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A decentralized data exchange protocol, powered by blockchain technology and a cryptotoken

Business Strategy

Information Memorandum

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Ocean Protocol Foundation Ltd

A joint project of

BIGCHAIN DB ⚹ DEX

v 0.7

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INTRODUCING OCEAN PROTOCOL

OCEAN PROTOCOL IS A DECENTRALIZED DATA EXCHANGE PROTOCOL TO MAKE DATA AND SERVICES UNIVERSALLY AVAILABLE FOR APPLICATIONS IN AI AND BEYOND.

Ocean Protocol uses blockchain technology that allows data to be shared and consumed in a safe, secure and transparent manner. Ocean is a decentralized platform and network that connects providers and consumers of valuable data, while providing open access for developers to build services.

Ocean Protocol facilitates the network and infrastructure to bring together data providers, data consumers, and service providers into a marketplace commons. It does not impose vendor lock-in or extract monopoly rents. The control of the network is decentralized and distributed between the Foundation, the network keepers, the developers, the data providers, and data consumers.

The Ocean Token (Ocean) is used as the means of value exchange within the Ocean Protocol network. Ocean tokens will be issued in a pre-programmed supply over several years. Keepers who provide verification and network services receive Ocean as part of the block reward function.

Ocean Protocol is supported by Ocean Foundation, which is a Singapore-based non-profit foundation. Ocean Foundation's mandate is to:

(a) development of the Ocean Protocol and activate a community of stakeholders;
(b) provide guidance for the development of the Ocean Protocol; and
(c) support the growth, and governance of a vibrant data exchange network and ecosystem based on the Ocean Protocol.

In the conduct of the functions of Ocean Foundation, Ocean Foundation shall abide by the principals and guiding values of, among others, universally accessible data, the equitable distribution of value among the Ocean Protocol community by ensuring open access to the Ocean Protocol network, and the discouragement the monopolization of power.

Why the world needs Ocean Protocol

The world's data is growing exponentially yet is massively under-utilized

In the past 30 years society has witnessed the transition from analog to digital. What the next decade will bring leveraging the power of data is virtually limitless.

While data was primarily a side-effect of successful business operations, today it is a vital element in the smooth operation of all aspects of daily life for consumers, governments, and businesses.

In 2010, the world produced 1 Zettabyte (ZB) of data[1], represented by the cube in Figure 1. In 2016, we produced 16 ZB and by 2025, we will produce 160+ ZB[2], represented by the large sphere occupying most of this page.

Yet, according to McKinsey[3], **less than 1% of data is analyzed**. Massive amounts of data are collected, then sit dormant on servers.

"Data, not algorithms, might be the key

limiting factor to development

16 ZB

1 ZB

160+ ZB

2025

2016

2010

[1] https://www.apixel.com.sg/blog/the-zettabyte-to-bring-more-business-and-success-to-singapores-economy/
[2] https://www.storagenewsletter.com/2017/04/05/total-ww-data-to-reach-163-zettabytes-by-2025-idc/
[3] http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world

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DATA IS IMMENSELY VALUABLE, YET REMAINS LOCKED UP

Data volumes already exceed manageable levels. It's estimated[4] that big data and analytics sales will reach **$187 Billion** this year, an increase of **over 50%** to 2015 levels. Even with these spending levels, the majority of data will remain under-utilized.

Leading organizations are learning that data can be a strategic asset. PwC estimated that revenue from commercializing financial data could be worth **$300 Billion** annually by 2018.[5] A Capgemini survey[6] supports the PwC finding: **61%** of respondents state[7] that big data is now a driver of revenues in its own right.

$124 Billion — 2015

$187 Billion — 2019
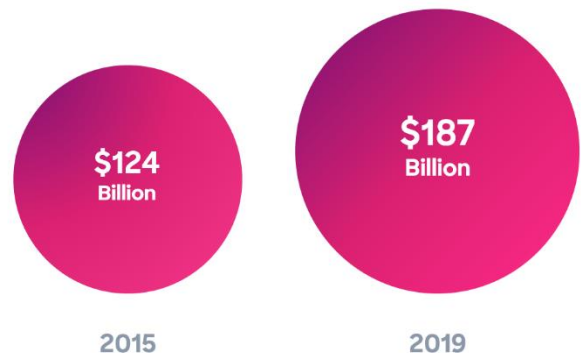
A FREE MARKET FOR DATA ALLOWS AI TO BECOME ACCESSIBLE

AI will affect nearly every sector of the economy in the coming years, including advertising, finance, healthcare, retail, automotive, energy, transport and logistics, and aerospace. By 2025, revenues for AI software and services will reach **$60 Billion**, according to Tractica[8], which has identified **over 150** specific AI use cases across 29 industries[9].

[4] http://www.informationweek.com/big-data/big-data-analytics/big-data-analytics-sales-will-reach-$187-billion-by-2019/d/d-id/1325631
[5] http://sloanreview.mit.edu/article/whats-your-data-worth/
[6] https://www.forbes.com/sites/howardbaldwin/2015/03/23/drilling-into-the-value-of-data/print/
[7] http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world
[8] https://www.tractica.com/newsroom/press-releases/artificial-intelligence-software-revenue-to-reach-59-8-billion-worldwide-by-2025/
[9] https://www.tractica.com/research/artificial-intelligence-market-forecasts/

AI needs data. Without data, AI models are not accurate. With no accuracy, the AI model is unusable. The winners so far have been companies with vast data resources and internal AI expertise, like Google and Facebook.

Elsewhere, progress in AI is being hampered by a lack of data. According to AI researcher Alexander Wissner-Gross, "many major AI breakthroughs have actually been constrained by the availability of high-quality training sets, and not by algorithmic advances."[10] , and "data, not algorithms, might be the key limiting factor to development of human-level artificial intelligence."

He says AI advances six times faster when data is available. "The average elapsed time between key algorithm proposals and corresponding advances was about 18 years, whereas the average elapsed time between key data availabilities and corresponding advances was less than 3 years, or about 6 times faster."

To overcome the lack of data[11], researchers resort to simulating data. However, even simulated data needs to start from a source of real data. Researchers also have the challenge that data is hard to move, otherwise known as the data gravity problem.[12] One hundred human genomes can be up to 30 TB and transferring the data over a network is impractical.

The cultivation of high-quality training data is essential to continued advancements in AI. High-quality data might lead to an order-of-magnitude speed up in AI breakthroughs over purely algorithmic advances. There may even be a direct relation between the availability of large amounts of data and AI advances.[13] The stark reality is that most startups are drowning in algorithms but starving for data.

[10] https://www.edge.org/response-detail/26587
[11] https://www.forbes.com/sites/forbestechcouncil/2017/04/10/the-commoditization-of-ai-and-the-long-term-value-of-data/print/
[12] https://blog.mccrory.me/2010/12/07/data-gravity-in-the-clouds/
[13] http://www.spacemachine.net/views/2016/3/datasets-over-algorithms

DATA IS LOCKED UP
BECAUSE SHARING HAS BEEN TOO RISKY

IT COMES DOWN TO CONTROL, PRIVACY, AND SECURITY

Once data is shared, it is out of the hands of the owner and in the wild. Without measures that can provide a semblance of control, an audit trail on usage, and fair compensation schemes, the data will remain locked up.

A World Economic Forum[14] report in 2012 highlighted that organizations and governments are hesitant to share data for risk of violating user trust and confidentiality. Privacy and security concerns must be addressed before personal data can be more widely shared. But even for non-personal data, enterprises have not opened the gates and let their data out.

Traditional, **centralized exchanges** should be the natural marketplace for the sharing of data. However, they are limited by the following reasons:

1. **Hosting** – data needs to be hosted at the data exchange, which is not acceptable for many data providers
2. **In Situ Data** – as an alternative, data could be hosted in situ at the data provider, but the range of is limited for data consumers.
3. **Cost** – data exchange finance themselves via transaction fees, commissions, and services, adding friction and cost.
4. **Pricing** – there is a lack of flexible pricing mechanisms for data used for building applications or model training.
5. **Audit** – data providers must periodically audit and confirm that their licensing terms are being adhered to.
6. **Control** – Data providers have no control over data use once the exchange is given the data.
7. **Trust** – A lack of trust frameworks, consent frameworks, and regulatory frameworks for data sharing.
8. **Tracking** – A lack of mechanisms for usage tracking to enable royalty pricing models for data.

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[14] https://www.weforum.org/reports/big-data-big-impact-new-possibilities-international-development

A MARKET FAILURE TO PROPERLY VALUE DATA AND MAKE IT AVAILABLE

The market for data is not behaving optimally. The value of data tends to increase the more it is used[15], but it is not being made available for use. There is a firehose of data supply that is under-utilized, unmanageable, and increasing in volume and velocity. Adding to this, there is a pent-up demand for data by AI algorithms that are starving for data, which holds back AI advances in multiple sectors, to the disadvantage of everyone. The problem is that existing data exchanges are limited in their scope and capabilities.

Data providers simply want

1. Controls in how their data is used and the ability to share different data depending on the usage.
2. Traceability on where their data flows and who uses it.
3. Compliance with local and international data regulations.
4. Confidence they will be paid a fair price, regardless of whether their licensing model is one-time, perpetual, or streaming.

Data providers and custodians need to feel safe before they can comfortably share data. Ocean Protocol provides a path to accomplish this.

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[15] https://www.information-management.com/opinion/how-do-you-put-a-value-on-data

THE ECOSYSTEM

A NETWORK, A PROTOCOL AND MANY STAKEHOLDERS.

Ocean Protocol is a business, technical, and governance framework that is brought together to serve the needs all stakeholders in the data ecosystem. Ocean Protocol enables the safe sharing of data and ensures payment to the provider, while guaranteeing control, auditability and transparency to everyone.

Each component of the Ocean Protocol, network, and Ocean Token is designed to give data providers full control over how they publish and share their data. Marketplaces and intermediaries can provide tools to offer discovery and value-added services to data consumers.

As Ocean Protocol is adopted, governments and public service organizations will need to tackle new challenges related to data governance, data privacy, and the protection of intellectual property. Ocean Foundation is tasked with nurturing and growing the ecosystem and working with stakeholders in solving issues that arise.

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Data Providers

Any enterprise, government, group or data custodian that possesses valuable but under-utilized data.

Data Consumers

Any enterprise, government, startup or university that needs data for analysis and training AI/ML models.

Community

The general public, legislators, oversight agencies, internet advocates that wish to monitor and contribute their input to shape how data is used.

Marketplaces

Any portal that acts as a market, bringing buyers and sellers together, providing computation, algorithms, storage, data and other relevant services for the network.

Developers

Anyone who wants to build value-added services or marketplaces on top of Ocean Protocol.

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POWERING A TWO-SIDED MARKET FOR DATA

Data Providers — Data — Tokens — **Marketplace** — Service Data — Tokens — **Data Consumers**

Data Providers

- Store data on premise, in the cloud, or on decentralized networks such as IPFS, Swarm, or Storj.
- Publish data for sharing
- Curate free public data for a share of the block reward.
- Set pricing for data via the protocol to prevent vendor lock-in.
- Sell data via a marketplace provider or directly using Ocean Protocol reference marketplace.
- Choose from multiple pricing models
- Have control over who gets to buy data.
- Have visibility into who has touched or accessed the data.
- Have control over the usage model—time limited, one-time use, perpetual, and more.
- Sell data without exposing or revealing it.

Data Consumers

- Discover data for your needs, from anywhere on Earth.
- Buy from the marketplace with the best selection, UI, or customer service.
- Access free public data.
- Transparent pricing.
- Clear usage guidelines on data that you buy.
- Check samples of data before buying to ensure quality.
- See data quality reviews and reputation ratings.
- Bring AI models to the data, train them and then harvest the results without needing to see the data.
- Keep track of the data you've purchased and used.

TOKENS ARE THE NATIVE CURRENCY OF THE PROTOCOL & NETWORK

The Ocean Tokens (Ocean) are used on the Ocean Protocol network as the means of value exchange, to power the protocol and incentivize the keeper nodes of the network. The Ocean Token is inseparable from the Ocean Protocol and Ocean Protocol network.

Earn Ocean Tokens by providing data

Data providers sitting on large sets of latent data can now publish data for sharing using a variety of pricing mechanisms, while maintaining full control over the data and complying with data privacy and compliance regulations.

Earn Ocean Tokens for curating data

Huge amounts of valuable public data sits unused on servers, always at risk of being removed when the funding dries up or when the political climate changes. Ocean Protocol network incentivizes the publication, curation and conservation of public data by expanding the market of buyers.

Earn Ocean Tokens by being a marketplace

Data marketplaces can connect to Ocean Protocol network to leverage their existing data and find new buyers. Meanwhile, developers, corporations, and governments with new ideas can build value-added services on top of the protocol or launch their own data marketplace.

Earn Ocean Tokens for providing network services

Network keepers provide validation and verification services for the network, store the blockchain history of transactions, and serve up relevant services to the community.

USE CASES

To bring the potential impact of Ocean Protocol alive, here are three real-world use cases that are currently being built on Ocean Protocol technology. In the coming weeks, you'll be able to learn more about specific Use Cases at usecases.oceanprotocol.com (coming soon!)

INDEPENDENT LIVING AT HOME WITH SENSORS & INSURANCE

Singapore is rapidly ageing as a society. Just like Japan, China and many others, the proportion of elderly is expected grow rapidly. The need to prepare Singapore for an ageing population is a key priority.
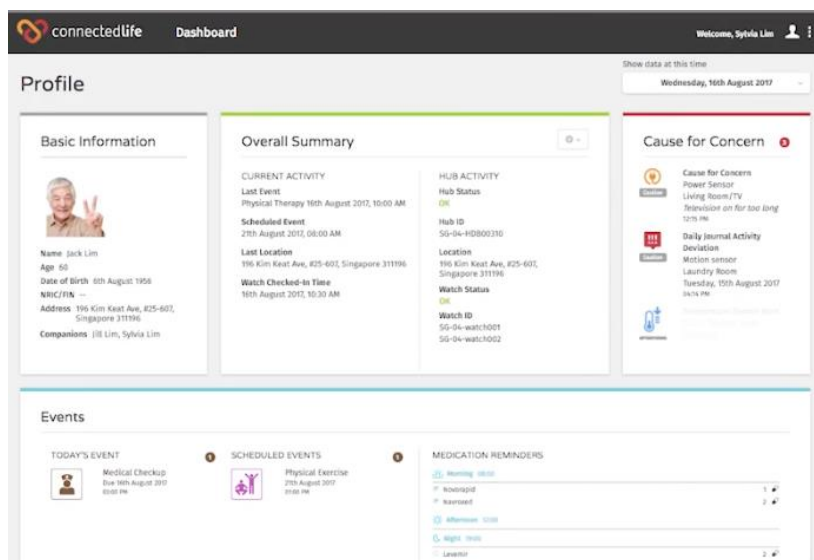
ConnectedLife is working with leading partners such as Aviva, Microsoft, Fujitsu, Adventist, SilverAlly and the Housing Development Board of Singapore to provide a complete **360° Smart Living** service for elderly, caregivers and guardians. The solution starts with innovative acoustic and motion sensors that are placed around the home, which feed data into AI algorithms to detect day-to-day and abnormal situations.

Sensors record activities of daily living, rest duration, bathroom visits coupled with notification alerts issues like prolonged inactivity, smoke or water leakage and emergency button activation to provide further insights for caregivers.

When incidents occur, caregivers are notified. If necessary, a 24/7 call center dispatches necessary first responders to the home. This service allows for families to have better peace of mind knowing that help is moments away.

The data collected by ConnectedLife is valuable, not because it is used to protect the elderly but also because that data collected gives deep insights that can be used by many other researchers.

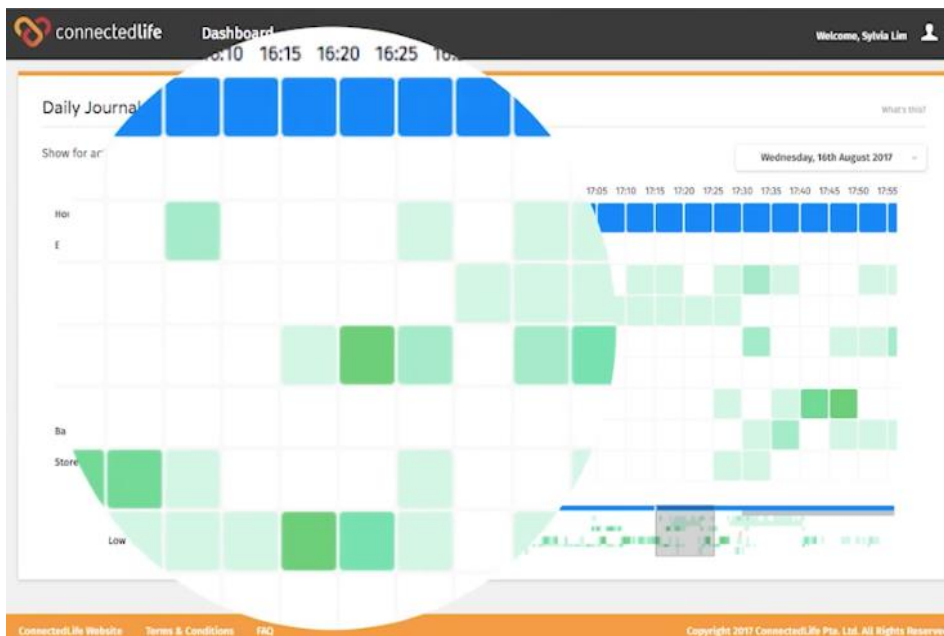Every ConnectedLife home produces 5,000 data points per day. Multiplied across 10,000 homes by end of 2019, it presents a trove of data that can be used by researchers to better understand aging, the needs of elderly, and for companies to design home care and insurance products that customers value.

ConnectedLife is developing a data marketplace built on Ocean Protocol that allows for anonymized, non-personal data to be shared freely for open research and can be sold to companies for market and health research.

Collaborating with the **National Medical Research Council** jointly with the **Ministry of Health**, data will be used as part of the **Care@Home Innovation Grant**, with the aim to improve productivity of caregivers by 20-50% and increase quality and customer satisfaction by 5-10%, while expanding the program to a broader audience.

To learn more about this use case, please go to usecases.oceanprotocol.com or watch the following videos: https://bit.ly/2ATdvej and https://bit.ly/2ju7q2s.

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HEALTH DATA SHARING WITH ROCHE DIAGNOSTICS

Patients with heart-valve replacement or chronic heart conditions such as atrial fibrillation often undergo blood-thinning therapy (aka anticoagulation therapy) to prevent blood clots.

One way to manage the dosage of blood-thinning treatments is to monitor a patient's INR (international normalized ratio), a measurement of how long it takes for blood to clot, and keep it within a safe range. INR is typically measured by taking a blood sample with a needle in the arm. This process is time-intensive, requires the help of medical staff and imposes a time-delay as laboratories process the blood sample. Since 1993, the Roche CoaguChek INRange home monitoring device has made checking INR easier, faster and safer, with reliable INR results in less than 5 minutes from a fingertip blood sample.

Today, patients using the CoaguChek system, send their results to doctors over the phone, via email, WhatsApp, and SMS. It is difficult to ensure consistency with this approach. Moreover, it's error prone, inconvenient, insecure and puts patient data at risk.

To support patients to monitor the effectiveness of their treatments and prevent side-effects, ConnectedLife provided an end-to-end solution that combines a mobile app, a management dashboard, and cloud services for Roche Coaguchek® INRange system.
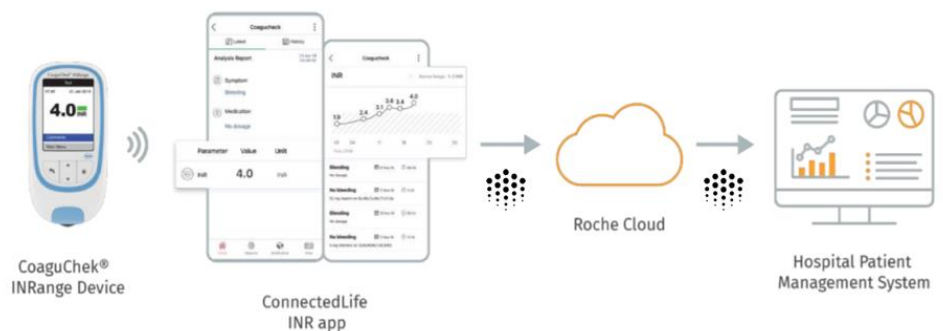
ConnectedLife is building a mobile-app that transmits INR results from the CoaguChek system to hospitals, allowing doctors to monitor and manage dosage regimens. The ConnectedLife app will use state-of-the-art Ocean Protocol technology to give patients full control over their data, securely transfer the data, and give a clear provenance of how data is being used, by whom.

THAI MINISTRY OF HEALTH AND PUBLIC SANITATION

Toilets may not be a typical starting point for AI and blockchain, but an initiative run by the Thailand Ministry of Health, NextBillion, and Microsoft is proving that data coming from non-obvious places can be valuable. Clean toilets in public and schools is a priority to prevent the spread of gastrointestinal disease and improve the health of millions of school children and the general public.

In a pilot project, 11,000 photos from around Thailand were collected and labelled for important restroom features. Based off this training set, AI models were trained to automatically detect restroom features with an 80-90% accuracy.

Data collected in the project can be used to dispatch maintenance and cleaning personnel faster. It is also planned to share the data with NGOs and AI for Good, so that the insights can help accelerate progress to improve sanitary conditions all over the world.
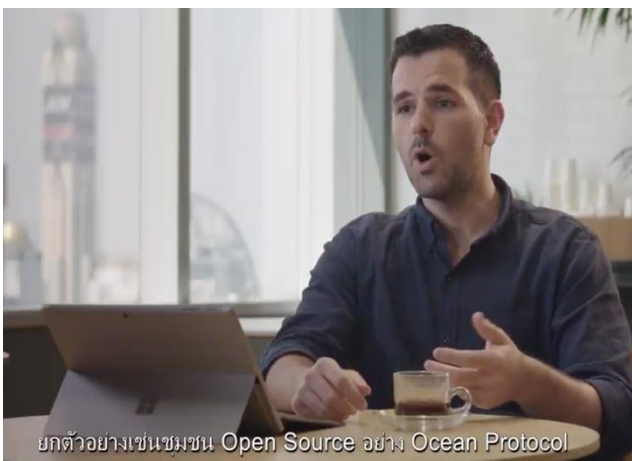
The pilot project is now being scaled up in Thailand. It has also inspired another project in Vietnam to improve the hygiene of schools, with the support of Unilever.

NextBillion is working with Ocean Protocol technology to develop a data sharing marketplace that is geared to both NGOs and enterprises, where data can be shared for free for public research or sold to enterprises for market research.

To learn more about the NextBillion use case, you can watch this video: https://bit.ly/2RFwcwa.

COLLABORATORS & STAKEHOLDERS

To date, the Ocean Protocol Foundation is pleased that organizations are building marketplaces and applications on Ocean Protocol. Collaborations are underway amongst multinational data providers, data consumers, data marketplaces, leading service providers, technology partners and governments.

REPUBLIC OF SINGAPORE

Singapore's goal is to be the pre-eminent hub for data sharing and AI. Towards this vision, Singapore is coordinating relevant ministries and agencies to provide an approved legal and regulatory framework for data sharing by industry and government alike.

Newton Circus (DEX) has signed a memorandum of intent (MOI) with the Info-communications Media Development Authority of Singapore (IMDA) and PricewaterhouseCoopers Risk Services to foster the formation of data collaboratives: structures where data contributors, data users, solution developers and technology providers collaboratively work together to solve common business challenges In a safe regulatory environment.

From left: Mark Jansen, Data & Analytics Leader at PwC Singapore; Chirdeep Singh Chhabra & Mike Anderson, DEX; Yeong Zee Kin, Assistant Chief Executive of IMDA; and Lance Little, Managing Director, Roche Diagnostics Asia Pacific.

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IMDA's medium-term intent behind this collaboration is to leverage the data sharing activities and protocols enabled by these collaboratives to co-develop a Trusted Data Framework, that will serve as an objective standard to govern data sharing in future.

Central to the agreement is the application of Ocean Protocol and the use of Ocean Token as the means of value exchange in multiple industry driven use cases. IMDA is tracking and feeding back to the Ocean Protocol Foundation as development and adoption progresses.

Technical and regulatory sandboxes allow all participants to remain compliant while experimenting with Ocean Protocol and marketplace implementations. The sandboxes will lead to accelerated learning and faster go-to-market adoption for all participants, while providing regulators with the ability to update governance rules required to operate decentralized data marketplaces.
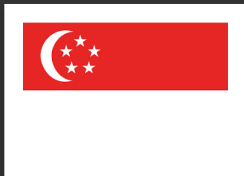
Singapore is the lead government partner for Ocean Protocol

IMDA and relevant sister authorities and agencies are supporting a development roadmap with DEX and the other Newton Circus companies, such as ConnectedLife, and Ocean Protocol Foundation, that enables safe, secure, trusted access to data, with clear milestones and targets to unlock value across six industry verticals. This work will allow Ocean Protocol Foundation to build a generalized data exchange protocol that can be applied to all jurisdictions, forging a path to resolve data governance and data privacy challenges, while protecting intellectual property.

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Enterprises & SMEs

With the support of Singapore, several companies are participating in the data sharing use cases. Based on the progress in building the decentralized data exchange protocol, we hope that more companies will embark on the path to unlock their data.

Here is a sample list of companies that are partaking in data sharing use cases. If you would like to join, please contact us at partners@oceanprotocol.com.

Other Governments, Non-Governmental, Academic, & Challenges

Ocean Protocol should be used to unlock public data and solve important challenges facing the planet. We have partnered with other governments, as well as with non-governmental, academic, and public service initiatives to kick-start use cases centering around the United Nations Sustainability Development Goals and AI for Good. By devoting resources to "commons" initiatives, Ocean Protocol can become a vital tool for global researchers.

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Ocean Protocol Foundation has signed a memorandum of understanding with the National University of Singapore through AI Singapore (AISG). AISG is a national AI programme launched by the National Research Foundation (NRF) to anchor deep national capabilities in Artificial Intelligence (AI) thereby creating social and economic impacts, grow the local talent, build an AI ecosystem, and put Singapore on the world map.

The programme office is hosted by the National University of Singapore (NUS) and brings together all Singapore-based research institutions and the vibrant ecosystem of AI start-ups and companies developing AI products to perform use-inspired research, grow the knowledge, create the tools, and develop the talent to power Singapore's AI efforts.

AISG is driven by a government-wide partnership comprising NRF, the Smart Nation and Digital Government Office (SNDGO), the Economic Development Board (EDB), the Infocomm Media Development Authority (IMDA), SGInnovate, and the Integrated Health Information Systems (IHiS).

Ocean Protocol and AISG are promoting joint research and development activities to unlock data for AI and smart digital technologies, to build a Data Economy. A Data Economy lab, data innovation challenges and hackathons will be used to promote data marketplaces between academic communities and external collaborators from government agencies, enterprises and start-ups.

DATA APPLICATIONS & SERVICES

Ocean Protocol will be more viable if data exchanges and marketplaces integrate with the protocol to offer their data for discovery. As a founding member of Ocean Foundation and a marketplace builder, Newton Circus (DEX) is building applications and services in collaboration with government and industry. These nascent services will be executed in regulatory sandboxes and monitored to ensure that use cases are consistent with local regulations and data privacy laws. Newton Circus (DEX) will release end-to-end use cases, implementations on top of the decentralized data exchange protocol and managed application environments for enterprise and government users.

The technologies being built will be released under an Apache open source license to the community, so existing data marketplaces and new entrants can freely use the code and logic that DEX creates to build competing products and services on the Ocean network.

NEWTON CIRCUS

❖ DEX

+

The first group of Data Marketplaces will be announced. If you would like to publish data from your data marketplace, please write: partners@oceanprotocol.com.

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BLOCKCHAIN & TECHNICAL

Ocean Protocol is working with the leading blockchain teams to leverage their technical advances and build an ecosystem of computation, storage and algorithm services. Additionally, innovative, blockchain approaches for governance, curation and staking will be integrated into Ocean Protocol to reinforce the decentralized ethos and give people more power.

SERVICE & TRANSPARENCY PARTNERS

Ocean Protocol holds itself to the highest standards for compliance to national laws, regulations and guidelines. We have engaged with reputable partners to support our tax, legal and compliance work, and ensure that all stakeholders can proceed with confidence. Here are the some of the partners we are proud to work with:

CURRENT CONTRIBUTORS & PROJECT BACKERS

We worked hard to attract contributors that could use the services of Ocean Protocol in the future and add meaningful value to the development of the ecosystem, to ensure that the utility potential of the network is realized.

The Seed and Pre-Launch phases brought 3,500 project contributors from over 100 countries. Approximately 1/4 of the contributors came from the AI, start-up or developer communities.

These are the groups who will run keeper nodes, provide data, consume data or build services on top of Ocean Protocol.

We're also proud to have the backing of leading VCs in the space that are specialized on AI, blockchain and big data, including the following:

You can read about how Ocean Protocol fits into the thesis of [Outlier Ventures](#)[16], [Fabric Ventures](#)[17] and [BIV](#)[18].

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[16] https://outlierventures.io/why-we-are-investing-in-ocean-protocol/
[17] https://medium.com/fabric-ventures/the-fabric-ventures-investment-thesis-6cd08684b467
[18] https://www.youtube.com/watch?v=m9YmqwFL-pw

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OCEAN PROTOCOL IS LED BY BIGCHAINDB AND NEWTON CIRCUS

OCEAN PROTOCOL IS THE SUM OF EVERYTHING WE'VE LEARNED THROUGH OUR JOURNEY TO DEVELOP BLOCKCHAIN TECHNOLOGIES, BUILD DEEP EXPERIENCE IN AI/ML, DEPLOY BIG DATA ANALYTICS AND DATA EXCHANGES.

BigchainDB GmbH and **DEX Pte. Ltd.** (a subsidiary of **Newton Circus Pte. Ltd.**) are two companies that are driven to build planetary scale technologies for human scale development. **Ocean Protocol** is the natural point of confluence for our mission.

BigchainDB was founded in 2014 in Berlin, with the mission to give power back to people using blockchain technologies. With breakthrough products of **ascribe.io**, a service for creators to claim attribution, **WhereOnThe.Net**, to track the spread of creative works, **ImageMatch**, machine learning based image recognition, **IPDB**, the Interplanetary Database, a shared global database with a pragmatic governance model, **9984**, a community dedicated to building the next generation of decentralization technologies, and **BigchainDB**, our flagship open source blockchain database, the team has built a set of tools to serve the needs of our community.

BigchainDB has been a card-carrying contributor to the **Enterprise Ethereum Alliance**, **Trusted IoT Alliance, Decentralized Music Society, Decentralized Identity Foundation, Estonia eResidency Program**, and the **German Bundesblock** working group. We have co-written standards for decentralization for **COALA IP**, **Interledger Protocol**, **DIN (ISO)** standards, and support efforts towards **GDPR** compliance for blockchain technologies. BigchainDB has also been a driving force to promote the #TokenEngineering community, a movement to instill engineering principles for token designs and networks.

DEX Pte. Ltd. was founded in 2013 in Singapore, with the mission to enable the sharing of data for data analytics and AI companies.

As part of the **Newton Circus** family of companies, DEX has been working deeply with public and private sector groups to leverage the value of data and build applications, solutions and prediction models to solve real industry, societal and public challenges.

DEX has pioneered data sharing platforms to connect government and industry. DEX was a lead partner of **Data City: Data Nation**, a public, private and international partnership between Singapore, UK and multinationals that provides the data governance and regulatory framework to unlock data and encourage data sharing.

Project Impetus

For ascribe.io, we developed a service and protocol to register and license intellectual property on blockchain. At Ocean Protocol Foundation, data is treated as intellectual property. In building AI/ML tools for image recognition, we experienced first-hand the difficulty in getting data.

October	**2013**	DEXTRA Alpha launch for Singapore Smart City initiative
February	**2015**	ascribe Production Release
May	**2015**	DEX platform launch with 250 data providers
July	**2015**	BigchainDB project start, a scalable blockchain database
October	**2015**	coalaip.org project with IPFS, Consensus / Ujo, COALA & others
February	**2016**	BigchainDB v0.1 Released in San Francisco
October	**2016**	IPDB Testnet Released
October	**2016**	COALA IP v1.0 Released
December	**2016**	Blog Articles on combining blockchain & AI
January	**2017**	Ocean Project start, with DEX and BigchainDB
May	**2017**	AVDEX MVP Released at Consensus 2017 in New York

With Newton Circus (via DEX), we learned the challenges in sharing data: that data providers wanted control over privacy, licensing, pricing, security and to have transparency and auditability so they could comply with laws and get fair value.

We built BigchainDB, a core blockchain technology uniquely suited to handle data in a scalable manner, while connecting to IPFS, Ethereum, IOTA, and other decentralization technologies.

With IPDB, we developed the methods to deploy a global network and design appropriate governance models that can stay true to the values and intent of decentralization, where power should be spread to the community.

It's as if all of our learnings were streams and tributaries of knowledge that would eventually converge together, at Ocean.
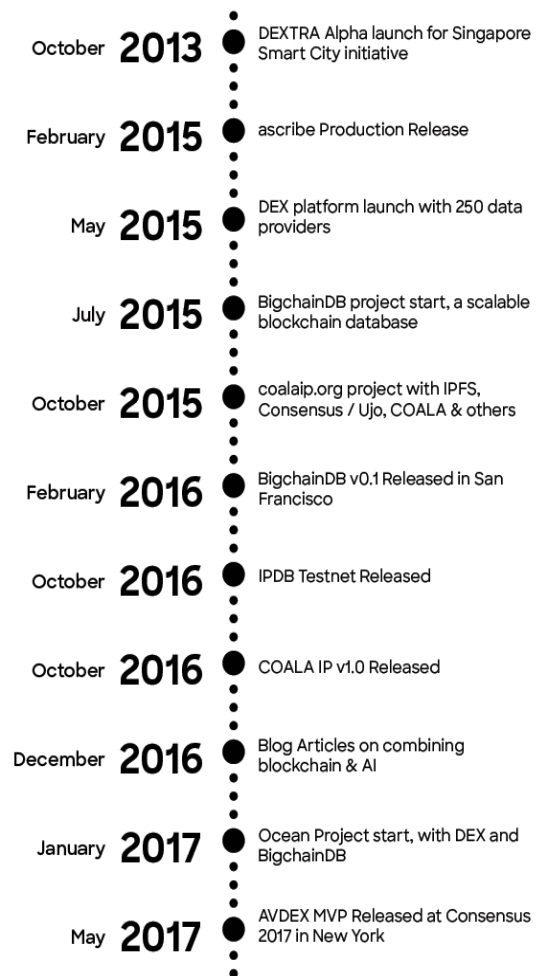
Technology

Ocean: A Decentralized Data Exchange Protocol

The technical whitepaper paper presents a decentralized data marketplace protocol and network called Ocean, on which data and AI services can be built.

The whitepaper is available for download at oceanprotocol.com/tech-whitepaper.pdf

Ocean Protocol:
A Decentralized Substrate for AI Data & Services
Technical Whitepaper
Ocean Protocol Foundation[1]
with BigchainDB GmbH[2] and Newton Circus (DEX Pte. Ltd.)[3]

Version 2019-FEB-19b

Abstract

This paper presents Ocean Protocol. Ocean is a decentralized protocol and network of artificial intelligence (AI) data/services. It aims to spread the benefits of AI, by unlocking data while preserving privacy. It helps power marketplaces to buy/sell AI data & services, software to publish and access commons data, and AI/data science tools to consume data. Ocean does decentralized orchestration: at its core are decentralized service agreements and decentralized access control, which execute on decentralized virtual machines. This allows connection to, monetization of, and curation of arbitrary data services. On that, Ocean adds network rewards to incentivize data sharing, including privacy-preserving data commons.

This Technical Whitepaper is intended to accompany the Information Memorandum for the Token Distribution Details published by Ocean Protocol Foundation Ltd. ("**Information Memorandum**"). Accordingly, this Technical Whitepaper is intended to be read in conjunction with, and is subject to, the legal disclaimers and notices as set out in the Information Memorandum.

Abstract: The world has recognized the value of data, but it's been very difficult to establish a price for the data (especially non-fungible data) while reconciling privacy and security concerns. Many enterprises have tremendous amounts of data, but have difficulty exploiting it. Conversely, many startups have deep expertise in artificial intelligence (AI), but lack the data to make their AI models perform. To address this problem, data marketplaces have emerged, but they are silos themselves.

Ocean is a protocol and network to ease building of decentralized data marketplaces. Ocean handles storing of the metadata (who owns what), links to the data itself, and data IP licensing information. On top of Ocean there can be thousands of data marketplaces and exchanges, all accessing the same data. Each marketplace acts as the last mile in connecting buyers and sellers. Crucially, pricing offers are at the shared Ocean layer, not at the marketplace layer, to help liquidity and avoid lock-in of a dataset offer to a given marketplace. Ocean incentivizes uploading data, especially for data commons. Each dataset is controlled by the respective rights holder, with privacy measures. Ocean provides programmable market mechanics, making fair yet flexible pricing easy. Ocean is designed for industrial scale usage.

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TECHNICAL PROGRESS

Ocean Protocol has delivered on the design described in the technical white paper. Our most recent release is v1.0 "Tethys" along with the beta network "Nile", which includes state-of-the-art innovations like Service Execution Agreements, smart contracts that govern each transaction, the Parity Secret Store for on-chain permissioning & asset controls, and integrations with fitchain for secure 3rd party compute.

TIMELINE

Every major timeline on our roadmap has been achieved[19]. We recently announced our v1.0 beta network launch "Nile" on April 8, 2019, which sets the basis for permissionless data sharing. You can access an updated version of our roadmap at **oceanprotocol.com/roadmap**.

OPEN & TRANSPARENT DEVELOPMENT

We build open software transparently and encourage community members to follow our progress on Github[20] A good starting point are the Ocean Enhancement Proposals (OEPs). Suggestions and contributions are encouraged and appreciated. You can reach a developer on our Gitter.im[21] channel or sign-up for technical bounties on Gitcoin and Bounties.Network.

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[19] https://blog.oceanprotocol.com/roadmap-setting-sail-an-ocean-odyssey-3e368897f1cc
[20] https://github.com/oceanprotocol/OEPs
[21] https://gitter.im/oceanprotocol/Lobby

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ARCHITECTURE

Ocean Protocol is a decentralized network for data service supply chains. This network allows connection to, monetization on, and curation of arbitrary data services. You can read more about the Ocean architecture in OEP#3 [22].

The diagram below shows the main services that are needed to create a data service supply chain – providing data, algorithms, compute, storage, analytics and curation. These components are bound together with Service Execution Agreements (like Service Level Agreements), secure compute, access control and permissioning.
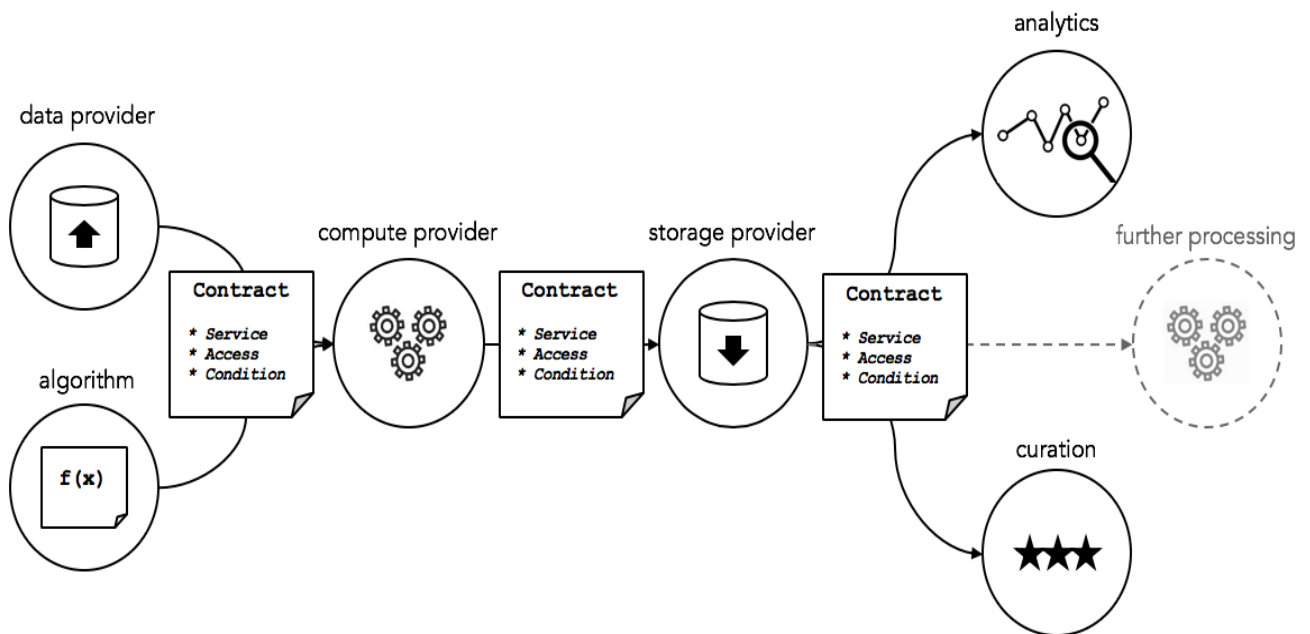
The main actors in the system are detailed below – data consumers, service providers, marketplaces, service publishers, verifiers and curators.
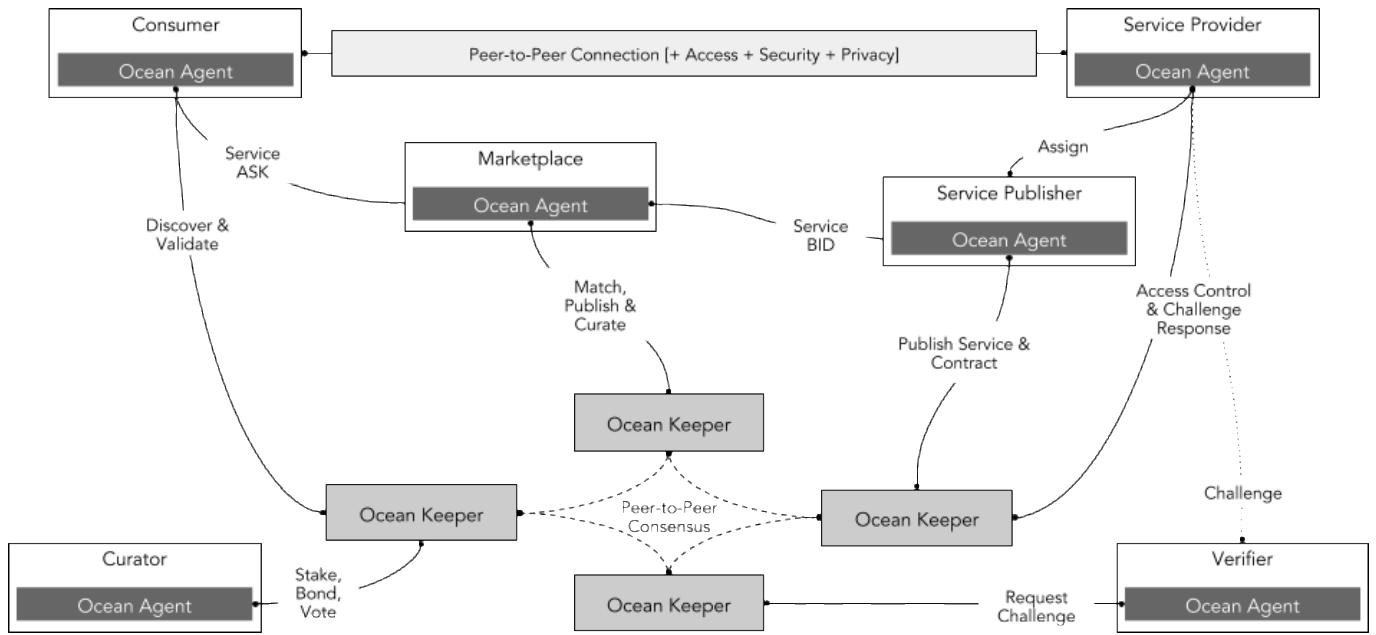
We foresee the clustering of service providers into curated "tribes" that data scientists, AI researchers and developers can daisy-chain together to create data service pipelines, to fully automate data science activities, with much less need for intermediaries.
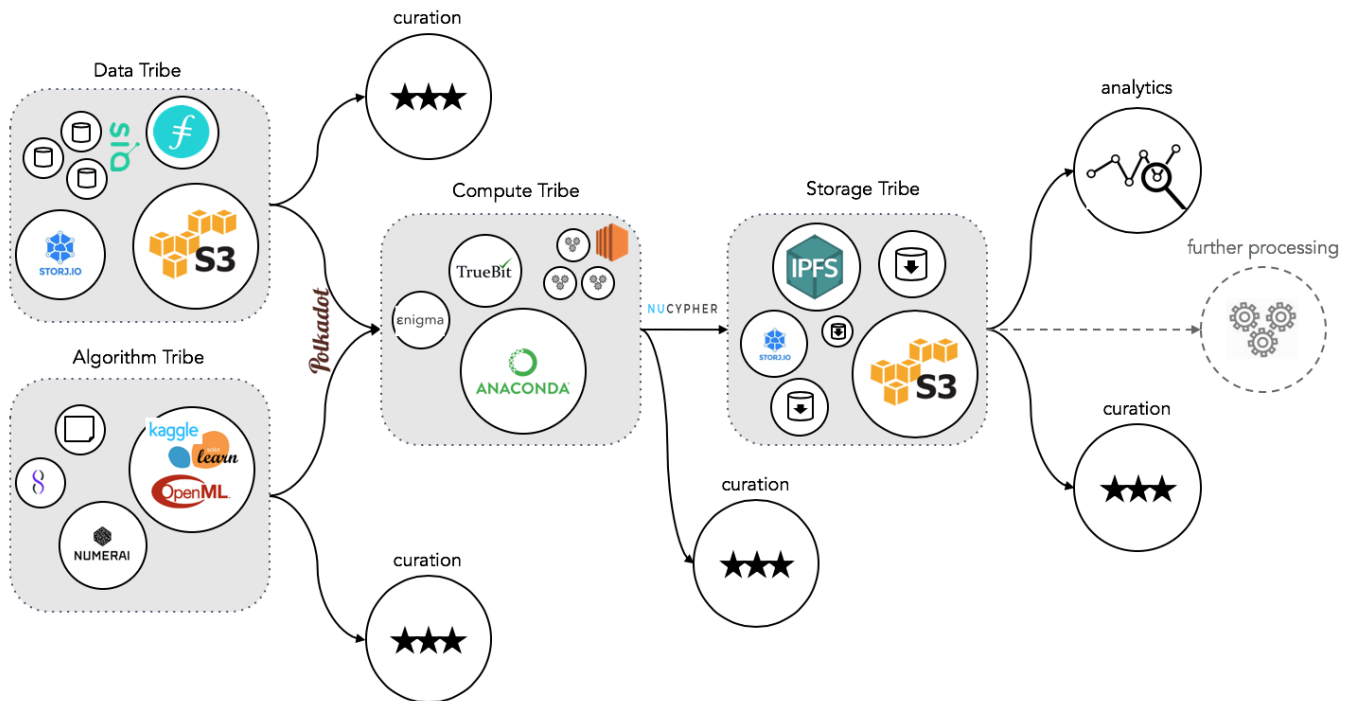
DOCUMENTATION

To activate a vibrant community of developers, we've provided clear and accessible documentation, which can be accessed at: docs.oceanprotocol.com.

We encourage developers to dive in, complete a tutorial or set-up a module. You can reach a developer on our Gitter.im[23] channel.

Ocean Protocol Documentation

Learn about the components of the Ocean Protocol software stack, and how to run or use the components relevant to you.

Core Concepts

Understand the fundamentals of Ocean Protocol.

Learn More →

Setup Guides

Setting up the Ocean Protocol components.

Learn More →

Tutorials

Browse tutorials for most common setup and development use-cases.

Learn More →

API & Library References

Get the references for REST APIs and library methods for all relevant components.

Learn More →

To help developers and collaborators to ideate and design new marketplaces and products, we will be releasing a series of Use Case – Case Studies at usecases.oceanprotocol.com, with starter kits and examples to design your own Use Cases on Ocean Protocol.

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[23] https://gitter.im/oceanprotocol/Lobby

DATA SCIENCE TOOLS

The world's most popular computational notebook for data scientists is Jupyter [24] [25]. With over 2.5 million notebooks and support for over 100 programming languages, Jupyter is the hands-down favorite for data scientists to collaborate and share research.

Data Scientists are encouraged to visit: datascience.oceanprotocol.com to test out the capabilities. The Ocean Protocol Jupyter console provides search/discovery, publish and consumption templates to allow data scientists to start projects quickly.

Manta Ray

Data Science powered by Ocean Protocol

The **Manta Ray** notebooks provide a guided tour of Ocean Protocol in an interactive Jupyter Notebook environment. Start using Ocean Protocol with your own pre-configured and loaded cloud instance after login with your GitHub account.

This project is in alpha! Feel free to ask questions and post bug reports in our Gitter channel. Notebooks are for tutorial and demonstration purpose only. Notebook instances may be periodically offline, and storage volumes will be purged.

JupyterLab Instance

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[24] https://www.theatlantic.com/science/archive/2018/04/the-scientific-paper-is-obsolete/556676/
[25] https://www.nature.com/articles/d41586-018-07196-1

DELIVERY OBLIGATIONS

THE GOAL OF THE OCEAN TOKEN EXCHANGE IS TO PROVIDE RESOURCES TO BUILD THE PROTOCOL, NETWORK, AND ECOSYSTEM AROUND OCEAN PROTOCOL TO SUSTAIN IT IN THE LONG-TERM.

The proceeds raised for the project will be dispersed to each of the founding teams — BigchainDB and Newton Circus (DEX) — to build the technology and kickstart the business development. Additional remaining funds will be kept by Ocean Foundation for ecosystem, advocacy, lobbying and community efforts.

Ocean Foundation

Ocean Foundation will take the lead to build a vibrant and healthy ecosystem. Given that data is currently designed to be siloed and locked up in many organizations, we believe that a long-term and resource-intensive effort is needed to educate, lobby government, seed the ecosystem with advocates, and help organizations along the journey to unlock their data. Large organizations also need to feel comfortable that Ocean Foundation will be a long-term and reliable partner.

All resources retained by Ocean Foundation will be managed by the Foundation under the control of the Board. The Foundation will report to the community with regular progress updates and transparency on the deployment of resources. We are working with one of the leading global companies on data governance and another leading auditing companies to support on tax planning.

BigchainDB & Newton Circus (DEX)

BigchainDB is responsible for deploying the network, protocol, data science and generalized marketplace components. Newton Circus is responsible for many of the initial use cases, collaborating with partners in Singapore, and working with public and private entities to help unlock their data. DEX is building additional marketplace components and services on top of Ocean Protocol.

Ocean Foundation has struck a 5-year deal with BigchainDB and Newton Circus (DEX) to build and improve on the following components:

Ocean Protocol Network & Protocol Software

- Support the designed token dynamics, including token storage and smart contracts business logic. Support for free, non-fungible, fungible, and programmable pricing schemes
- Individual identity / KYC, individual reputation, data identity, data reputation
- Support for intellectual property claims & licensing (e.g. COALA IP)
- Integrate metadata storage, w/ privacy considerations (e.g. integrate zero knowledge proofs)
- Integrate blob storage (on-premise, cloud, decentralized), w/ privacy considerations
- Integrate compute (on-premise, cloud, decentralized), w/ privacy considerations (e.g. integrate secure containers, homomorphic encryption)
- http API and drivers (JS, Py, etc)
- Individual node deployment tools (e.g. Kubernetes, nginx)
- This includes work to improve software of building blocks as needed. This means BigchainDB and IPDB (metadata storage), but also work on IPLD (data interoperability), ILP (value interoperability), COALA IP, IPFS, Ethereum etc. as needed

Management of the Ocean Protocol network

- Dashboards for management & analytics of individual nodes, analytics on overall network, voting in long-term governance
- Short time scale governance / consensus (e.g. is a transaction valid)
- Long time scale governance (e.g. how to update protocol)

Data Marketplace templates & legals

- GUIs for discovering data, making commons data available in Ocean, buying & selling data according to various pricing schemes
- Data compliance frameworks (e.g. GDPR) and data quality frameworks

Software & support to support the ecosystem and catalyze the community

- Low friction on-boarding for crypto wallets and crypto exchanges
- Hooks into other data networks

TEAM

The Ocean team combines a deep background in big data, blockchain, artificial intelligence and data exchanges, with real-world business experience as entrepreneurs, designers and technologists who have started over 20 companies.

Bruce Pon   Daryl Arnold   Trent McConaghy   Dimitri De Jonghe   Don Gossen

Yvonn Ong   Cristina Pon   Aitor Argomaniz   Irene Lopez De Vallejo   Paul Galwas

Patty Lee   Pedro Puente   Sheridan Johns   Emily Hirschberg   Mike Anderson

Marcus Jones   Matthias Kretschmann   Dev Pramoth   Chris Lee   Kiran Karkera

![ocean logo]

Our diverse team from 18 nations has worked for a wide range of global technology and consulting multinationals, building leading edge technologies and services.

Fang Gong	Troy McConaghy	Ahmed Ali	Kwinten Crauwels	Manan Patel
Kyriakos Zannikos	Masha McConaghy	Jernej Pregelj	Malte Sielski	Sebastian Gerske
Ervin Tham	Daniel Lustig	Sarah Vallon	Enrique Ruiz	Alexandra Au Yong
Artur Gomer	José Pablo Fernández	Javier Cortejoso	Chalid Mannaa	Aishwarya Nair

Experts within the team have developed state-of-the-art AI/ML software to help drive Moore's Law forward, calculated gravity assisted trajectories between Earth and Mars, paving the way for low cost space travel, built a dozen banks around the globe, executed data transformation projects for large multinationals, built one of the world's largest digital marketing agencies and managed operating budgets in excess of $30 million.

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COMMUNITY

In the past year, we've worked to build a vibrant community that is united around unlocking data for AI. We feel privileged to have attracted a broad spectrum of advisors, ambassadors and friends to the project.

ADVISORS

Our advisors come from a broad swath of society and are world leaders in business, AI, data, blockchain and academia. We feel privileged that these people have joined us on the journey, through common, shared values and a vision to equalize access to data and AI.

Peter Wang
Anaconda

Dr. Andreas Mueller
Columbia U, SciKit Learn

David Holtzman
Internet Pioneer, NSA

Dr. Amir Banifatemi
Xprize, AI for Good, VC

Dr. Luciano Floridi
Oxford Internet Institute

Adam Drake
Atazzo, Skyscanner, Zanox

Gil Allouche
Metadata

Azeem Azhar
Exponential View, WEF, VC

Dr. Wendy Hall
Royal Society, MIT, Tsinghua

Dr. Peter Grinrod
Oxford, Turing Institute

Eric Anderson
Planetary Resources, Xprize

Chris Ballinger
MOBI, Toyota, B of A

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Andy Kalambi
Rize, Dassault
Systemes

Pindar Wong
Internet Pioneer

Suhas Kulkarni
UBS, Valuable,
Hydrolines

Mark Messow
ABB, Wharton,
Corning

Maja Vujinovic JD
Coindesk, GE
Digital, SEC

**Dr. Anastassia
Lauterbach**
Wirecard, D&B,
McKinsey

Dr. Michael Mainelli
Y/Zen, City of
London

Charles Smith
ATP, Shanghai F1

Dr. Carsten Stoecker
Spherity, WEF, Innogy

Kenneth Oh
Dentons

Franck Martins
ST Microelectronics

BUSINESS

Luis Cuende
Aragon, EU
Commission

Meltem Demirors
Coinshares, DCG,
Oxford

Simon de la Rouviere
Consensys

Ben Gorlick
Wizard Investments

Dr. Ben Goertzel
SingularityNet,
AGI Society

Ryan Selkis
Messari, Coindesk, DCG

Dr. Sebastian Gajek
Weeve, NEC

Dr. Jason Teutsch
Truebit, RAND Corp

Richard Muirhead
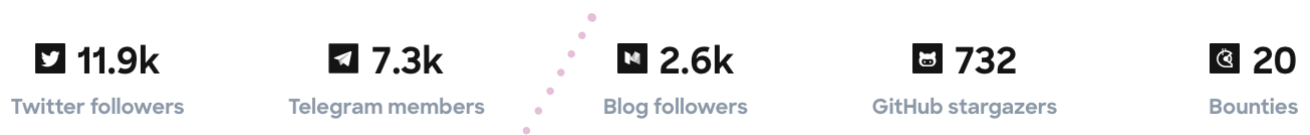Fabric Ventures

Lawrence Lundy
Outlier Ventures

BLOCKCHAIN

Ambassadors

Over 236 people from 46 countries and 108 cities answered the call to be an Ocean Ambassador, to run meetups, participate in hackathons and spread the word about Ocean Protocol.

NORTH AMERICA

Toronto, Canada
Seattle, USA
Boston, USA
Chicago, USA
New York, USA
Denver, USA
San Francisco, USA
Los Angeles, USA
Austin, USA

LATIN AMERICA

Mexico City, Mexico,
Bogotá, Colombia
Lima, Peru
São Paulo, Brazil
Buenos Aires, Argentina

EUROPE

Moscow, Russia
Amsterdam, Netherlands
London, United Kingdom
Brussels, Belgium
Paris, France
Zurich, Switzerland
Madrid, Spain
Lisbon, Portugal

AFRICA & MIDDLE EAST

Istanbul, Turkey
Tel Aviv, Israel
Cairo, Egypt
Dubai, United Arab Emirates
Lagos, Nigeria
Nairobi, Kenya
Cape Town, South Africa

ASIA PACIFIC

Seoul, South Korea
Tokyo, Japan
Hong Kong, China
Mumbai, India
Bangalore, India
Singapore, Singapore
Sydney, Australia

Followers

11.9k
Twitter followers

7.3k
Telegram members

2.6k
Blog followers

732
GitHub stargazers

20
Bounties

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OTHER DATA & AI PROJECTS

MANY TEAMS ARE BUILDING DATA EXCHANGES AND DATA PROTOCOLS. HERE ARE SOME OTHER PROJECTS.

Enigma

A data marketplace for financial data, and sharing of trading algorithms.

Datum

A data marketplace for personal and structured data, to be built using BigchainDB technology.

Dentcoin

A data marketplace for mobile data.

DX Market

A data marketplace for business data.

IOTA Marketplace

A data marketplace for IoT data.

Pandora Boxchain

A marketplace for AI kernels, computations and big data powered by Proof of Cognitive Work (PoCW).

Streamr

A data marketplace for streaming IoT data.

Morpheo

A trusted compute economy for traceable ML on hidden data, on blockchain.

Wolk

A data marketplace for ad data.

Zenodys

A visual IoT marketplace platform.

Ideally, Ocean Protocol can build the tooling and network that allows all these marketplace products to co-exist with each other and leverage Ocean Protocol to reach more customers. For instance, Enigma could build a marketplace on top of Ocean Protocol to facilitate the trading of time-sensitive financial and corporate data, using the multiple pricing mechanisms provided by Ocean Protocol. Datum advertised BigchainDB as part of its technology stack, meaning Ocean Protocol will be compatible if Datum decides to open a marketplace using Ocean Protocol.

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