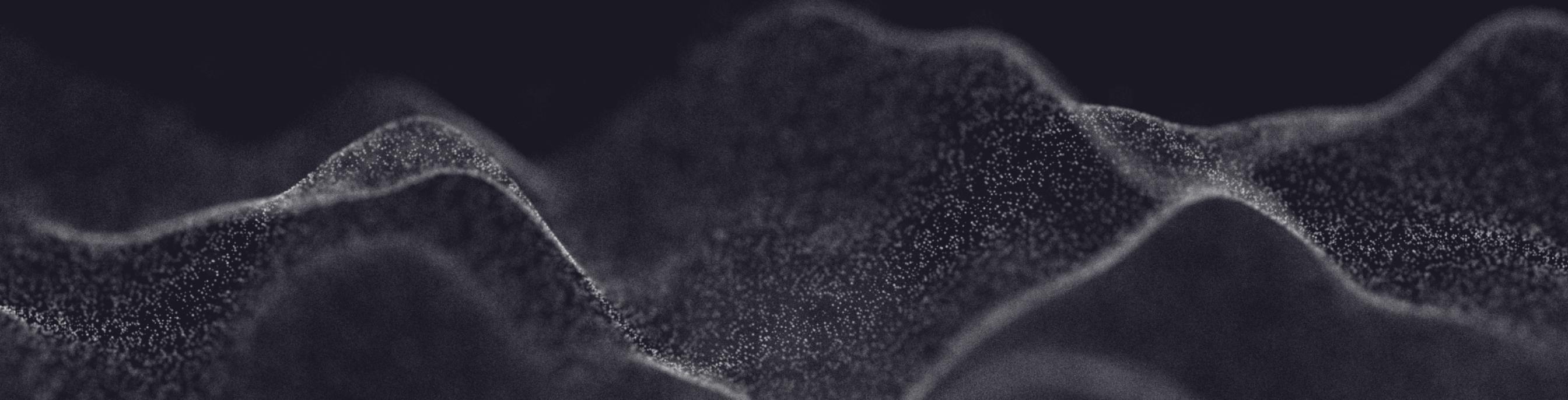


# CONSENSUS

DECENTRALIZED AI FOR COLLECTIVE GOVERNANCE





# ABSTRACT



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#### What is Consensus

Consensus is the open-sourced, decentralized artificial intelligence platform, powered by native cryptocurrency, and built with the vision to improve the governance mechanisms at all levels of organizational structures: community, startup, non-profit, enterprise, city, county or the entire country.

Once fully realized, Consensus AI will be able to offer automated, data-driven solutions to the most complex problems of our collective co-existence by modelling the potential outcomes of proposed changes. Consensus will help govern communities, societies and countries in a more cost efficient, transparent and progressive manner.

This will be implemented via collective voting, initiatives proposal and funding, execution reporting and intelligent algorithms that will perform project analysis and model the outcomes with the efficiency, budgetary concerns, social, environmental and other factors under consideration.

#### Mission

The mission of Consensus is to achieve collective governance based on interdependence using advanced technologies.

#### Abstract

There are three main components to the Consensus system: the Sentient blockchain network built with verified nodes that allows running distributed machine learning, the Research Platform with extended data collection and modelling capabilities and the AI Advisor – a standalone system constantly monitoring and learning from the incoming available data that is used to make predictions. Later stages of development will include internally and externally built Dapps for various governance applications.

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At the initial project stage the Consensus Foundation team will build and launch the Sentient network, a distributed ledger system capable of performing decentralized machine learning, powered by its own currency, smart contracts and the implementation of trusted nodes.

**Two main features of Sentient are:**

- i) verification of users and nodes with eIDs, which allows the creation of governance applications and faster adoption by public sector as a legitimate platform for data processing and decision making,
- ii) decentralized machine learning, allowing for secure, encrypted and distributed data analysis.

**Phase Two**

Following Phase One we plan to launch the Research Platform – a system to enable conducting extended research, working with various data sources, including proprietary data acquired by the Foundation and contributed by the participants, data from open sources, public voting and opinion data gathered from the members of the network in exchange for Sen. Being the second main component of Consensus, the Research Platform will enable effective data collection, processing, visualization and actionable insights.

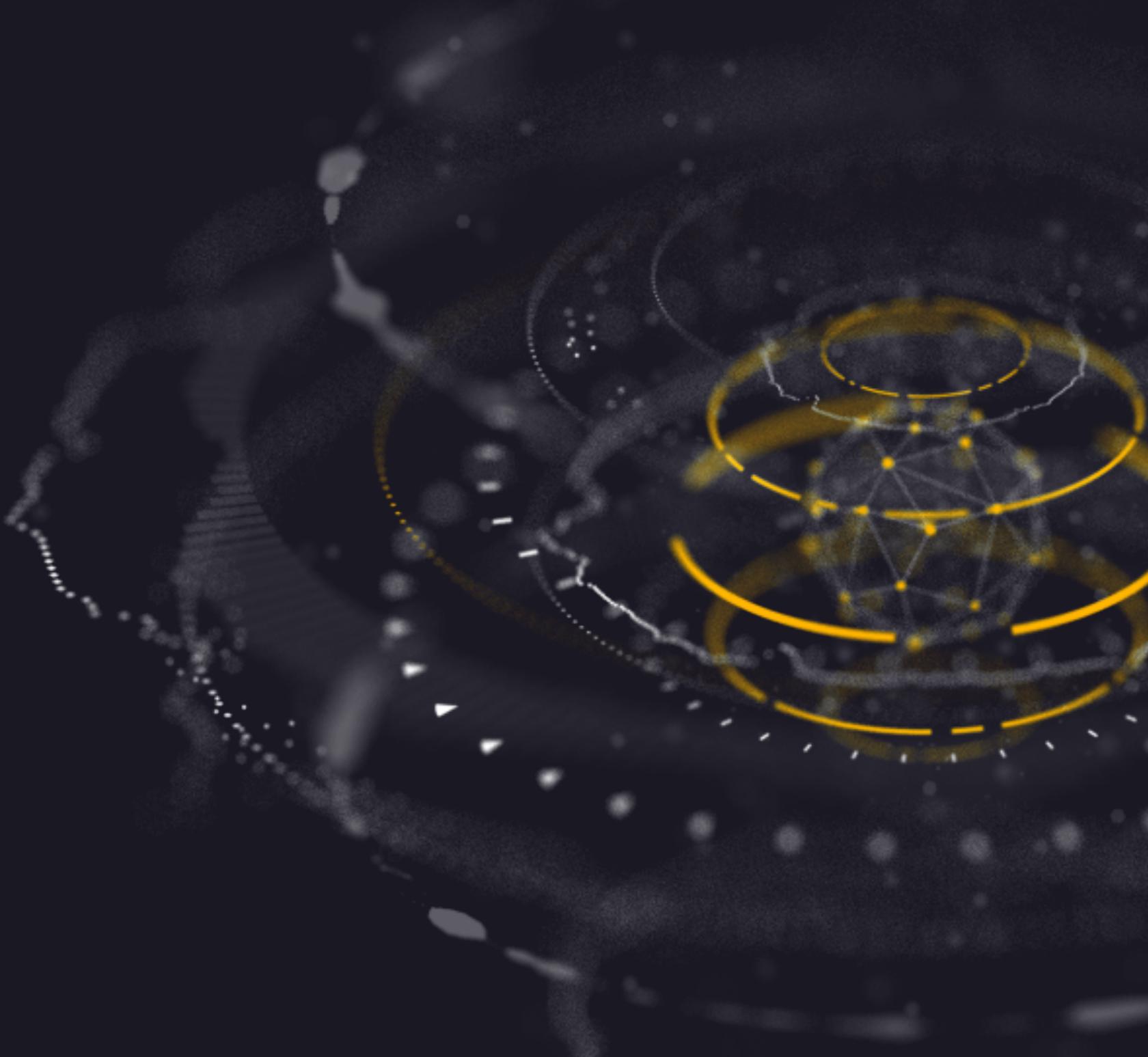
**Phase Three**

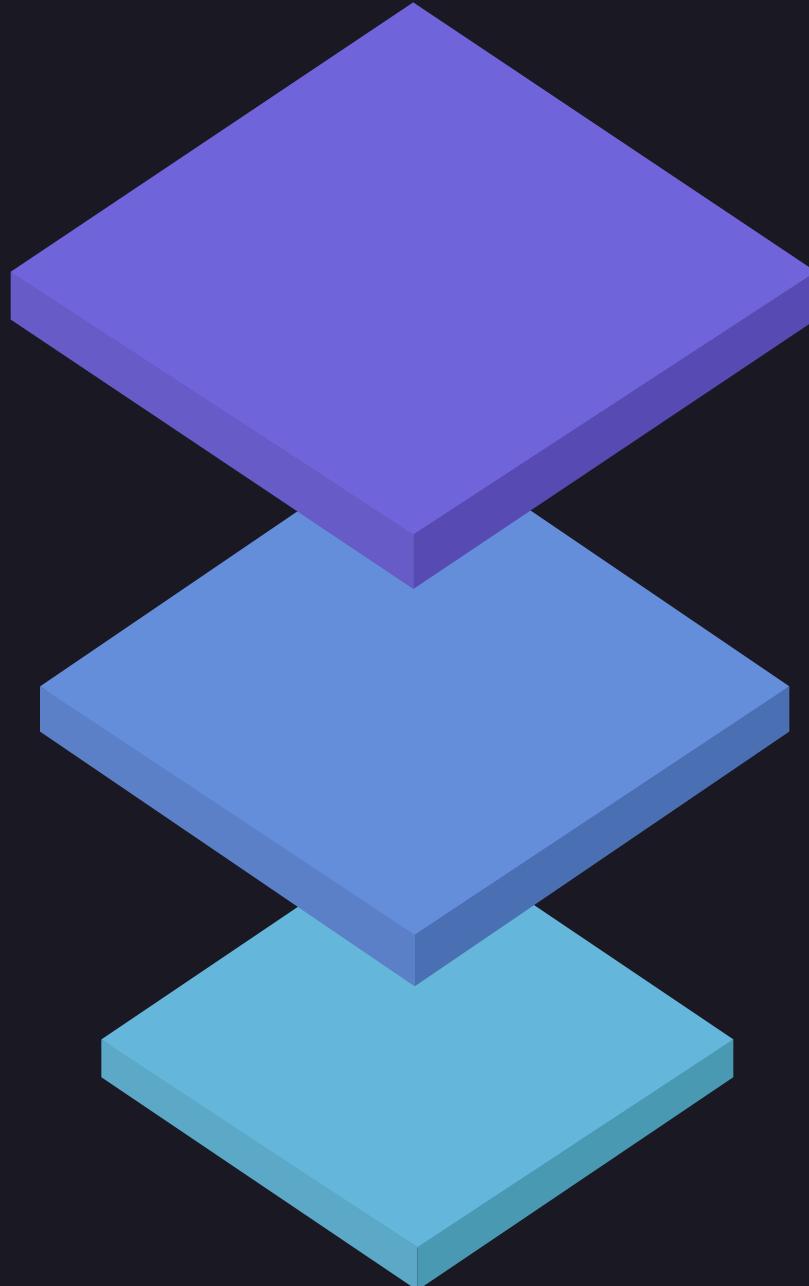
As the platform will grow, evolve and mature we foresee certain entities to require customized research performed. Our plan is to introduce the AI Advisor subsystem – the extension to the Research Platform that will give organizations and government bodies the ability to instantly model the outcomes and analyze any particular proposal and/or decision without taking them to public, effectively acting as a text sandbox for any proposed change.

**Future**

As the final step the platform will be opened to the third-party developers for building governance applications using the Consensus infrastructure such as algorithms, smart contracts templates, reputation system and any governmental registries integrations.

PLATFORM





### Decentralized Apps Top layer

- Public Tender System – marketplace for projects and public works, where contractors can be selected using voting, execution can be monitored and feedback given
- Reputation System, giving the rating to the responsible party and participating in other decisions required for successful execution of public tenders
- Open Budget will allow relevant participants verified by eIDs to participate in decision making processes with respect to budget allocation, and perform public audit of the budgetary spending

### Research Platform Middle layer

- Data collection and fusion system – data import from various sources and transformation to structured data objects, association with real objects and events
- Dashboards and data visualization systems
- AI Advisor to model the outcomes and analyze proposals or decisions
- Governance modules for budgeting, legislation and economic development
- Citizen feedback collection and processing and proposals, budgets, regulations publishing system

### Sentient Network Base layer

- Decentralized computer with machine learning on chain and trusted nodes, verified with electronic national IDs
- Native currency SEN
- Smart contracts signed with eIDs with the possibility be adopted by countries with the progressive outlook



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### Network

Sentient, the decentralized machine learning network with trusted nodes, will be developed in collaboration with the Estonian e-Residency team and launched as a pilot in Estonia first, with 25,000 e-Residents becoming the initial users.

At the start of the project this network will be used for decentralized machine learning by various data scientists and researchers, and later by the Consensus itself to simulate the outcomes of government decisions, make predictions and investigate hypotheses. Also, the network capacity will be used for distributed data storage and running Dapps.

### What the Future Holds

By the end of 2018 all public services in the European Union are obliged to accept the eIDs of other member states under the eIDAS regulation. Expansion to the private sector is the next step. Within years, online services offered by organizations such as universities, healthcare providers, financial sector companies and many others will be accessed using eID. About 3,6 billion people globally to carry a national eID card by 2021. UN Sustainable Development Goal 16.9 calls for identity documents for everyone in the world by 2030, which by then will be electronic.



99% of Indians aged 18 and above had been enrolled in Aadhaar eID



98% of Estonians irrespective of their location, have state issued digital identity

### Electronic National IDs

Sentient will be the first distributed global computer network to include the strong digital ID linking. We believe that in the near future transactions running on smart contracts and verified by eIDs will be adopted by countries with the progressive outlook.

Futhermore, eIDs linking will provide the network participants with access to a range of government services. For example, citizens will be able to vote for a budget allocation items, or transfer property rights immediately upon digitally signing the deal, with smart contracts linking to the government property register.



over 22 million eID cards issued in Belgium as of 2017



over 50 million eID cards had been issued in Germany



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### Federated Learning

One of the innovations we are proposing is building an artificial intelligence layer that is hosted by the network participants and is training on data contributions to the network and other available external datasources.

Currently, most of the machine learning is done in centralized locations that are controlled by closed corporate entities. Beyond Google and Apple using decentralized model training on their respective mobile platforms, there is no openly available network for everyone else. Our approach for training models is inspired by the federated learning method, which is appealing due to a number of factors, primarily because of privacy considerations – the distributed training data remains on the nodes, and a shared model is learned by aggregating locally-computed updates. A key advantage of the federated learning approach is the ability to decouple the model training from the need to access the raw training data directly.

Furthermore, we introduce additional privacy protection mechanisms that enable the nodes to carry out the necessary computations without the risk of their local data being compromised by, or stored in and transmitted to the training-requesting party.

### Smart Contracts Signed with eIDs

Within the scope of the project we plan to build a user wallet with eID integration for general, non-developer participants (regular citizens) to allow the creation customized smart contracts for virtually any type of deals or transactions. The smart contracts will be available to be signed by the holders of the eIDs, creating the additional level of security and trust between the parties.

### Sen Coin

The Sentient network includes a native platform currency, called Sen and denoted SEN. Sen coin provides the payment mechanism to network participants and is generated by the network during mining and execution of smart contracts.



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### Assembly

In order to overcome the issues of the network governance itself, we propose a decision-making entity called the Assembly, comprised of the trusted nodes, authenticated by the eIDs, starting with Estonian e-Residency IDs, and expanding in the future as other eIDs become available. Governance matters like the development of the source code, forks, mining rates, and decisions related to the allocation of Consensus Foundation coin reserve within the network will be made within the Assembly. In addition, the Assembly members will be able to provide security and encryption services to the Sentient network, earning these members extra mining rewards.

### Synaptic Core

One of the main parts of the Consensus system is the smart contract system that acts as a dispatcher service between the machine learning service requestors and the user nodes. To facilitate the secure interactions between the entities requesting the particular data processing, Synaptic Core builds a research-related smart contract, encrypts using Assembly Protection Service and makes it available for distribution. It also distributes Sen rewards for the successful execution.

### Homomorphic Encryption

We propose the use of homomorphic encryption to allow for privacy-preserving computations performed on the datasets. Sentient network will be applying these principles to protect the requestor models and user data. In later stages, once the datasets get sufficiently large, we intent to combine the differential privacy approaches with homomorphic encryption to further enhance user data privacy, achieve greater scalability and improve performance.



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## Sentient Network



MUNICIPALITY



CITY



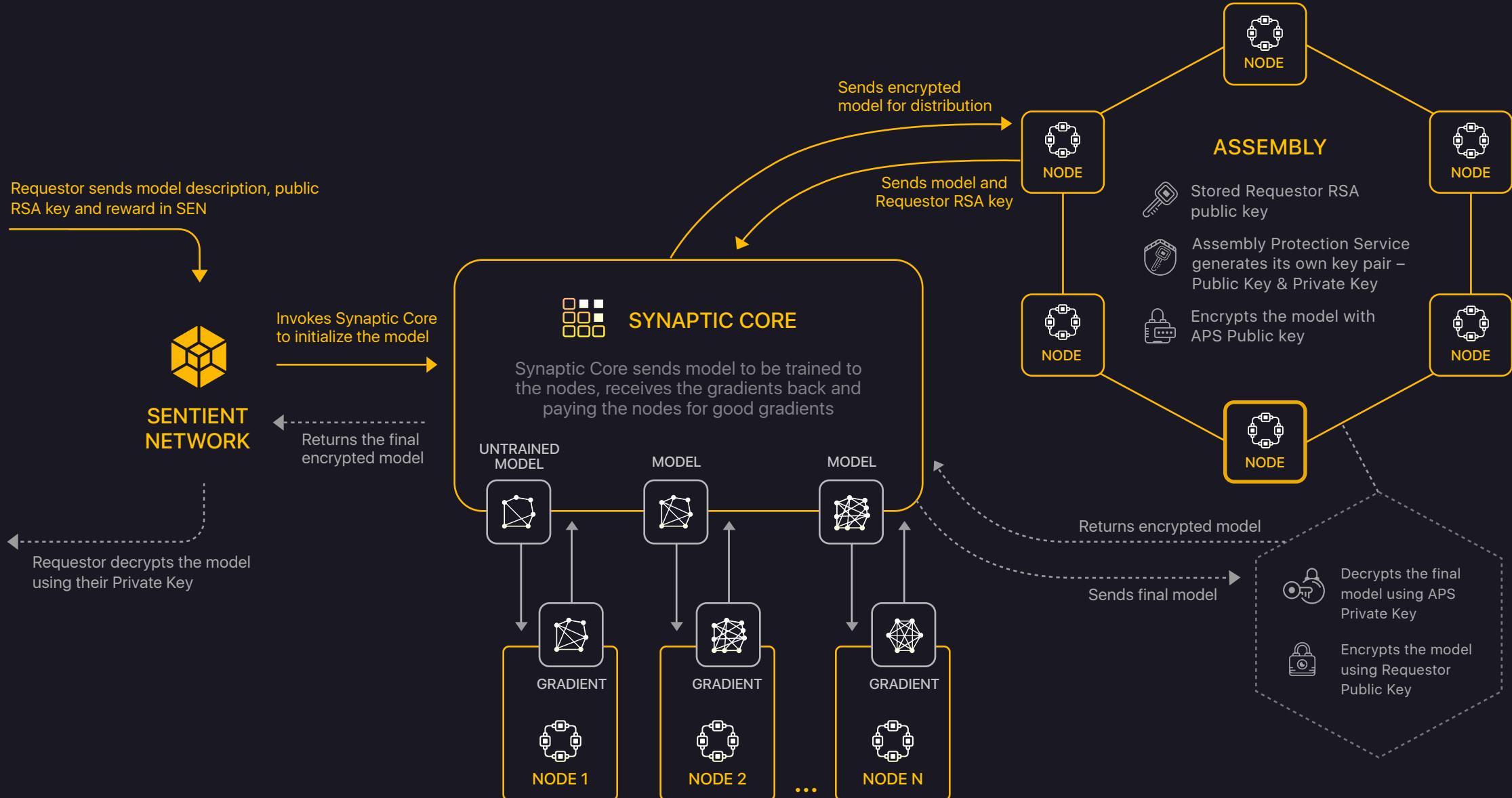
COUNTY



REGION



COUNTRY



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Following the release of the Sentient network, its initial adoption and user growth, we plan to launch the second main component of Consensus – the Research Platform, which will enable effective data collection, processing, visualization and actionable insights. The platform consists of several components.

### Datascope

GUI for working with data with on-chain and off-chain elements that allows requestors to perform a number of data collection and analysis tasks. The Datascope modules include:

1. Data Collectors, gathering data from various available sources, both open and proprietary and Data Fusion mechanisms.
2. Data Transformers, turning unstructured data into structured data objects and creating associations with real objects.
3. Data Intelligence – visual representation, dashboards, graphs, tables, etc.
4. Multiuser Collaboration system, with various access levels.

In addition to the off-chain data preparation and analysis tools, Datascope will provide options to run simulations and perform public opinion research with requests to the Sentient network.

### Features



#### Competitive Intelligence

Compare data with other cities, counties or regions to find how they solve similar challenges.



#### Trend Analysis

Signals that point to the future and identify which trends are rising and which are fading.



#### Collaboration system

Multiuser collaboration system, with variety of access permissions to securely analyze the data.



#### Case management

Ability to create workflows, assign tasks and get notifications, track metrics and status information surrounding cases, ensuring that the execution is complete and the goal is achieved.



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**Public Opinion Gathering Module**

Different types of Requestors – enterprises, non-profit groups, government agencies – will have the ability to present a proposal for evaluation and collect public opinion data from the users of Sentient network via the Public Opinion Gathering Module. The proposal will be valued on a pay-for-success basis when the requestor pays a fee once the data collection results meet certain criteria. There will also be a back data contribution option that will waive this fee if the requestor releases the results of the research for open use.

**External Data Module**

This is the subsystem that allows collection and processing of the data that may not be available to the requestors, or may not be structured to be immediately usable. This includes data from open sources, as well as proprietary data that the Consensus Foundation will help acquire for the research users, to supplement and enhance the research capacity of a particular project.

During this stage of the project development, the governance modules will be built as part of the Consensus that will be used for effective collective governance and decision making.

**Use case**

The city officials are assessing the impact of the proposal to prohibit the entry of cars into the city centre. After the initial assessment of the consequences and costs of this new initiative in Datascope, the officials send it in the form of a ticket to the Research Platform. The city residents using their eIDs vote and comment on the proposal. The collected feedback is processed and returned to the research initiator.

Further request is made to the AI Advisor, which predicts externalities, such as the economic losses from the ineffective delivery services if this initiative is adopted, and suggests optimizing the parking spots instead. If the redesign of the parking spots is selected as an active initiative, it could be published on the Open Tender platform with the budget details, and the contractors for execution could be publicly selected.

**1 ABSTRACT****2 PLATFORM****3 PEOPLE****4 CROWDSALE****5 FINANCING****Budgeting Module**

Datascope subsystem that enables the city, region or country budget formation.

The new proposals that require funding will be created and managed in this module, where experts will be able to analyze a particular proposal and dedicate a team of researchers with various access levels (to enable the involvement of both internal and external experts) to model the consequences of the initiative implementation and estimate the financial requirements and future benefits and profits, influence on the environment, public opinion, public health and safety, and consider other factors and outcomes.

This module will allow formation of the optimal budget from the multitude of separate proposals, taking into considerations the desires and preferences of the citizens (including the electronic voting on the items of budget allocation) and the recommendations of the AI Advisor as to where the funding should be directed or increased, and what programs should be scaled down or stopped. The final proposal will be available for publishing, adoption and implementation. Each proposal that requires an outside contractor to execute will be created in the Open Tender (described below) as a smart contract, stating the terms of the proposal, requirement, implementation details etc. The tracking of the execution progress will be attached to the proposal for transparency.

**Use case**

In order to attract innovative companies and create new jobs in the sector, a regional government plans to introduce a new incentive that will reduce corporate tax for IT startups to 0% for the first 3 years.

The module simulates this situation with the given input: "What will happen if in the first 3 years the corporate tax is 0%, increasing by 2% per year after that".

The budgeting engine predicts the outcome:

- A subset of the current IT companies in the region will be tax exempt, and the tax revenue will drop by \$3.5M per year.
- In the long term, the region will attract X new companies, and Y skilled specialists will move from other regions.
- In 5 years this development will contribute to additional \$5M in tax revenue annually.



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### Legislation Module

This Datascope subsystem enables the proposal and formulation of legislative initiatives, such as introduction, change or repeal of laws, regulations and policies. Every legislative initiative coming to Datascope will be evaluated and processed by experts.

We foresee that a sizeable part of the proposed initiatives will be rejected for obvious reasons, but a subset of the proposals, appearing to have potential and deserving further study and analysis, will be sent to the Legislative Module.

This module will contain all active laws, regulations and policies and the AI Advisor will monitor the current state of matters and indicate what should be adopted, changed or repealed. An example would be a proposal to lower the speed limits within the city due to the rising number of accidents.

The new proposals will come to the Legislation Module in the form of tickets and will be assigned a team to review and execute if deemed acceptable and useful. The team will evaluate the details such as impact and cost, gather feedback from citizens and model the consequences and outcomes of the proposed policy with the help of AI Advisor.

### Use case

The mayor of the city is exploring ways to increase the municipal revenues and proposes to extend the liquor sales hours, in order to increase the income from the alcohol sales in bars and nightclubs. However, there is a concern that this may increase the number of incidents of drunk driving, causing discontent among the residents and may have a negative impact on the public safety.

The inquiry goes into the Legislation Module to simulate the situation — "What will happen if the region extends the liquor sale hours until 3am, instead of the current 2am?"

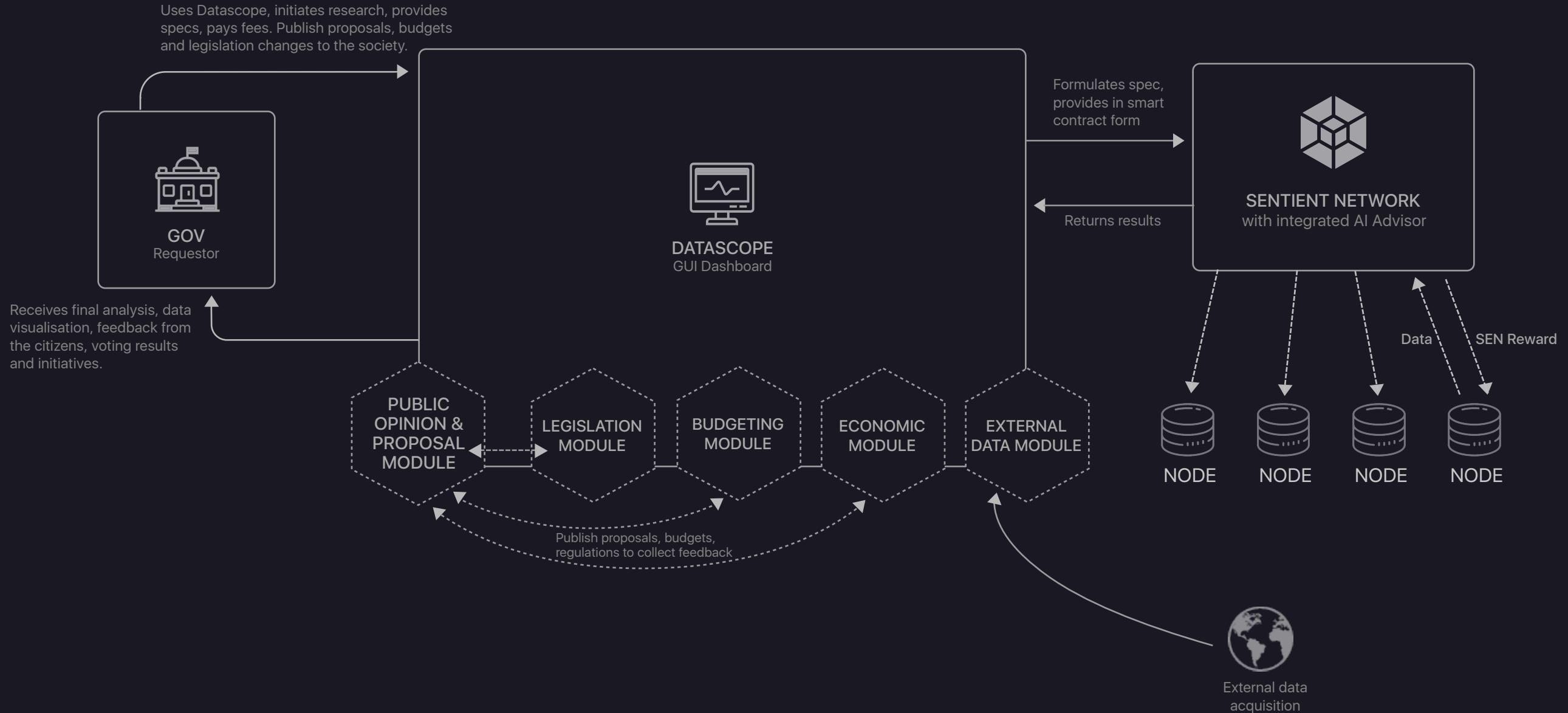
The AI Advisor analyzes key indicators, such as the similar policies of other cities and the current rate of incidents, models the scenarios and produces a prediction:

- Additional revenues to the budget: \$2M per year
- The cost of maintenance will increase (additional load on the law enforcement, ambulance, hospitals): \$500K per year.
- Increased cost of city cleaning: \$200K per year.
- The city's public safety index will decrease by 3% per year.



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Research Platform





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As the final step the platform will be opened to building governance apps (to both internal and external developments) using the Consensus infrastructure such as algorithms, smart contracts templates, reputation system and any governmental registries integrations to the third-party developers.

### Open Tender

Consensus platform will allow government bodies to post social projects on which invited residents will be able to vote, comment and take part in the application process. The projects will be submitted to the network with the necessary information such as importance and advantages to the society, permits and licenses required, execution timing etc.

The system will track the responses and engagement, help rate the proposals by feasibility, importance and timing. Once the tender or grant is awarded, the terms of the transactions outlined in a smart contract are signed by the involved parties and the allocated funding is transferred. The network participants subsequently monitor the execution of the tender or grant giving the rating to the responsible party and participating in other decisions required for successful execution of the tender.

### Social Proposals and Crowdfunding

Individuals, communities and organizations can invite members and residents to participate in launching project initiatives for collective voting, discussion and funding. Natural and legal persons can apply as executors for these initiatives if required, offering plan of implementation, timeline and budget. Network users then can give their votes to award the project to the most suited proposal. The effective execution and management will be achieved through higher degree of transparency, faster adaptive processes and reputation system developed though the track record of executed transactions. This will allow to select the most suitable stakeholders, domain experts and network observers for monitoring.

### Open Budget

Will allow relevant participants verified by eIDs to participate in decision making processes with respect to community/city/county budget allocation and do public audit of the budgetary spending.



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## Implementation Roadmap

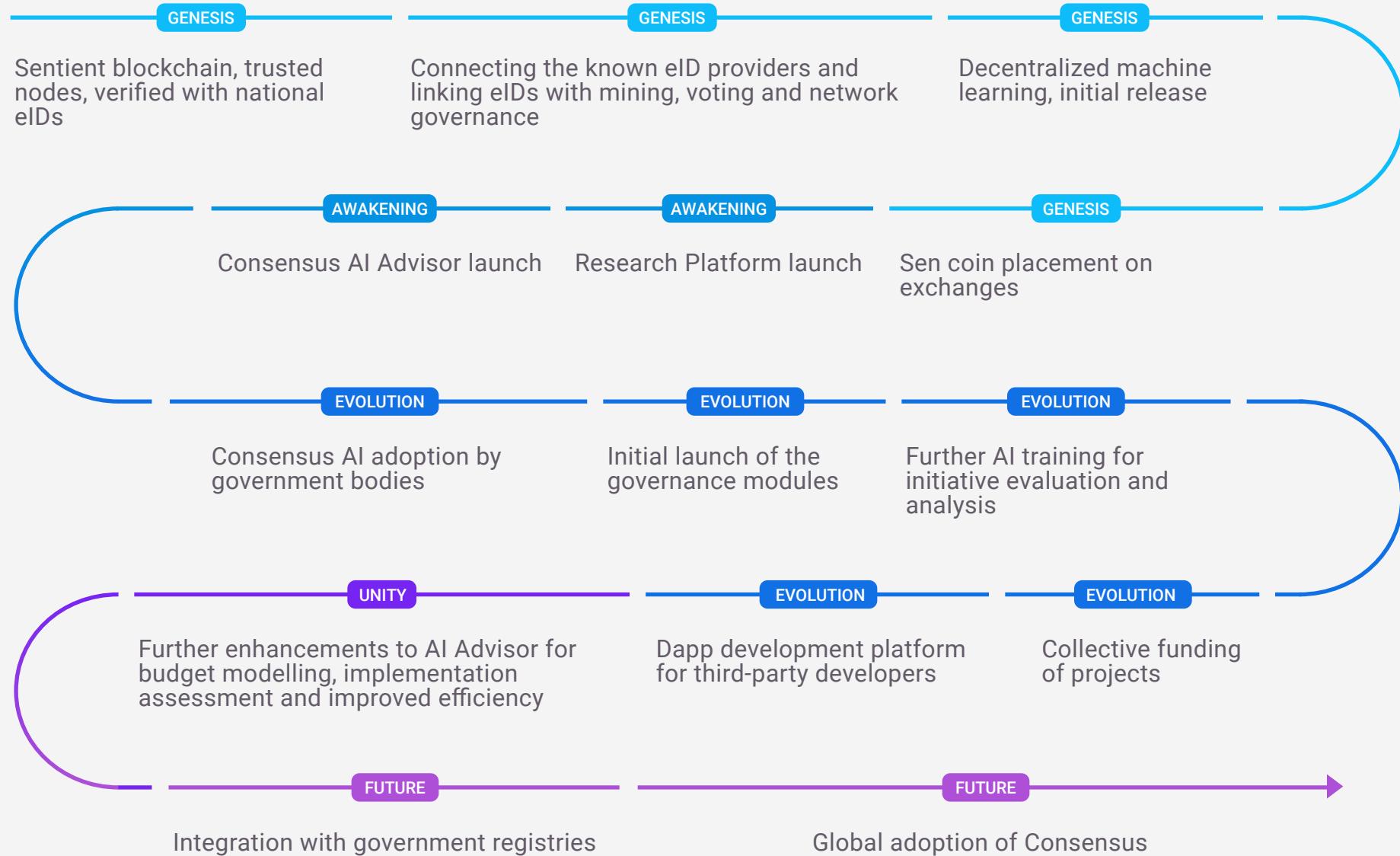
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**Oleg Gutsol**

Founder

Former founder and CEO of 500px, ex-Head of Global Growth at the Republic of Estonia e-Residency program, which provides the basis for the Consensus AI implementation.



**George Bordianu**

Blockchain & AI

Founder of Paradiso cryptocurrency index fund. Ex-VP of Engineering at Deep Genomics, Director of Engineering at 500px. Masters degree in Computer Science from McGill University.



**Artem Loginov**

Product, AI, Governance

Chief Product Officer, over 10 years of experience in mobile and artificial intelligence. Previously Director of Product at Yandex (\$YNDX), VP of Product at LinguaLeo. Masters degree in Government Management and International Law, PhD candidate in Economics.



**Julia Ivanova**

Growth, Marketing

Co-founder of Parla.ai, an artificial intelligence language teacher. Marketing and business development specialist. Masters in Business Informatics from Higher School of Economics in Moscow, and Masters in Sociology, Specialist in Social Science, from Saint Petersburg State University of Economics and Service.



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## Advisory Team

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**Yin Cao**

Founding Partner and Chief Strategy Officer of the Energy Blockchain Labs. Principal Energy Analyst of China Cinda Securities – the biggest financial asset management company in China.



**April Rinne**

Local and national governments consultant. Member of China's Sharing Economy Committee and Advisory Boards member of Seoul, Amsterdam and the National League of Cities (USA).



**James Stewart**

Co-founder of the UK Government Digital Service, playing a wide variety of roles in the digital transformation of the the UK government.



**Alkarim Nasser**

Currently running product and growth at Facebook. Also, co-founder and Chairman at Gallop, a radically innovative data science company.



**Yury Selivanov**

Founder of EgdeDB. Core Python developer, author of uvloop, asyncpg, asyncio. Consulted Cisco, ABB, Nintendo and others. His software is used to improve performance at Facebook, Instagram, Pinterest etc.

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REPUBLIC OF ESTONIA  
E-RESIDENCY

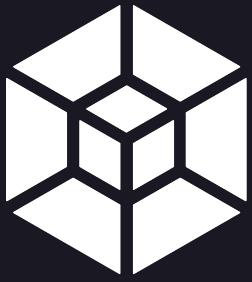
Consensus AI pilot will be developed and launched in Estonia, with e-Residents becoming the initial users. Named “the most advanced digital society in the world” by Wired, Estonia has set the goal to onboard 10 million e-Residents by 2025.



Creative Destruction Lab is a Canadian program that provides access to world-renowned experts and chief scientists from leading academic institutions, including University of Toronto, McGill University, University of Montreal, Rotman School of Management and others. Consensus joined CDL in October 2017.



Mothership is a digital asset exchange and a token market platform established in Estonia with a goal to make digital assets accessible to EU businesses and e-Residents. The goal of Mothership is to make Estonia a leading country for blockchain companies streamlining their registration, development and providing access to funding and incubator-type services.



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