Conserving and Creating Resources	11
Provision of Ecosystem Tools	13
Ecosystem Governance	14
Future projects	15
Token Allocation	16
Roadmap	17
Team	18

Problem Statement

When we examine the world broadly, we see a growing issue of aging infrastructure. Unfortunately, service providers governing these infrastructure assets have not always adequately maintained and renewed the facilities they manage. Take, for example, the aging water infrastructure of the United States, where it is estimated that approximately 1 trillion USD in capital investment will be required to replace all water pipes by the year 2050 ([AWWA](#)). Most water pipe infrastructure in the United States was installed between the late 1800s and 1970s, so most of it is at least 40 years old, with a large fraction being 60-80 years old. With the useful life of most types of water pipes somewhere in the range of 60-100 years, increasingly more of the existing pipes will have to be replaced. Most citizens, however, are not fully aware of this situation or the reality that they will carry the burden of this cost in the form of increased water bills. This problem is not unique to the US; most of Europe has even older pipe systems, and similar issues exist in most countries worldwide.

Upon further examination of this problem, two fundamental characteristics specific to public infrastructure become apparent:

- 1) Imbalanced access to information between service providers and citizens
- 2) The lack of general incentive among parties to challenge the status quo

Infrastructure service providers are often managed by public institutions or are tightly regulated by government agencies; they often lack incentives to invest resources to incorporate effective and more efficient business practices. On the other hand, the general public, who are the beneficiaries of these services, have no means to be informed of the status of the infrastructure they utilize and have little incentive to prompt service providers or participate in activities to help them operate more effectively. These problems, if left unaddressed, can lead to significant disruptions in communities and result in substantial loss of valuable resources.

The Age of U.S. Water Pipes

From pre-Civil War to Civil Rights era, U.S water systems reflect a range of ages.

Each year about **240,000 water main breaks** result in lost water and disruptions to daily life.

(U.S Environmental Protection Agency)

America's municipal water systems are responsible for more than **1.2 Millions miles** of water mains.

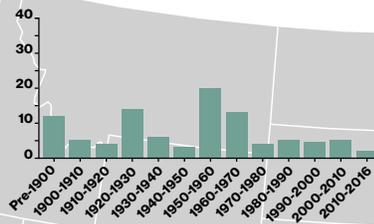
(Utah State University)

Repairing and replacing old water pipes could cost more that **\$US 1 Trillion** over the next two decades.

(American Water Works Association)

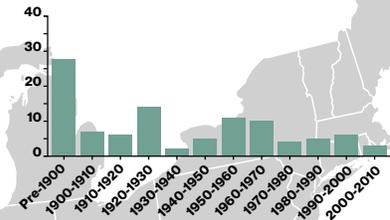
Milwaukee, WI

Half of Milwaukee's water mains were installed before 1954.



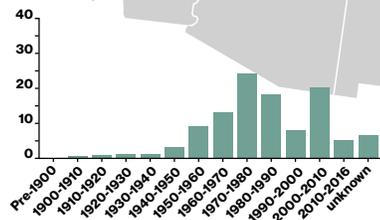
Philadelphia, PA

Half of Philadelphia's water mains were installed before 1930. Some pipes still in use today were put in the ground before the Civil War.



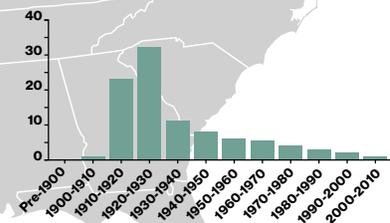
Phoenix, AZ

Phoenix ramped up its water main replacement program in the 2000s, which helped cut water main breaks by 40 percent.



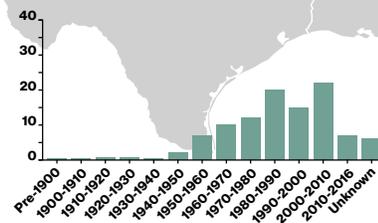
Baltimore, MD

The average age of a water main Baltimore is 75 years.



San Antonio, TX

San Antonio's water pipes are relatively young. Half were installed after 1985.



Source: The Age of U.S. Water Pipes. Adapted from Infographic: The Age of U.S. Drinking Water Pipes – From Civil War Era to Today.

The question of how to efficiently manage public goods such as water and air has been studied for a long time in economics. It is generally believed that markets fail to allocate resources for public goods efficiently. A primary reason for this stems from the fact that highly public activities are not always valued economically and are exchanged outside the market. Consequently, the general public has no incentive to engage in activities such as providing information about the status of infrastructure to service providers. If, however, these activities performed by the general public could be appropriately valued and attributed to them, presumably, it is possible to manage public goods efficiently (Coase Theorem, 1960).

Approach

To address this problem, the Whole Earth Foundation (WEF), a Non-Profit Organization, proposes to utilize the Whole Earth Access (WEA) platform to connect general citizens (or information providers) and infrastructure service providers by providing access to a database containing detailed information about their infrastructure, and an ecosystem designed to facilitate communication and collaboration.

At its core is the environmental database, constructed by pooling together and geoprocessing multiple public and privately available data sources. Once normalized, the data will undergo additional processing to be made available in very high geographical resolution, which is not available in most publicly available datasets today. The data is also pre-cleaned, helping shorten the development time for machine learning projects by third-party developers. Information providers can interact with this data through a UI (e.g., mobile app), enabling them to stay informed about the infrastructure's status around them, thereby helping alleviate the imbalance of information between them and the infrastructure service providers.

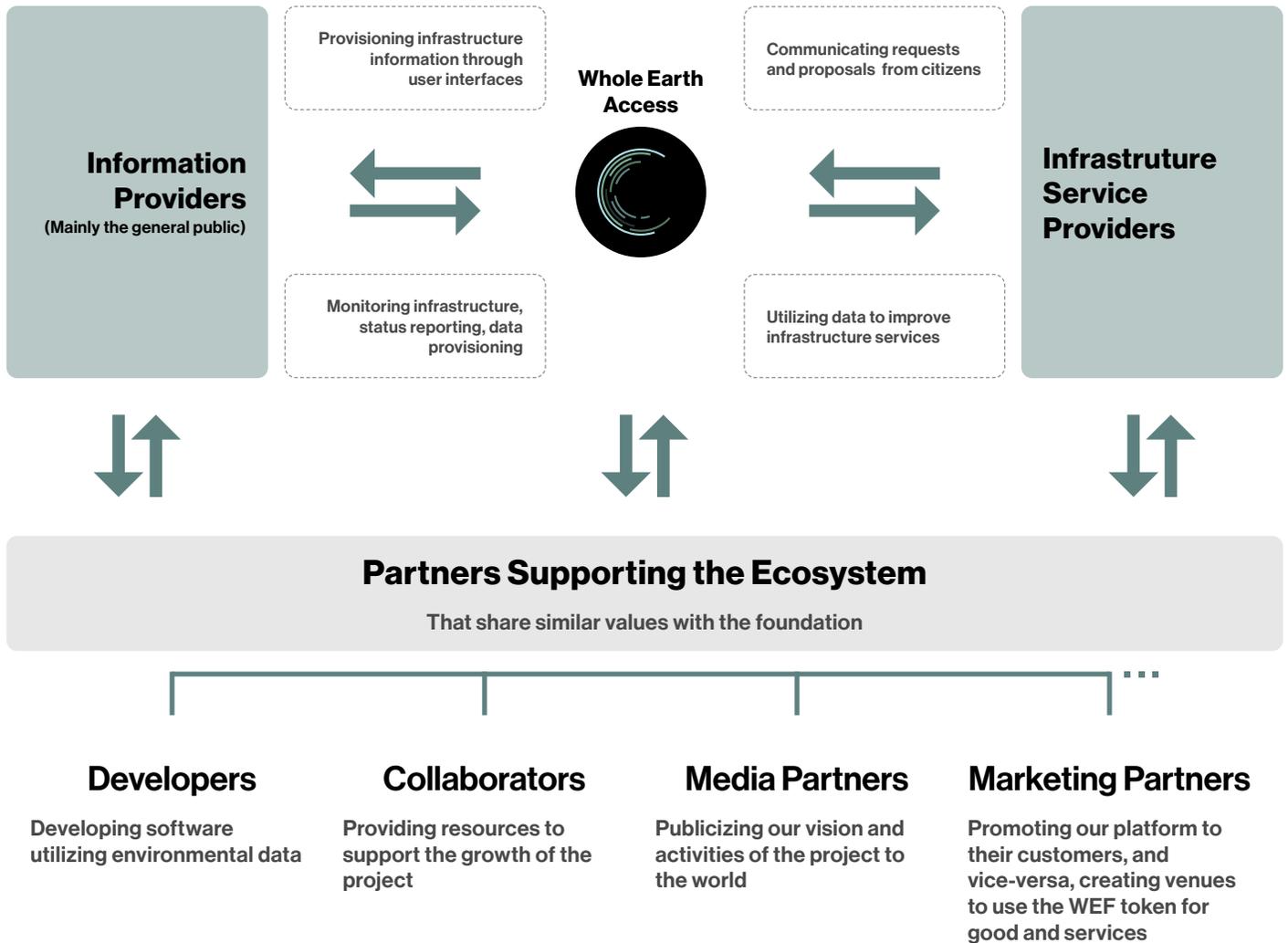
Furthermore, in addition to having access to data, citizens can actively support the database and, consequently, maintain the underlying infrastructure. A commonly shared limitation among existing environmental databases is the slow renewal of information - an average of 1-5 years of wait time. The WEA platform expects to address this by crowdsourcing data collection; Participants of the ecosystem will contribute data to help maintain an up-to-date database

that infrastructure service providers can use to make better-informed decisions. Gamification mechanisms such as Quests will be explored to motivate participant engagement.

Participants will earn a blockchain-based token (Whole Earth Coin, hereafter WEC) for the provision of high-quality data, enabling a free and open marketplace that allows for the creation and efficient exchange of important data.

This approach is expected to help establish a system that promotes regular maintenance and renewal of infrastructure while raising the general citizens' interest in the topic. As the public's interest further grows, this momentum will accelerate the establishment of a society where citizens actively collaborate with institutions in joint-effort projects geared towards environmental improvement.

The Envisioned Ecosystem



Among various infrastructure-related services with sustainability issues, the WEF will start first focusing on water. It is the most fundamental resource for all life and a critical resource for our society.

In December of 2020, the Chicago Mercantile Exchange launched the world's first water futures contract to hedge against the rising water prices and manage water supply risk. However, this is only a temporary solution and does not solve the fundamental cause of water shortages. Furthermore, there is a risk that market transactions will prioritize profits over ensuring adequate availability of water and public access to it. On the other hand, the WEF approach encourages social change in water-related infrastructure through public participation. In a sense, we are not just providing a platform for people to participate in public affairs, but we are creating a new collective form of economic collaboration.

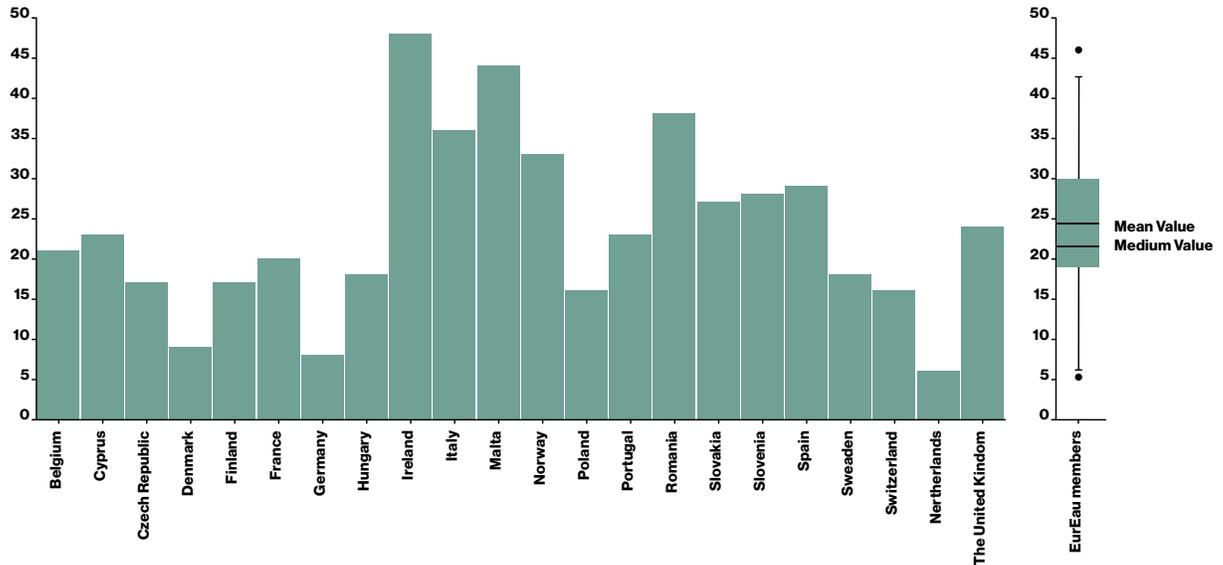
Conserving and Creating Resources

An essential part of implementing the approach is a method to quantify the value of the information provided. For example, if a general citizen provided information that led to the elimination of a water pipe leak, he or she likely succeeded in helping save water that would have otherwise been lost. In other words, making this water now accessible can be considered the equivalent to the act of producing water. Therefore, the value of the information is derived from its ability to conserve and create resources, such as water.

Representation in this manner is a powerful method to conserve resources, maintain infrastructure and realize savings. For example, water that does not reach the consumer from the water supply station due to reasons such as leaks in distribution pipes is usually referred to as “non-revenue water”. The amount of “non-revenue water” in Japan is equivalent to 1.6 billion USD per year – a significant amount of potential savings. Non-revenue water is a widespread issue across several countries, including European and other Asian countries. But we can achieve much more if we understand and represent resource savings as the equivalent of resource creation.

Based on this method of quantifying the value of saved water resources, participants can earn tokens for their data contribution efforts. Part of the process for calculating the amount earned will involve using algorithms produced by third-party developers designed to predict factors such as the deterioration state of water pipes. For example, Fracta, with whom the WEF is partnered, has demonstrated the environmental database’s utility by developing state-of-the-art machine learning to predict water pipe deterioration states. By learning detailed environmental factors

Average distribution losses in percentages – Europe (Selected countries)



Source: Average Distribution Losses in Percentages. Adapted from Europe's water in figures.

captured within the database, the model has allowed providers to accurately anticipate which water pipes have the highest risk of failure. This has permitted providers to successfully take preventative measures to address infrastructure problems before damaging bursts occur, fix invisible leaks, and save water. Algorithms like these are expected to evolve and become more advanced in the future, achieving improved performance. Simultaneously, the size, amount of details, and features of the database will continue to grow due to crowdsourced data collection efforts.

Future service providers and partnering organizations that wish to collaborate on projects with the Foundation, or utilize the Foundations network and tools (e.g., database) can purchase WEC's as a subscription fee for maintaining a partnership. As the project develops, we plan to form strategic partnerships with various organizations and create new ways

to utilize the WEC token within the ecosystem. The Foundation is also actively looking at creating avenues to use these tokens for goods and services

Provision of Ecosystem Tools

To promote the use and adoption of the WEA platform, the WEF will be providing a set of tools for those looking to engage with our platform upon the launch of the network.

General citizens will be able to access the environmental database for information regarding their infrastructure using applications developed by partners and developers of the community. Participation with the platform and provisioning of data will be encouraged by exploring gamification mechanisms to engage users in various tasks. Users can then manage and utilize the utility tokens they earned in exchange for various tasks.

Infrastructure-related service providers will obtain access to the environmental database. This data will enable service providers to improve the efficiency of development projects by having access to the most up-to-date information maintained by the community. They will also be able to utilize products created by third-party developers.

Third-party developers will also have access to the environmental database. They will be encouraged to explore novel applications of data for projects which benefit infrastructure and the environment. The Foundation aims to work with partners to ensure all projects are aligned with the foundation's vision.

The Foundation is currently partnered with Nippon Chutetsukan (NCK), a major Japanese water infrastructure firm, on a Proof-of-Concept game app designed to mobilize players and collect images and information on maintenance holes scattered throughout Japan. Crowdsourcing data collection in this manner allows for rapid monitoring of infrastructure, which all degrade at a different rate due to varying environmental factors and external events (such as earthquakes, accidents, construction, human traffic, etc.). In addition, this data will allow service providers to determine which maintenance holes should be examined first based on degradation levels, allowing for efficient repair and maintenance.

Ecosystem Governance

Currently, WEC tokens are ERC20 Utility Tokens based on the Ethereum blockchain. We selected the Ethereum blockchain for its maturity as a decentralized platform offering robust security and access to various development tools. As we advance, the Foundation will actively search for a governance structure that better supports our goals and consider factors such as scalability and overall environmental impact.

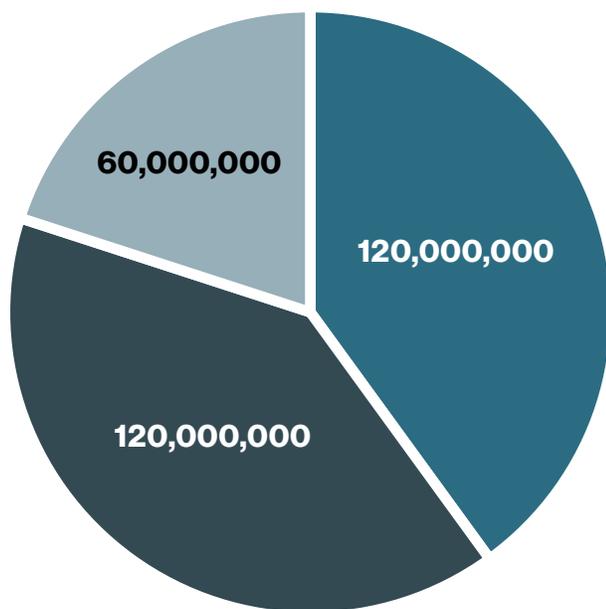
Future Projects

As its name implies, the “Whole Earth” Foundation intends to focus on all infrastructure & environment-related projects around the world. As a starting point, we are focusing on water topics, but potential uses of the platform extend far and beyond water infrastructure.

Building energy-efficient buildings is another potential area of application for the environmental database. Many startups in this space are pursuing innovative data-based solutions to improve energy efficiency. However, many of these companies are working with insufficient data. The data is disparate for each company, making it impossible to perform a holistic analysis and generate optimal results. The WEA database could unite this field by providing a place where environmental data related to a large number of buildings could be collected, curated, and shared by companies working in this field and building owners alike. The WEC creates an incentive for the companies to exchange and share this data, which typically would be kept private, thus benefiting all the companies.

Many organizations working to improve a broad range of infrastructure segments face similar challenges, limited by the availability or lack of a quality dataset ready for analysis. The Foundation plans to help these organizations as partners of the ecosystem by providing shared access to the database created by the WEF community.

Token Allocation



- **40% Reserved for ecosystem operations**

Will not be immediately used. Saved as an incentive for future project milestones.

- **40% Reserved for Public Sale**

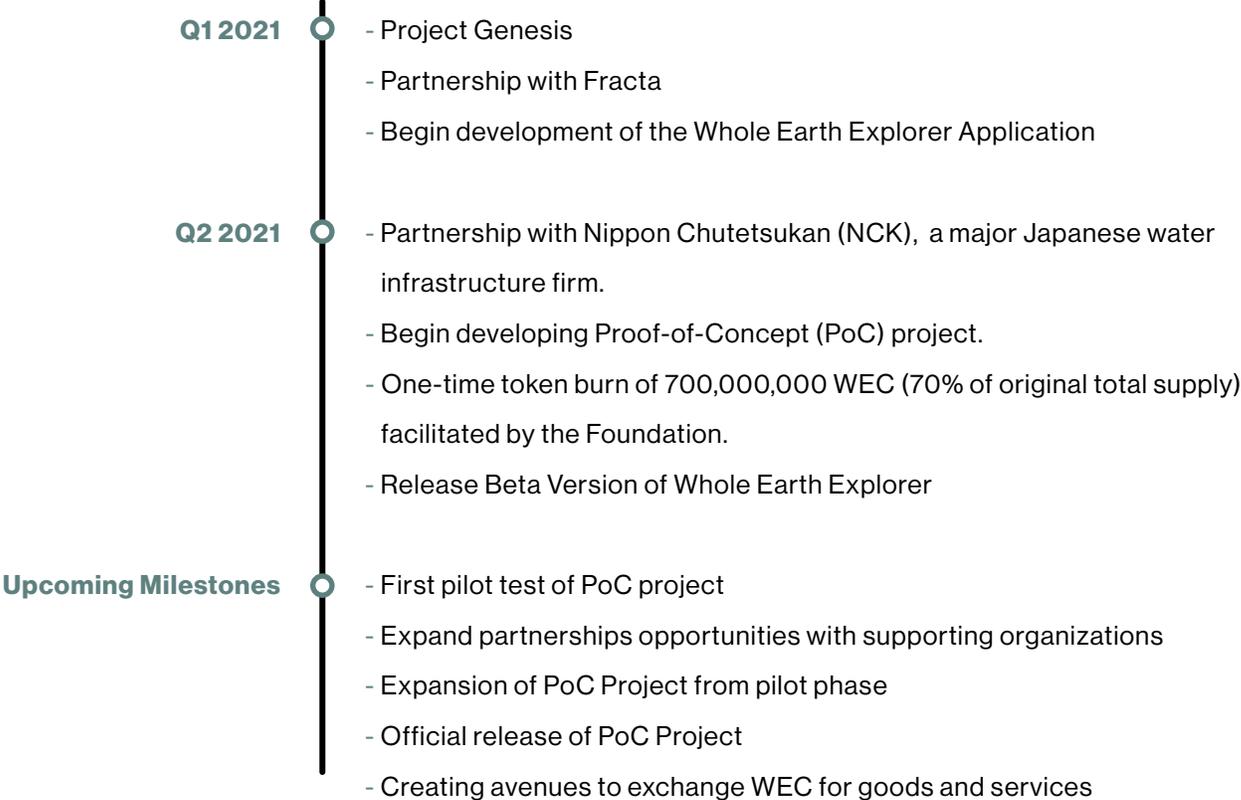
- **20% Reserved for Team**

1 year locking period.

300,000,000
Total Max Supply

The WEF’s mission is to “Democratize Infrastructure Management,” and it aims to bring about social change through citizens’ participation. Therefore, we believe that it is vital to have a significant portion of tokens allocated for the ecosystem. These tokens will be distributed out to the ecosystem participants in exchange for their efforts and contributions towards the growth of the environmental database.

Roadmap



Team



Daiki Moriyama

Daiki began his career at the Boston Consulting Group, where he worked in management consulting for a wide range of industries, including telecommunications, banking, securities, automotive, energy, and pharmaceuticals. Later, at Deloitte Tohmatsu Venture Support, he served as an advisor for technology startups, head of corporate planning and government relations, contributing to the firm's growth from 10 to 100 employees. He then moved to Tel Aviv, Israel, where he worked at Deloitte Israel as the first and only Japanese expatriate in Israel's professional firms. He provided technology scouting services to Japanese companies, fundraising/M&A advisory services to Israeli startups, and government project execution. He holds a Master of Applied Physics from the University of Tokyo and a Master of Design Methods from the IIT Institute of Design.



Hiroaki Sengoku

Hiroaki received his Ph.D. degree in Geographic Information science from The University of Tokyo. While doing his Ph.D., Hiroaki established Microbase Inc, Ltd, a company based on location-based data, winning several awards, including the Best Technology Award at the 7th Campus Venture Grand Prix and the G-Award from the Ministry of Land, Infrastructure, Transport, and Tourism. He has also been involved in R&D related to location information, jointly developing "Machilog" with Dentsu inc and Docomo Insight Marketing Co., Ltd. He also holds several other positions as the director of NPO Inoshachu, Visiting Associate Professor, Center for Urban and Real Estate Science, Reitaku University, and Visiting Researcher, Center for Spatial Information Science, University of Tokyo.



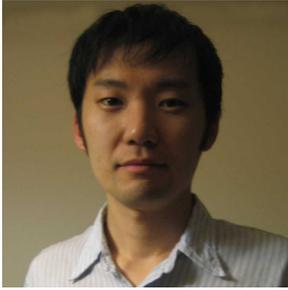
Koki Sasagawa

Before joining the Foundation, Koki worked at top academic institutions such as the University of Michigan and Stanford University. During his time at Michigan, he was a core developer at Knowledge Grid, a startup focused on providing a platform that made publicly generated medical research data more applicable for translational medicine use cases. At Stanford, he was involved in research, applying supervised and unsupervised machine learning to uncover the relationship between immune cells and heart disease development. He has also held a senior engineering role at an AI-based e-commerce startup, building on their products' core components. He currently holds a B.S. in Genetics and Genomics from UC Davis and an M.S. in Science of Information (Data Science) from the University of Michigan, Ann Arbor.



Takashi Kato

Takashi is currently the Co-founder and CEO of Fracta Inc. This company utilizes artificial intelligence to rapidly identify and understand the impact of an unplanned failure of aging water pipe infrastructure and improve the overall reliability. Previously, Takashi was a Co-founder & CFO of SCHAFT, the humanoid robotics startup which was awarded the first prize at the 2013 U.S. DARPA (Defense Advanced Research Projects Agency) Robotics Challenge Trials. SCHAFT was acquired by Google in the same year. He was also a visiting scholar at Stanford's US-Asia Technology Management Center (US-ATMC) and is currently acting as visiting professor of Tohoku University. Takashi has been published in the following articles including Bloomberg, The Economist, The Financial Times, Fast Company, CNBC, Business Insider (Japan), and Forbes (Japan). In 2019, he was the recipient of the WIRED Audi Innovation Award (Japan). He was also recognized as the "Top 100 globally respected Japanese people" by Newsweek Japan. Takashi holds a B.Eng. degree in applied physics from Waseda University and an MBA from the Australian National University.



Kengo Nakajima

Kengo started developing games when he was in elementary school. Since the late '90s, he has worked on MMORPGs for browsers, multiplayer games for PCs, and home video games. In 2000, he started to produce and sell VCE, a middleware for online games, and in 2010, he created a platform for indie game development and cloud games. Since the summer of 2016, he has been in charge of the development of the communication middleware business as CTO of monoAI, Inc. Currently, he spends his days working and raising his children in the rice farming area of Toyama.



Yumiko Nishimura

Yumiko, also known as Mimi, is a freelance producer specialized in international business development and a writer/columnist covering Japanese readers. Before working independently, Mimi worked at Stanford University as the Associate Director of the Comparative Healthcare Policy Research Project at Asia/Pacific Research Center. There, she conducted various international comparative studies and also organized international conferences with timely themes that were both well received. Mimi is the founding member of the Ronald McDonald House Children's Charities Japan Foundation and is still active on the board there.



Jordan Breslow

Jordan is an established leader in the tech industry, serving as former General Counsel for several successful businesses such as Etsy, a widely popular e-commerce website focused on selling handmade or vintage items and craft supplies. He has also held positions in the past as General Counsel for New Island Capital Management, an impact investment advisor, Silver Spring Networks, a leading green technology company, and Opsware and GeoWorks, both successful private-to-public software companies. He also served as a business development attorney for leading law firms.



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