NGI ONTO CHAIN

Blockchain for the Next Generation Internet

ONTOCHAIN OPEN CALL 3 DOCUMENT

THIRD OPEN CALL FOR PROPOSALS

Closing dates for proposals: 25 July 2022, 17:00 CEST

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4	INTELLISEMANTIC SRL	IS	IT
5	ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS - RESEARCH CENTER	AUEB	EL
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PREAMBLE

This document provides the technical details for ONTOCHAIN Open call 3.
It first presents an overview of the outcomes from ONTOCHAIN Open Call 1 as well as an overview of the activities already engaged by Open Call 2 innovators at the time of writing this document. All this information should be considered to understand the ONTOCHAIN vision and concept and shape your application.
Then a first use case that may serve as an umbrella use case for the project named "The Trustworthy Semantic Marketplace" is discussed as well as how the ONTOCHAIN Ecosystem could be used in real life.
Finally, the Open Call 3 scope, topics and intended deliverables are detailed. As a reminder, the indicative timelines of this Open Call close the document.

The **specific objectives of the ONTOCHAIN Open Call 3** are two folds:

Objective A- To complete the missing blocks of the ONTOCHAIN infrastructure in particular those related to :

- Service Integration (Gateways APIs) for ONTOCHAIN applications,
- Semantic Matching and Reasoning,
- Energy-efficient and sustainable hosting infrastructure for the ONTOCHAIN software ecosystem and services.

Objective B- To exploit the ONTOCHAIN infrastructure designed and implemented respectively through ONTOCHAIN OC1 and ONTOCHAIN OC2 for real life use cases that cover real need of individuals in terms of trustworthy data/services exchange and trustworthy content handling from various vertical domains/vital sectors of the European economy. Applications domains that should be considered by applicants of the OC3 are provided in the table hereafter. These are examples but are not limited to, as long as it serves the overall ONTOCHAIN vision and objectives:
"Develop scalable blockchain, decentralized reputation systems and semantic web technologies, in order to achieve trustworthy content handling and information exchange as well as trustworthy service exchange in the next generation Internet/social networks for vital sectors of the European economy".

All topics for the objectives A and B are summarised in the following table. Any specific topic is detailed in the following sections.

Topic id	Topic description
A1	Service Integration (Gateways APIs) for ONTOCHAIN applications
A2	Semantic Matching and Reasoning
A3	Energy-efficient and sustainable hosting infrastructure for the ONTOCHAIN software ecosystem and services
B1	Semantic Digital Logbooks for Companies, Buildings, Cars or similar

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Topic id	Topic description
B2	Decentralised Fact Checking and Data Credibility for Social Content
B3	Decentralised Online Semantic Social Networks
B4	Semantic energy data management
B5	Smart City Applications Relying on Trustworthy Semantic Metadata
B6	Automotive, e.g., electric vehicle charging, road side management, car insurance, communication interoperability
B7	Distribution Logistics / Supply Chains Using Trustworthy Semantic Data
B8	Data/Digital content /Multimedia marketplace, including social media
B9	Semantics-based DAO
B10	Decentralised Public Services & Common Goods
B11	Remote Presence/Working and Metaverse
B12	Any other application in synergy with ONTOCHAIN objectives

1 ONTOCHAIN SO FAR

1.1 OVERALL OBJECTIVE

Today, more than ever, our digital life is an extension of our physical world. Thanks to the Internet, it is now possible for citizens from all over the world to participate in the generation and use knowledge like never before. However, from the current Internet standpoint, the way knowledge is actually generated, curated, shared and stored raises critical concerns about security, privacy, fair and equal distribution of benefits, potential for abuse and adverse impact on individual rights. Citizens, everywhere, are at risk of being presented with partial or biased information reflecting the viewpoint of their provider.

From now on, it is time to handle our digital world with the same critical, moral and ethical thinking that we use in our physical one. The internet of the future should follow a human rights approach, be more resilient, trustworthy and sustainable. It is time to empower citizens by means for collective organisation as well as for contribution and use of knowledge thanks to smart solutions that support transparency, trust, plurality and democracy.

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ONTOCHAIN - Trust traceable and transparent ontological knowledge on blockchain, is a European project funded by the European Commission under the European Union's Horizon 2020 Research and Innovation Programme, and part of the European Commission's Next Generation Internet (NGI) initiative.

ONTOCHAIN was launched in September 2020 to empower Internet innovators and end users to develop trustworthy blockchain-based knowledge management solutions that will be part of a novel software ecosystem, through 3 Open Calls and a budget to be distributed of 4,2M€. The concept underlying this ecosystem is a better share of knowledge and value on the internet and that for various domains such as health, economy, mobility, public services, energy and sustainability, news, media, entertainment, Industry 4.0, tourism.

The Figure 1 below shows an overview of the ONTOCHAIN ecosystem architecture.

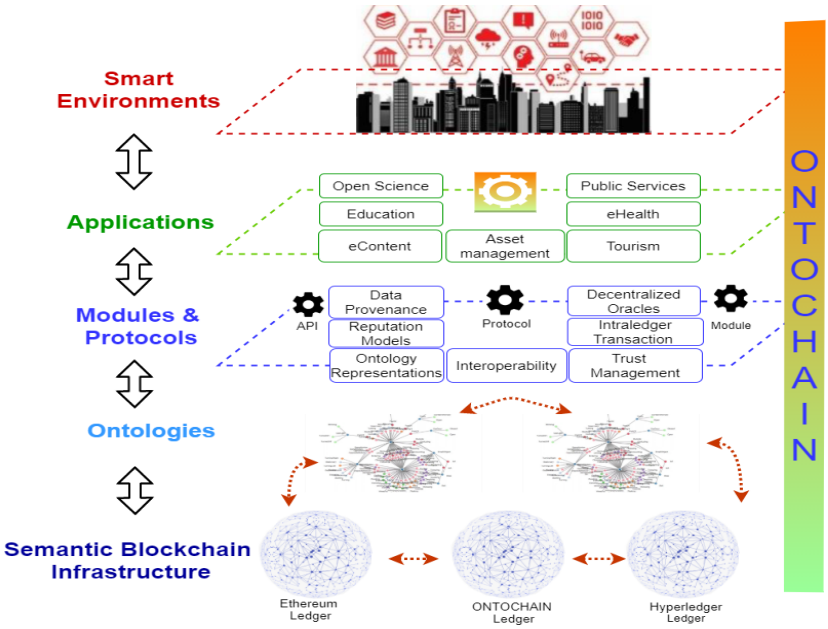

FIGURE 1: ONTOCHAIN ECOSYSTEM ARCHITECTURE

The merging of the semantic web, trust and blockchain constitutes its backbone. Building it with relevant actors such as internet technologists, researchers and innovators from both industrial and academic sectors is the catalyst for its achievement. In addition to Figure 1, Figure 2 below shows the mapping of the ONTOCHAIN technical topics on the architecture as well as existing and intended software development for each of the three open calls.

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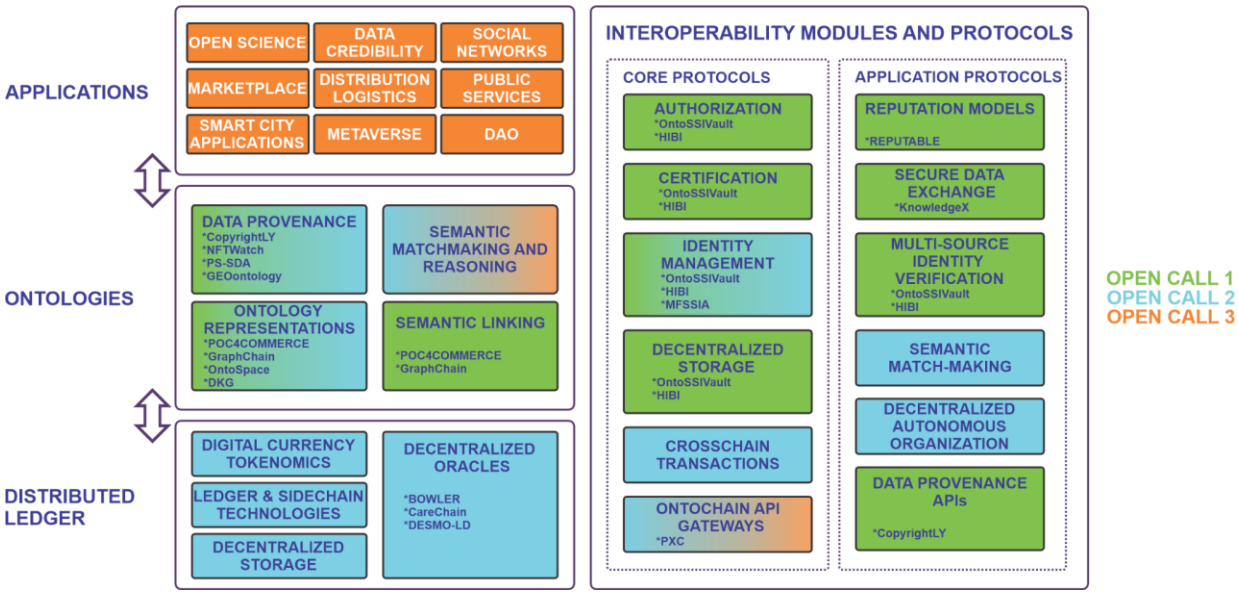

FIGURE 2: ONTOCHAIN VISION ARCHITECTURE FOR SOFTWARE DEVELOPMENT

ONTOCHAIN Open Call 1 has already been completed and ONTOCHAIN Open Call 2 is now running.

This document provides the technical details for ONTOCHAIN Open call 3.

1.2 ONTOCHAIN OPEN CALL 1 AND OPEN CALL 2

1.2.1 Open Call 1 outcomes

The Open Call 1 objective was to establish the ONTOCHAIN framework as a human-centric solution to achieve decentralisation & trustworthiness for various domains such as health, economy, mobility, public services, energy and sustainability, news, media, entertainment, Industry 4.0, tourism and so on.

It was breaking down into 3 phases:

- Phase 1 Research proposal,
- Phase 2 Research award,
- Phase 3 Challenges for conferences.

It was launched on the 16th of November 2020. 137 projects applied to contribute to the specification design of the ONTOCHAIN ecosystem. Selection and negotiations were successfully completed with 17 projects to proceed to Phase 1.

More specifically, the 17 third parties were enrolled to conceptualise along 2 phases, a research project for 1 of the 6 following topics:

- Applications,

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- Semantic interoperability,
- On-chain data management,
- Off-chain knowledge management,
- Ecosystem economy,
- Ecosystem scalability & integration.

The concepts they proposed are described hereafter per topics and third parties.

Topic 1: Applications

- **CopyrightLY** - It is a decentralised application that leverages blockchain and semantic web technologies to facilitate the copyright management for social media. It links social media content to on-chain authorship claims, in turn tied to creators' identities and content hashes. It is to state reuse conditions, allowing their negotiation and registering reuse agreements on-chain. Authorship claims are integrated with social media platforms through content hashes that creators add to media description. They are verified on-chain using oracles, which can also associate social media user profiles with on-chain identities.
- **LCDP-ONT-APP** - ONTOCHAIN Domain Builder is a model-driven approach that is centred on the research and development of a meta-language for application/components, ontologies to be used in domain-specific scenarios, and a low-code environment (IDE). Meta ontologies enable to model ONTOCHAIN applications components and formally define them. The IDE could be accessible in SaaS (via the AstraKode Blockchain platform).
- **OntoSsiVault (Gimly ID)** – It is a set of software applications (mobile and web) and libraries enabling self-sovereign identity and selective disclosure and verification of data for humans, organisations, machines, and objects. Gimly ID centers on the mobile application, which offers a password-less single-sign on experience and selective disclosure of data by leveraging decentralised identifiers (DIDs) and Verifiable Credentials (VCs) and a sovereign data vault. Gimly ID is built for interoperability, allowing a Gimly ID user to interact with other SSI conformant systems and solutions. The software developed can be consumed by other developers that will implement the SSO functionality and the issuance, management, and verification of identity and credentials into their applications and systems. The software can be used in open and closed ecosystems to manage and verify sovereign identities and data.

Topic 2: Semantic Interoperability

- **ISLAND** - Interlinked SemanticaLly-enriched BlockchAiN Data focuses on the generation of semantic data based on various sensors and Artificial Intelligence methods, that can be aggregated and used as ONTOCHAIN metadata as well as for further operations of smart applications in various use cases (e.g. part tracking and similar). The ISLAND framework envisions a layer of intermediation between the exposed APIs from the participating smart-contract-users (southbound) and the data consumers (northbound). The framework is set to expose a unified

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abstraction model to any data consumer that aims to infer meaningful knowledge from smart contracts, while at the same time enabling the semantic interoperability of the data. The project solution framework lies also in indexing and querying capabilities to structure data from multiple blockchain networks, represented as RDF Graphs and annotated with rich metadata from ontologies, and ensure the data integrity of RDF data instances via blockchain solutions.

- **OntoROPA** - Ontology based ecosystem for trustworthy Records of Processing Activities (ROPAs) focuses on the validation and certification of the processes for data management, with particular focus on legal compliance (e.g. with data protection acts such as GDPR). Successful Semantic Web approaches such as Linked Data and OWL are combined with blockchain technologies for the aim of ensuring easy access, quality and trust of ROPAs.
- **TENACIOUS** - Trustworthy sEmaNtic Aware marketplaCe for Interoperable clOUd. This project focuses on building a trustable marketplace where semantically described Cloud Services can be researched, discovered, and composed, according to the specific requirements needed. This project also offers a storage of the composed solution in RDF format within the Blockchain, to ensure the compliance to a proposed contract.

TOPIC 3: ON-CHAIN DATA MANAGEMENT

- **GraphChain** – It is a framework for on-chain data management for ONTOCHAIN which implements decentralised On-chain graph management technologies, including the ability to perform usual graph operations. Graphchain proposes a radically different approach – instead of encapsulating the semantic data into Blockchain blocks, they propose to design and implement the Blockchain mechanisms on top of semantic data. The Graphchain solution provides different functionalities such as:
    - Hashing of subgraphs for the on-chain graph structures.
    - Procedural smart contracts with access to the on-chain semantic data.
    - Identification, authorization and data provenance for the on-chain data.
    - Sharding mechanisms and strategies.

The whole idea of Graphchain is adding a new level of trust without sacrificing availability, query ability and performance of graph databases so the solution can be integrated in any software ecosystem that uses traditional LPG databases.

- **SEIP** - Service for Encrypted Information Provider focuses on delivering a framework to ensure granular data access control and confidentiality of data exchanged both On-chain, and Off-chain, in a decentralised and scalable fashion, by exploiting novel asymmetric, encryption mechanisms (Ciphertext-Policy Attribute-Based Encryption - CP-ABE) and credential-based approaches (W3C VCs). This project aims to reduce solution fragmentation that is critically impacting blockchain's large scale adoption and interoperability and also try to address current regulation constraints.
- **UniProDaPI** - Universal Proven Data & Process Interchange is a full-fledged platform for the exchange of verifiable and trustworthy data within industrial settings and sets up an interesting implementation scenario that can be used in

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industrial context. The solution addresses the key issues of Data and Identity Sovereignty and privacy, protection against CloudAct, GDPR or eIDAS compliance. It separates the probative and user metadata made public at sidechain level from the data itself, linked from the chain, made accessible only to authorised parties, and kept on producer's premises or securely accessed from distributed object storage. The proposed scheme allows for perfect file level auditability of the entire audit trail, from the blockchain to a (zipped) collection of all registry writes relative to some identifier, making it possible for lawyers to settle disputes. The unforgeable and easily verifiable registries of proofs of data, events and documents that produce the backbone of multi actor interaction is accessible through simple business APIs.

Topic 4: Off-chain knowledge management

- **DART -** A Distributed-OrAcles Framework for PRivacy-Preserving Data Traceability which provides methods to include Off-chain information with high probabilities of trustworthiness in the operation of services running on a semantic blockchain - ONTOCHAIN infrastructure. Their solution provides a scalable distributed oracles system, in which off-chain data to be stored in Ontoblocks pass through a consensus process autonomously handled by the involved oracles. A correlation model in order to enforce trust between oracles. They also can do a data traceability framework, in which content to be inserted in the ONTOCHAIN comes together with oracle measured contextual information.
- **KnowledgeX** - Trusted data-driven knowledge extraction focuses on establishing communities of data science professionals that can set up and perform various analyses on data (e.g. industrial data) in a trustworthy way globally. In its operation it makes use of secure processing enclaves and other means for the protection of the privacy of the data. KnowledgeX is applicable to any situation where knowledge for a specific problem is needed and data is valuable.
- **REPUTABLE** – It is a Provenance-aware Decentralised Reputation System for a cross-platform privacy-aware reputation system which leverages blockchain technology to achieve decentralised, verifiable calculation of reputation scores. It enables interaction with end users and systems through a secure, reputation analytics dashboard to facilitate user verification as seamless integration with other systems and services.

Topic 5: Ecosystem Economy

- **DW-marking** - Data Watermarking: The missing link to on-/off-chain implementation of distributed data marketplaces which provides methods to include watermarks in structured data sets. DW-marking can develop a new breed of digital watermarking techniques for protecting ownership, and establishing accountability, in the off-chain handling of datasets. Their solution provides three main functionalities such as:
    - Frequency Watermarking for datasets,
    - Recursive Watermarking as an off-chain provenance primitive,
    - Oracle for importing off-chain dataset transactions.

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Frequency Watermarking is planned to be implemented as a standalone primitive for off-chain handling of ownership issues in Data Marketplace (DM) and other distributed systems. Recursive Watermarking is planned to be implemented as an Oracle for allowing off-chain DMs to upload past transactions into a blockchain.

- **POC4COMMERCE** - Making ONTOCHAIN practical for eCommerce is fundamental. POC4COMMERCE focuses on the design of ontologies needed for eCommerce that can further be embedded and used by the services of the ONTOCHAIN software ecosystem in various use case scenarios related to trading of products (agricultural products in the current use case) including their traceability and the use of various token mechanisms. POC4COMMERCE contributes to a shift towards a novel micro-economic model where individuals and companies cooperate and coordinate, deciding the allocation and utilisation of resources, without third-parties intermediaries. In practice, it aims to design an eCommerce search engine for offerings as a software agent on OC-Commerce and OC-Ethereum.

Topic 6: Ecosystem scalability and integration

- **HIBI** - Human Identity Blockchain Initiative focuses on the ability of the users to establish their identities in a legal way and link them to blockchain network addresses, which unlocks immense possibilities to improve trustworthiness of the information stored and managed On-chain. To realise a blockchain transaction, it is required to perform authentication via an eIDAS compliant eID. The address is then tied directly to a trustworthy ID and can be represented in further interactions. HIBI will provide Decentralised Key Management infrastructure and contribute to a key management tool called Smart Distributed Key Recovery which enables the mapping of blockchain keys to eIDAS identities for the purpose of backup and recovery. The technology can be integrated by integrating an eID solution that leverages an official eID app like "AusweisApp2". This bridge will allow accessing the European eID servers to extract data from it and can be integrated into mobile- and desktop wallets. It will also be open-sourced.
- **KUMO** – It focuses on designing and developing a network crawler that can keep gathering information about the peers in the Eth2 network and their behaviour such as a sudden and sharp increase or decrease in the number of messages communicated. The information gathered by the network crawler can be general or specific. The crawler can gather information like: what is the latency and geographical distribution nodes in the network, version of node which client is using and how much data is it propagating to the network, in this way it can suspect bad actors and suggest different attacks that may occur.
- **Solid Veriff** - Verifiable Credentials and Solid is a project that focuses on the Solid framework with its W3C compliant storage solutions. It is a generic SDK design by which it is possible to achieve verifiable credentials. In this framework, actors can certify and verify the origin of data so that trust is increased and data can be reused with confidence.

All the aforementioned projects have set up high standards and technologies for trustworthy content handling and information exchange, focusing on key aspects of

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the ONTOCHAIN architecture including identities, reputation (of identities, products and services), data protection (e.g. encrypting, governance, secure processing), On-chain metadata handling mechanisms that can be coupled with Off-chain data, the use of Smart Contracts, Decentralised Oracles, Verifiable Credentials and other existing mechanisms.
Their contribution in ONTOCHAIN Open Call 1 led up to the definition of the necessary Blockchain infrastructure that could be used in order to support the operation of the ONTOCHAIN software ecosystem. They have leveraged reliable, widely used and proven open-source technologies in order to further develop the software ecosystem with key necessary ingredients to unlock new applications that rely on processes for trustworthy metadata handling and that will be the cornerstone of ONTOCHAIN Open Call 3.

After a highly selective process where these 17 teams had to highlight the reasons why their work was the best match to help establish the ONTOCHAIN framework as a human-centric, decentralised & trustworthy solution, only 7 third parties could progress to the phase 2 of the Open Call 1. The context was both competitive and collaborative since building an ecosystem is all about co design, synergies and team work.

The teams granted for Phase 2 were: **CopyrightLY, GraphChain, HIBI, KnowledgeX, OntoSsiVault (Gimly ID), POC4COMMERCE and REPUTABLE**. Nonetheless, all projects that have collaborated so far were welcome to stay and collaborate with ONTOCHAIN around the development of the ecosystem.

For phase 2, the selected teams have elaborated on the concept proposed in Phase 1 and prepare design specifications to be implemented in the subsequent Open Call 2, dedicated to "Protocol Suite and Software Ecosystem Foundations".
The main intention to work with a comprehensive, smaller number of third parties was to be able to look into the details of those aspects that are deemed core to the establishment of the ONTOCHAIN ecosystem and in particular to the understanding of the possibility to integrate and provide an added value through collaboration in core design aspects. Furthermore the innovations and demonstrations brought by Phase 2 projects are summarised in the following sections.

Graphchain
For this project, the first key innovation is the real-life implementation of the mechanism that allows for the direct and fast access to graph data from the smart-contract code. The second innovation is the design and implementation of REST APIs for working with
Ontohub. It greatly simplifies the mechanisms for the deployment of various application on top of Ontonodes. The third innovation, albeit of the delivery and QA character, is the use of Gherkin (as a script to Cucumber) and Puppeteer based automation for the tests of the critical web access methods.
This project has deployed 2 applications on Ontochain Github. Ontonode – the core part of Graphchain solution. Ontohub – PoC use case demo of ontology publishing portal backed by graphchain network.
The project has also produced some demonstration use cases:

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1) "Verification of ontology in Ontohub and Ontonodes"
The demo presents Ontohub portal and the use case of uploading and verification of ontology (example of CopyrighLY ontology), verification of ontology in ontonodes and replication between nodes." (https://www.youtube.com/watch?v=gEjrvGkUmMs)

2) "Replication of graphs in Ontonodes"
The demo presents uploading, downloading and modification of graphs (example of graph from CopyrightLy) and replication between Ontonodes"(https://www.youtube.com/watch?v=6VoYWVoKSZ4).

3)"Smart contract in the modified Besu client" :
The demo presents the use case of loading the graph in a smart contract in a modified Besu client (https://www.youtube.com/watch?v=u5AmkI5rmjs).

OntoSsiVault
This project has:
- Developed and published an Open-Source mobile SDK which anyone can use to build a mobile SSI wallet. The mobile SDK supports registering and resolving of DIDs, as well as management of Verifiable Credentials and Verifiable Presentations.
- Developed and published a set of libraries that together enable an authentication flow between an End-User and a Relying Party (RP). End-Users can use Self-Issued OpenID Providers to authenticate themselves and present Verifiable Credentials to a Relying Party. This allows the End-User to interact with the RP directly, without a third party.
- Delivered an interoperable and portable solution. The solution is currently implemented with the ether DID method, but is architected with the ability to easily extend support to additional DID methods and blockchains. Verification of VCs and DIDs using other blockchains is already supported.
- Provided features that are full self-sovereignty and compatible with Open ID Connect. Gimly ID is among the first to implement a DID authentication for SSO with Self-issued OpenID Provider (SIOPv2), allowing for a fully self-sovereign login to be implemented with Open ID providers that are broadly used in industry.

Demo video: https://www.gimly.io/gimly-id/ontochain .
In this demo are shown the two most important functionalities of Gimly ID in the context of the Copyrightly project

HIBI
In the ONTOCHAIN project, HIBI developed two modules - EVERKEY and EVERID. EVERKEY is a protocol for decentralised, non-custodial, eID-based backup- and recovery protocol whereas EVERID lets the user derive a Self-Sovereign Identity-compatible Verifiable Credential from their eIDAS-notified eID. HIBI adds significant identity value to the ONTOCHAIN ecosystem by providing an SSI-compatible Verifiable Credential of the user's ID for all European citizens that have access to an eIDAS notified system. This Verifiable Credential can then be stored in the user's wallet. In case the user loses access to the wallet, EVERKEY can help them recover the wallet by authenticating with the user's national ID.

Demo video: https://www.youtube.com/watch?v=nVNrArlW2yY.

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The video shows the demonstration of the HIBI SDK. This demonstration shows the SDK in a custom ElectronJS User Interface with the use PersoSim – a simulation of a real-world German ID card .

CopyrightLy

CopyrightLY has contributed to a decentralised system for authorship claims, with supporting evidence and a token to help curate the list of claims. The claimed rights can be then used to sustain the minting of licensing NFTs, tied to an unambiguous description of the rights transferred with the NFT and traceable back to the original authorship claim.

Demo video: https://youtu.be/Ky8aowIP3wc

The video is also linked to the page of the CopyrightLY web application. The video presents the project and then showcases it through different scenarios.

REPUTABLE

This project has delivered an effective reputation system for ONTOCHAIN. These includes:

- User-centric reputation modelling and calculation
- Privacy-preserving user engagement
- Provenance-aware verifiable reputation modelling
- End-to-end decentralisation
- Interoperability with other services of the ecosystem

Demo video:
https://www.dropbox.com/s/94kj68kwa8o3wx4/Reputable%20demo.mp4?dl=0

KnowledgeX

This project has implemented an end-user interface that raw data owners (RDOs) and data scientists (DS) can use to interact. RDOs can create a new gig on which a DS can make an offer. RDOs can choose between different DS who would be suited after a pre-selection of KX. The RDO defines data processing agreements that the DS needs to adhere to. These agreements are stored in a smart contract to preserve the integrity of the agreement. The matchmaking algorithm uses an ontology to match data science challenges to skills. An extensive backend that has functions for user management, gig management and execution using iExec has been implemented. The backend is divided in a microservice architecture.

The goal of creating an end-to-end prototype of KX that demonstrates the value added and introduced interesting new concepts for decentralised marketplaces and their usability has been achieved.

Demo video: https://www.youtube.com/watch?v=AyFJw39i9qQ&t=7s

The proposed video shows user interactions.

POC4COMMERCE

The project builds its stack by leveraging building blocks such as the OASIS ontology for agents, the BLONDiE ontology for the Ethereum blockchain, and the GoodRelations ontology for commercial offerings. The stack rests on the OC-Found ontology modelling ONTOCHAIN participants and actors, then continues with the OC-Commerce ontology modelling commercial offers, products and services, and

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culminates with the OC-Ethereum ontology modelling the Ethereum blockchain, smart contracts and digital tokens exchanged for commercial purposes.
POC4COMMERCE also delivers effective tools to access the rich and diverse knowledge base that the ontological stack makes available. The main tool is the OC-Commerce Search Engine (OC-CSE) to profitably find goods, products, information, and services published in the ONTOCHAIN digital market. OC-CSE exposes an API and hence may be profitably called by any software agent in the ONTOCHAIN ecosystem. The engine is constructed by means of a combination of Semantic Web tools, reasoning services, and SPARQL queries.
POC4COMMERCE exploits the knowledge representation and reasoning capabilities of web ontologies to practically realise the semantic core of ONTOCHAIN and how the ONTOCHAIN ecosystem shapes up in the eCommerce vertical domain.

Demo video: https://www.youtube.com/watch?v=MuY3slZwN4A.

1.2.2 Open Call 2 activities engaged so far

The Open Call 2 objective was to implement an infrastructure that will host ONTOCHAIN's trustworthy data, metadata and services, and specific software solutions that can be used widely, further extending the use cases and the architectural features delivered by the Open Call 1 selected teams.

It was distributed around to types of projects

- The short terms projects lasting for 5 months,
- The long terms projects lasting for 10 months,

It was launched on the 15th of July 2021. 76 projects applied to contribute to the implementation of an infrastructure that will host ONTOCHAIN's trustworthy data, metadata and services, and specific software solutions based on the specifications provided by Open Call 1 projects. Selection and negotiations were successfully completed with 13 projects i.e. 7 short term ones and 6 long term ones.

More specifically, the 13 third parties innovators have been enrolled to implement their projects for 1 of the 6 following topics:

- Decentralised oracles for ONTOCHAIN,
- Market mechanisms for ONTOCHAIN,
- ONTOCHAIN interoperability and APIs gateways,
- ONTOCHAIN network design and scalability,
- Semantic based marketplaces for ONTOCHAIN,
- Data provenance in ONTOCHAIN.

Proposals can be also submitted under "Other" topic, as long as it was serving as a building block of the ONTOCHAIN infrastructure and the overall ONTOCHAIN vision and objectives i.e. "Develop scalable blockchain, decentralised reputation systems

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and semantic web technologies, in order to achieve trustworthy content handling and information exchange as well as trustworthy service exchange in the next generation Internet/social networks for vital sectors of the European economy".

The selected sub projects are briefly described hereafter per third parties innovators. For more details please follow the link: Selected Projects | ONTOCHAIN (ngi.eu) .

ADOS: AirTrace Decentralized Oracle System
The aim of ADOS is to apply blockchain technologies to IoT (Internet of Things) systems, as current IoT systems can be lacking in certain key network aspects such as scalability, security, resource consumption and trustworthiness. This project can be a use case in any IoT application for example monitoring of soil contents in smart farms or distributed warther stations.

BOWLER: Blockchain-Oriented Warehouse & Low-Code Engine and Reasoner
The aim of BOWLER is to make a low-code, end-to-end, web-based IDE that will enable those which are not very familiar with Smart Contracts to learn how to program dApps. The main goal of this project is to make it easier for new programmers to start developing for blockchain technologies. An example of this project's use case would be to make a web-based PyCharm, but for Smart Contracts.

CARECHAIN: Supporting CARE through micro insurances using blockCHAIN
The aim of CARECHAIN is to make a platform for issuing microinsurances and compensation if conditions are met using Smart Contracts. Smart Contracts are encrypted and public, so no one can deny partaking in the process. CARECHAIN intends to build a platform and environment for executing smart contracts if all conditions are met, for example: policies for farmers based on damage a particular type of crop is likely to suffer under specific conditions, e.g. 100 mph winds; when those are met, the farmer receives compensation without the need for human inspectors. Without inspectors evaluating damages, claims can be quickly settled, allowing claimants rapid access to funds to keep businesses running.

DESMO-LD: Decentralized Smart Oracles for Trusted Linked Data
The aim of DESMO-LD is to design and implement a trustfun Oracle prototype and provide the necessary data for its operation. It uses Smart Contracts to gather off-chain data through oracles. It can be used to collect data from for example IoT devices and gather them in one place.

OriginTrail DKG: Decentralised and Scalable Knowledge Graph supporting ONTOCHAIN
The goal of OriginTrail DKG is to implement a rounded approach adding to ONTOCHAIN's distributed storage, core protocols and application protocols stack to facilitate transition from a broken data economy to a trusted, semantic, human-centric and privacy-by-design adopting knowledge economy. With this approach, OriginTrail DKG aims to vastly improve ways data and knowledge are being exchanged in a trustworthy, privacy-preserving and inclusive way in vital sectors such as supply chains, eScience, eCommerce, eInfrastructure and eEducation.

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GEONTOLOGY
The aim of GEONTOLOGY is to make a geo-aware protocol for enabling cross-border operations and data exchange in a digital economy. Its main goal is to provide geolocation data to any transaction using smart contracts. It uses an innovative protocol called Proof of Offset which enables nodes to find out the country of origin of the contract which will in theory make scams harder. The use case can be any form of purchase using the blockchain.

MFSSIA: Multi-Factor Self-Sovereign Identity Authentication
The aim of MFSSIA is to create a multi-factor authentication service via blockchain. Blockchain is used to store authentication related data. The use case would be the same as oAuth is now, but for Web3.

NFTWATCH
The aim of NFTWATCH is to collect and aggregate information about NTF's and its marketplaces. It can be used to analyse either on or off-chain data. The use case would be to study the NFT trends.

ONTOSPACE: a stable, scalable, efficient and cost-effective network for ONTOCHAIN
The aim of ONTOSPACE is to expand on GraphChain's project to enable networks to emerge. It will provide all necessary building blocks to make the deployment of the ecosystem as easy as possible with graph databases. Ontospace can be used to develop applications using Ontologies or Knowledge graphs and Smart Contracts.

Perun-X: Efficient Cross-Chain Infrastructure for ONTOCHAIN
The aim of Perun-X is to create a framework for transactions between different blockchains that can be performed at minimal cost. It can also be used to execute code on a specific channel, leading to potentially cross-chain contracts. A use case would be any kind of cross-platform application or exchange.

PiSwap: Price-Building-Mechanism for asymmetric NFT-markets
The aim of PiSwap is to solve the current problem of NFT markets with enabling crowdsended markets (independence of primary and secondary markets), building decentralised price (enabling margin trading-short/long, mechanism to determine price) and providing automated liquidity (similar to UniSwap). A use case would be buying or selling an NFT on PiSwap.

PRINGO - Private Incentives for Common Goods
The aim of PRINGO is to make a mechanism for funding charitable causes via blockchain. It provides a direct link from common goods to companies/charities. A use case would be someone scanning a tree to be used in a video game via NFTs.

PS-SDA: Provenance services with Smart Data Agreements
The aim of PS-SDA is to make a platform for human-centric data management. It enables data to be encrypted on the chain and not accessed by everyone. It follows GDPR. A use case would be a company storing its employee's user data.

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1.3 AN UMBRELLA USE CASE FOR ONTOCHAIN: "THE TRUSTWORTHY SEMANTIC MARKETPLACE"

The first use case that may serve as an umbrella use case for the project has been named "The Trustworthy Semantic Marketplace".

Blockchains, being shared databases of cryptocurrency transactions, are all about trust, transparency and traceability when trading. Hence, it makes great deal of sense to think of using trustworthy metadata in the context of trading any kind of real or digital assets. In a way, the Trustworthy Marketplace is the ultimate place of testing the utility of ONTOCHAIN's infrastructure and software ecosystem.

Several **Open Call 1 and Open Call 2** projects may rely on semantic descriptions and annotations of different entities, such as people (e.g. in the context of the KnowledgeX project), products (e.g. agricultural products of the case of the POC4COMMERCE project), data (e.g. the Copyrightly project) and internet services (e.g. in the context of the TENACIOUS project). Several existing projects from the two first open calls address the issue of off-chain data management, Decentralised Oracle Network (e.g. DART, ADOS, Desmo-LD). NFTs and their marketplace and generally the semantic marketplace are key building blocks of ONTOCHAIN. Trust, identities (e.g. Decentralised Identities, Verifiable Credentials), verifiability of the provided information (e.g. application-level proofs, Proofs of Presence, Proofs of Contribution, Proofs of Ownership, Proofs of Location, various Zero Knowledge Proofs etc.), and reputation matter a lot in the context of trading. When one goes to a marketplace, it is necessary to check out the quality, which can be established by both on-chain and off-chain metadata management means and consensus mechanisms. In addition to this, it may be necessary to verify and/or certify the properties of either the entities that participate in the trading system, or the processes that govern the trading of those items (e.g. real-world items or data) marketplace, including any contextual information such as geolocation, precise time, environmental conditions and similar.

Within blockchains and their consensus mechanisms, an ontology of a traded entity can easily be agreed and even recorded (or its hashtag) on a blockchain. Following this, various instance data can be included (off-chain or on-chain, encrypted or public, verifiable/non-verifiable, identity, digital signature) that relate to either the actual ownership, versioning, manipulation, trading, part-tracking and any other aspect of the traded entity. Semantic information can be gradually updated from by the various actors in the marketplace that can engage in different interactions. In addition to this, temporal and geospatial information could be included and can be always verified by using on-chain methods.

The other side of the market is that of its users, with the products and services they provide or consume. The users may all come with their public or private data, identities and verifiable credentials. They may be engaged in various interactions, such as storing their own data for their personal use, giving access to their data to external entities, providing Verifiable Credentials to other users, using sensor data and AI methods for further annotations of the traded entities and similar. Such data can

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be linked to time, geospatial, identity and versioning information whenever it is generated, and can further be used to establish trustworthiness and fine-grained choices in the trading process.

Each interaction of two users (such as a provider and a consumer) can be accompanied with various proofs of such interactions, such as proof of buying the apple for which the quality is being assessed on social media, or proof of being present in a room when something really interesting happened, proof of using an apartment for which the user can perform rating at the end of the rental period and similar.

Moreover, tokens are popular trading mechanisms that can be associated with different market concepts, and can be used in the trading system to achieve win-win situations among their users, and move assets from one blockchain to another, while relying on the semantics of such transactions. Mechanisms to achieve actual value sharing, be it information or actual real-world assets are currently embedded in various blockchains and should be possible to use along with semantic blockchain-based information.

ONTOCHAIN provides some essential components to build trustworthy applications, including blockchain-based metadata management, be it by using decentralised knowledge graphs, semantic enhanced blockchain-virtual machines, and similar techniques.

1.4 HOW WOULD THE ONTOCHAIN ECOSYSTEM BE USED?

The idea behind the ONTOCHAIN Ecosystem is to focus on the needs of software companies that develop various smart applications and wish to include trusted knowledge management mechanisms in the operation of their applications. The main benefits of such smart application would be the added value of semantic blockchain metadata management mechanisms that can be used as essential trust-building measures.

In the context of ONTOCHAIN Open Call 1, the design specifications of the Ecosystem have been delivered so that to ONTOCHAIN Open Call 2 selected projects to implement them in a coherent infrastructure including trading mechanisms that can be exploited by the use case proposers of the ONTOCHAIN Open Call 3.

Hence, it is expected that applicants in the ONTOCHAIN Open Call 3 will develop interoperable and sustainable applications that employ both Semantic Web and Blockchain concepts to enhance data quality aspects (high-level semantics, completeness, data uniqueness, timeliness, validity, integrity, privacy, consistency, assets trading and monetization, tokenomics principles, the use of application-level proofs and decentralised digital identities etc.) and the trustworthiness of data communication and handling processes. Applications should be able to build on top of software services of the ONTOCHAIN ecosystem, and should cover real needs of end users from various vertical domains/vital sectors of the European economy.

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2 ONTOCHAIN OPEN CALL 3

2.1 SCOPE

The overall goal of the ONTOCHAIN project is to generate an ecosystem of blockchain-based solutions, processes, and business models with strong market potential in the area of trusted blockchain-based data, metadata, ontology, knowledge and information management in order to achieve trustworthy content handling and information exchange as well as trustworthy service exchange in the Next Generation Internet and for vital sectors of the European economy.

The **specific objectives of the ONTOCHAIN Open Call 3** are two folds:

Objective A- To complete the missing blocks of the ONTOCHAIN infrastructure in particular those related to:

- Service Integration (Gateways APIs) for ONTOCHAIN applications,
- Semantic Matching and Reasoning,
- Energy-efficient and sustainable hosting infrastructure for the ONTOCHAIN software ecosystem and services.

Objective B- To exploit the ONTOCHAIN infrastructure designed and implemented respectively through ONTOCHAIN OC1 and ONTOCHAIN OC2 for real life use cases that cover real need of individuals in terms of trustworthy data/services exchange and trustworthy content handling from various vertical domains/vital sectors of the European economy. Applications domains that should be considered by applicants of the OC3 are provided hereafter. These are examples but are not limited to, as long as it serves the overall ONTOCHAIN vision and objectives:
"Develop scalable blockchain, decentralized reputation systems and semantic web technologies, in order to achieve trustworthy content handling and information exchange as well as trustworthy service exchange in the next generation Internet/social networks for vital sectors of the European economy".

The topics for Objective A and B are further elaborated in the next section. Applicants should clearly specify the objective of the Open call 3 they are going to address as well as the specific topic.

2.2 Objectives and topics to be addressed in Open Call 3

Whatever the objective A or B, each table hereafter, elaborates on the definition, the challenges, the requirements, the context and the expected outcomes to be addressed.

Essentially, it should be realised by all proposers that ONTOCHAIN involves the use of data/metadata/semantic metadata expressed in Semantic Web languages and

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formats, and the use of specially designed blockchain-bases services that help achieve high quality of the communicated and handled semantic data.

All Applicants within their project proposals must be accurate in explaining the type of data quality properties that will be achieved, including, but not limited to the focus on high-level semantics, completeness, data uniqueness, timeliness, validity, accuracy, consistency, integrity, anonymity and other aspects. ONTOCHAIN fosters the use of advanced cryptographic and other methods and solutions of achieving such properties, and the proposers should be clear in how exactly various application-level proofs, Decentralised Identities (DIDs), Verifiable Credentials (VCs), tokens and similar can be used in order to achieve the intended data quality properties.

Proposed applications will be assessed on the basis of their replicative value in various ecosystems concerned.

The value of the proposed applications and services must be made clear through a credible business model that may involve the use of tokenomics principles (e.g. an ONTOCHAIN coin and various SFT and/or NFT minting services).

All proposers should organise their information as focused as possible, explaining at least the following aspects of their projects: overall description of the application; potential customers and markets; methods and approaches for customer engagement; a monetization approach potentially benefiting from an ONTOCHAIN-based coin and NFT minting services; description of detailed use cases scenarios; description of the ontologies and the semantic content used and and semantic content handling solutions employed by the proposed application; resolution of the ownership (including preferably open source licensing approach for the results); positioning on the market against existing similar solutions/services; clear description of the obtained benefits when using the existing portfolio of ONTOCHAIN solutions, exactly which solutions and how would be used; data quality properties that will be achieved by the application solution; ONTOCHAIN's 3rd party solutions that are particularly relevant and will be used in the development part; time to market of the proposed solution/application.

All topics for the objectives A and B are summarised in the following table. Any specific topic is detailed in the following paragraphs.

Topic id	Topic description
A1	Service Integration (Gateways APIs) for ONTOCHAIN applications
A2	Semantic Matching and Reasoning
A3	Energy-efficient and sustainable hosting infrastructure for the ONTOCHAIN software ecosystem and services
B1	Semantic Digital Logbooks for Companies, Buildings, Cars or similar

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Topic id	Topic description
B2	Decentralised Fact Checking and Data Credibility for Social Content
B3	Decentralised Online Semantic Social Networks
B4	Semantic energy data management
B5	Smart City Applications Relying on Trustworthy Semantic Metadata
B6	Automotive, e.g., electric vehicle charging, road side management, car insurance, communication interoperability
B7	Distribution Logistics / Supply Chains Using Trustworthy Semantic Data
B8	Data/Digital content /Multimedia marketplace, including social media
B9	Semantics-based DAO
B10	Decentralised Public Services & Common Goods
B11	Remote Presence/Working and Metaverse
B12	Any other application in synergy with ONTOCHAIN objectives

2.2.1 Objective A- ONTOCHAIN infrastructure complementary blocks

TOPIC A1

Title	Service Integration (Gateways APIs) for ONTOCHAIN applications
Definition	For this topic, the goal is to produce a service/application catalogue and expose its functionality internally and externally to facilitate software integration. The ONTOCHAIN network will embrace several applications and business cases; thus this topic must ensure that they will integrate smoothly together with the outside world. Of interest is also the accessibility of outside services within ONTOCHAIN, and of ONTOCHAIN services to the outside world. Interoperability whether or not cross chain but especially semantically and syntactically is thus a key aspect of this topic. The solution to be developed will have to be trustworthy, privacy-preserving, secure, transparent, democratic and consider traceability to manage access and operations over ontologies, metadata, data, knowledge and information for the ONTOCHAIN ecosystem.
Challenges	The challenge will be to provide a unified entry point to all ONTOCHAIN services and applications while retaining critical

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	properties such as trust, consistency and security of data and services which are all paramount to mass adoption. The proposed solution must ensure that semantic information, trust, identities and privacy are preserved while maintaining the highest possible level of security. On-chain and off-chain ontology management will have to take into account the trade-offs between the cost and benefits of storing metadata on-chain versus the cost and benefits of storing metadata off-chain. The challenge will also be to design solutions for integration of databases and knowledge bases with blockchain protocols, thus providing specific trustworthy properties to databases and at the same time high-quality of service in the operation of the knowledge management systems.
Requirements	The Gateway APIs and integrated services will have to use standard technology for full stack development and the results will have to be open source. The proposed solution will have to implement the APIs defined in ONTOCHAIN deliverable D3.4-Framework-specification.pdf (ngi.eu) (for account management, services discovery, etc.) and support all ONTOCHAIN Open Call 1 and Open Call 2 services and APIs, as defined in their individual deliverables. Concretely, this involves integrating all OC1 and OC2 projects in the service catalogue and providing their endpoint to client applications. The GUI frontend and the service catalogue will have to support all exploitable results from OC1 and OC2 projects (Complete list at Selected Projects | ONTOCHAIN (ngi.eu)) Ontologies for resource models, reputation models, Trustworthy information and knowledge management operations for content, services, clusters, hierarchies or similar will have to be seriously considered as well as the two following aspects: o Management of ontologies' operations (CRUD) through blockchain smart contracts o Validation of the correctness of ontology data instance via blockchain
Context	Proposals should position the proposed solution on a landscape of existing services and platforms in particular all exploitable results from ONTOCHAIN OC1 and ONTOCHAIN OC2 projects (Complete list at Selected Projects | ONTOCHAIN (ngi.eu))
Expected outcomes	The proposed solution will become the main point of entry to the ONTOCHAIN platform both for end-users and for programs. It will be the ONTOCHAIN interface to be used by new users to create an account, to access ONTOCHAIN stores, to navigate the ONTOCHAIN available services and use the ones of interest. In addition, APIs will be the default way for external applications to discover ONTOCHAIN services and start using them programmatically. In particular, it is expected: o New connectors between blockchains (e.g. Ethereum Smart Contracts) and production databases and ontological knowledge;

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	o Scalable API endpoint for connecting clients to ONTOCHAIN applications and services; o Decentralized storage medium for ontologies in OWL and similar standard formats; o Free software libraries for interconnecting existing ontological systems with ONTOCHAIN and associated; o Modern security protocols and standards to provide the highest level of security to the users. Specific use cases are expected to be as follow: User account creation, developer/service provider account creation, listing of new service/application, along with metadata, display of registered services/applications in the catalogue, like a app store, search engine for services/applications that match specific criteria from a GUI, search engine for services/applications that match specific criteria from an API, filtering of results through GUI and APIs, access to services endpoints directly from the APIs, so that programs can query the catalogue and use results programmatically, admin interface to manage user accounts, developer accounts, applications and services.

TOPIC A2

Title	Semantic Matching and Reasoning
Definition	Schema matching is a critical step in many applications, such as XML message mapping, data warehouse loading, and schema integration. For this topic, the goal is to develop a marketplace where ONTOCHAIN users can buy or sell any goods or services that can be described with an ontological representation. The resulting software will provide services for publishing ontology-based descriptions of goods and services, creating and publishing market orders, searching through the orders based and complex criteria and matching sell and buy orders. Ontology matching is a solution to the semantic heterogeneity problem. In this topic, ontology matching is a requirement for finding compatible offer and demand (buy and sell orders) in semantic-based marketplaces. To guarantee the fairness of the transactions in the marketplace, the matching process should be fair to every party, e.g. preventing exclusion, censorship, price manipulation and fraud. The goal of this topic is to design and implement prototypes that will provide ontologies management and setup for decentralized semantic matching of demand and supply for different use case scenarios (e.g., apartments, land, cars, etc.). e.g., Pellet atop blockchain, schema matching/mapping, etc.
Challenges	The challenge is to develop a component that offers services similar to existing virtual marketplaces but for arbitrary goods/services, and ensuring the highest level of trust and fairness. The marketplace logic (including the propagation and the matching of market orders)

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	must thus be as decentralized as possible, while offering high performance and low response time. The solution should leverage ONTOCHAIN services introduced in Open Call 1 for increasing trust between users (e.g., identity, reputation) and be open to all of the present and future ONTOCHAIN stakeholders. In addition to decentralization, particular care must be given to avoiding any censorship, market manipulation (e.g., by hiding, erasing or forging orders or ontological descriptions) and spam attacks. The semantic matching component must guarantee that every offer has been considered, that the returned service/good is always the most appropriate for the user, and that it satisfies every expressed requirement.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It should address as much as possible the challenges and the following requirements: o Support different ambitious use-case scenarios (e.g., apartment rental, car sale, freelancing) based on metadata and semantic constraints (e.g., apartment size and location, etc.). o Rely on existing ONTOCHAIN components to provide new services like ontology description, evaluation, integration, etc. o Find the best trade-off for decentralized ontology matching for achieving higher throughput in large ontologies while maximizing trust and fairness. o Provide incorporation of Property Graphs (PGs)/ Labelled Property Graphs (LPGs) as an alternative data model for using semantics, this should include (but not limited to) the mechanism for encoding Ontologies using LPG data model, mechanism for reference to OWL Ontologies and the mechanism for reasoning over LPGs.
Context	Proposals should position the proposed solution on a landscape of existing services and platforms. Specific context for the action is provided by the following services, however, other contexts may apply: S- Match: an algorithm and an implementation of semantic matching. This algorithm is therefore that of developing a platform for semantic matching, namely a highly modular system where single components can be plugged, unplugged or suitably customized In this approach the strongest semantic relations between concepts of nodes. o OAEI: The main goal of OAEI is to support the comparison of the systems and algorithms on the same basis and to allow anyone to draw conclusions about the best matching strategies. o COMA : is a schema and ontology matching tool. In their last version they enable workflow management and additional features like ontology merging. Furthermore, it offers a comprehensive infrastructure to solve large real-world match problems. The graphical interface offers a variety of interactions, allowing the user to influence the match process in many ways.

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Expected outcomes	The expected outcomes are an API, a SDK and a GUI for interacting with the marketplace that implement the following functions: o Uploading ontological descriptions of goods and services. o Publishing and propagation orders. o Matching ontological market orders. o Sealing deals permanently in a smart contract on the underlying blockchain. All the functions must be accessible to end users and applications through all three interfaces This open-source software outcome can be used mainly as a design of a potential front-end to the ONTOCHAIN infrastructure and services. It can be used to showcase the potential of the new trustworthy knowledge management services provided by ONTOCHAIN. Specific use cases are expected to be as follows: Ontology engineering, Information integration, Linked data, Peer-to-peer information sharing, Web service composition, Autonomous communication systems, Navigation and query answering on the web Mapping between schema elements. Semantic relations by analyzing the meaning, Resource discovery, Data integration and migration, Query translation, Agent communication, Schema and ontology merging, Representation of graphs and text data, AI (Natural Language Processing), Computer Vision.

TOPIC A3

Title	Energy-efficient and sustainable hosting infrastructure for the ONTOCHAIN software ecosystem and services
Definition	The intention of ONTOCHAIN is to produce a portfolio of software results that can be used to exemplify key technologies and solutions for trustworthy, decentralised knowledge management.
Challenges	The ONTOCHAIN project has witnessed several approaches to building an energy efficient, elastic and sustainable infrastructure that would be particularly suited to the ONTOCHAIN services and applications.
Requirements	The key requirements here are to build an infrastructure consisting of a minimum of 3 blockchain nodes that will be used to host the ONTOCHAIN services and applications.

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	Calculations of energy-efficiency, sustainability, cost-benefit and other aspects will have to be performed. Security analysis of the chosen configuration and consensus protocols is also necessary to be performed. Results of this work are also scalability and other stress tests to highlight key Quality of Service parameters of the newly designed network.
Context	The ONTOCHAIN project currently features 30 projects and around 14 new projects and applications are supposed to enter the project in the 3rd project year.
Expected outcomes	Energy efficient and scalable, appropriately configured ONTOCHAIN Network (running infrastructure) with a minimum of 3 nodes that fits the needs of the ONTOCHAIN software ecosystem and its applications. Energy-efficiency and Quality of Service testing results that are appropriate for the needs of the project. A Memorandum of Understanding allowing the participation of various entities in the ecosystem.

2.2.2 Objective B-Provision of ONTOCHAIN applications that cover real need in terms of trustworthy data/services exchange and trustworthy content handling for various vertical domains/vital sectors of the European economy

TOPIC B1

Title	Semantic Digital Logbooks for Companies, Buildings, Cars or similar
Definition	In modern society a variety of products and services are centred on specific valuable entities, such as companies, buildings or cars. The trustworthiness of products and services that are involved in the process of interacting with such entities is of immense importance. Moreover, the immutability of the data, and the use of various application-level proofs can greatly contribute to knowledge sharing along the overall lifecycle of these entities.
Challenges	The challenges here are to propose and implement a solution that is capable of integrating information from various actors, being product and service providers, along with their necessary credentials.

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	The use of such information in the overall process can greatly enhance the assessment of such entities (e.g. companies from the viewpoint of their credibility on the market, the energy-efficiency and sustainability of buildings, or the overall car markets, starting from their production, usage, servicing and 2nd hand markets trading). Using various credentials in the overall process can greatly enhance the trustworthiness of these entities and the interactions on the real-world market.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will provide a full-fledged solution that covers a specific part (e.g. usage) of the lifecycle of such entities. E.g. companies with blockchain-based digital identities could accumulate various certificates and credentials, so that their information can be made transparent in market interactions (e.g. concept of Self-Sovereign Identity of companies). Proposers should go well-beyond existing developments such as those of the European Blockchain Services Infrastructure (and their associated use cases).
Expected outcomes	An attractive Technologies Readiness Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected.

TOPIC B2

Title	Decentralised Fact Checking and Data Credibility for Social Content
Definition	Social media platforms provide citizens with virtual spaces where they can share information, express themselves and organize social and democratic actions. However, the control of the largest platforms by a handful of companies creates an imbalance of power that is harmful to users: unverified/fake information, censorship, violence/bullying and scams are regulated behind closed doors, with little to no possible appeal. In addition, all of the value created by social media platforms is kept by their providers, which creates an ecosystem in which there is little to no reward for good contributions, and where the exploitation of private information is the norm. Creating fair and sustainable social networks and social media platforms thus requires novel software tools and novel business models. DLTs and Decentralized Autonomous Organizations can support new governance structures for social platforms by placing information verification, moderation and censorship through a democratic process. Cryptographic tokens can help create a virtuous business model which rewards users and contributors fairly and discourages abuses.

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Challenges	The challenges here are to propose and implement a solution that: o Is both technically strong and appealing to users, in order to compete with mainstream social media platforms, o Demonstrates good potential for business without compromising with social welfare and decentralization of power, o Supports some form of identity verification without breaking anonymity, which is paramount to true free speech.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Oracle system (e.g Dart, Ados), o Reputation mechanisms (e.g REPUTABLE), o Identity management and verifiable credentials (e.g OntoSSIVault, HiBi), o Decentralised social management tool (e.g CopyrightLY). o Data provenance (e.g., PS-SDA, ONTOROPA).
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. It can be an entirely new decentralized social media platform or a new tool which can be used on top of existing platforms (e.g. a decentralized fact checking plugin for Twitter). Here are some potential examples: Copyright management on social media platforms, Platform neutrality, DAO for collective intelligence and democracy, Collective content verification and fact checking, Trust networks, Privacy-preserving account verification

TOPIC B3

Title	Decentralized Online Semantic Social Networks
Definition	Distrust in the Internet is causing people to change the way they behave online, for example by disclosing less personal information. Users also express an increasing level of distrust of social media platforms. A decentralized semantic social network concerns an application where social profiles are stored in a decentralized manner, storage is secure and privacy-aware, and semantic content is highly available. The idea is that users have similar Quality of Experience (QoE) with centralized social network solutions, but even better/more services than those available therein. e.g., a trusted services exchange environment can be activated on top of this

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	decentralized social network. The business viability of the solution has to be clearly described.
Challenges	The challenges here are to propose and implement a solution that: o Is both technically strong and appealing to users, in order to compete with mainstream social network platforms, o Maintains high content availability and discoverability, o Provides high data privacy guarantees for the end users, o Does not involve any centralised governance, o Enables trustworthy social interactions online.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Decentralised reputation management (REPUTABLE), oDecentralised metadata management (GRAPHCHAIN, ONTOSPACE, OriginTrail DKG), o Data provenance (e.g., PS-SDA, ONTOROPA), o Data ontologies (POC4COMMERCE), o data ownership watermarking approaches (DW-marking), o decentralised identity management (OntoSSIVault), o decentralised data oracles (DART, ADOS, DESMO-LD).
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. It should be an entirely new decentralised online social network platform, alternative and competitive to existing ones.

TOPIC B4

Title	Semantic energy data management
Definition	Resources conservation, climate protection and cost savings are today the cornerstone of climate protection efforts, while allowing users to have permanent access to the energy they need. Renewable energy resources are currently being deployed on a large scale to meet the requirements of increased energy demand, mitigate the environmental pollutants, and achieve socio-economic benefits for sustainable development. In this context, efficient semantic energy data management is thus crucial. It includes the use of semantic data in the planning and operation of energy production and energy

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	consumption units as well as energy distribution and storage. The microgrid concept that is a self-sustained system consisting of distributed energy resources becomes more and more popular and applications in microgrids are considered more and more common having the goal to minimise the cost of energy taken from the final customer. A number of actors are so enabled to be procurers of green energy themselves, putting into the grid the extra productions from renewable sources that they don't use. If relevant, microgrid applications nonetheless need a semantic energy data management system for an optimal use of these distributed energy resources in intelligent, secure, reliable, and coordinated ways. This management system to operate in a trustworthy manner should incorporate features like Identity management, grid control, data interoperability, service accounting. Additional features could be also the control over the sustainability of the energy itself, checking the source of provenance (renewable vs. fossil ones).
Challenges	The challenges here are to proposed and implement a solution for distributed semantic energy data management that : o can be secure, trustworthy and reliable with what concern energy production versus energy consumption, and overall energy efficiency management actions, o enable the rewarding of final customer when contributing to the efficiency of the system and trade surplus of resources with other members of the grid, o can control over the sustainability of the energy itself, checking the source of provenance (renewable vs. fossil ones) as well as that can control greenhouse gas emissions while unlocking compensatory mechanisms for inappropriate behaviours.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : oSemantic distributed oracles (e.g. projects ADOS, DESMO), oReputation mechanisms (e.g REPUTABLE), entity management and verifiable credentials (e.g OntoSSIVault, HiBi), oMarket support, energy transaction support (e.g. POC4COMMERCE), o Tokenomics (e.g. NFTSwap, PRINGO),
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. The proposed application should be oriented around e.g. smart grids, microgrids, energy trading, green energy management, energy waste reduction.

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TOPIC B5

Title	Smart City Applications relying on Trustworthy Semantic Metadata
Definition	Smart cities are places where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and business. They go beyond the use of digital technologies for better resource use and less emissions. It means smarter urban transport networks, upgraded water supply and waste disposal facilities and more efficient ways to light and heat buildings. It also means a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population. In this landscape, blockchain applications have the power to coordinate, integrate and control different city services with transparency, efficiency and privacy thanks to their features for identity management, service accounting, system control and analysis, payment system, privacy management, tokenomics.
Challenges	The challenges here are to proposed and implement a solution for smart cities semantic data management that can for example: o Control and act for the reduction of greenhouse emissions in the city to lessen the climate change, or o Facilitate more efficient use of resources and the circular economy in the city, or o Improve traffic safety and overall mobility services in the city, from the city and to the city (cross cities/countries care sharing or other transport means sharing), or o Improve public and the waste collection service, or o Enhance participation and guarantee the security, reliability, transparency and anonymity of public consultations, such as elections, surveys, referendums, or o etc.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Semantic distributed oracles (e.g. projects ADOS, DESMO), o Reputation mechanisms (e.g REPUTABLE), o Identity management and verifiable credentials (e.g OntoSSIVault, HiBi), o Market support, (e.g. POC4COMMERCE), o Tokenomics (e.g. NFTSwap, PRINGO),
Expected outcomes	Urban areas drive economic development and deliver many public services, such as education, healthcare and transportation; but they are also associated with environmental degradation, congestion,

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	economic and social exclusion. In this context, an attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. The proposed application is expected to contribute to the resource efficiency or the energy efficiency or the green mobility or the mobility security or the control and reduction of air pollution or the overcrowding limitation (e.g. adaptive traffic control system) or participatory urban planning etc.

TOPIC B6

Title	Automotive, e.g., electric vehicle charging, road side management, car insurance, communication interoperability
Definition	The automotive industry has always been at the forefront of technical innovation, with automakers constantly looking for new ways to utilize cutting-edge technologies to their advantage. And blockchain has the potential to bring significant benefits to this industry. Electric and autonomous vehicles are two emerging trends promising to transform the automotive industry and transportation. In combination with other technologies such as the Internet-of-Things, machine learning and big data, the blockchain in automotive can enable development of: o Solutions that help owners of electric cars to more easily charge their vehicles; o Blockchain mechanism for hiring smart autonomous vehicles o efficient ways for autonomous vehicles to collect, store, organize and share data, which, in turn, will help them learn how to better navigate any environment; o Platforms for tracking and managing global or localized fleets of self-driving vehicles and more. In general, a part from the specific use case of EV and autonomous vehicles, the blockchain technology can also help develop other solutions for this sector as : o For ensuring trustworthy, legal and ethical sourcing of raw materials to ensure that every step of the supply chain is documented and the resulting documentation is securely stored, forgery-proof and readily available for inspection. o Digital passports for vehicles for ensuring trustworthy, legal resale of a used car or sharing relevant information about a vehicle with third parties, for example, insurance companies that need to avoid frauds. o New type of ride/car-sharing services that run on a peer-to-peer network without the need for a central authority e.g management of car sharing among the members of an organization or a community.

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Challenges	The automotive sector brings together different stakeholders that have different goals and interests. For example, for EV, these include EV AGGregator (EVAGG), which is needed to aggregate the batteries of EVs and represent their users in the energy market (e.g., EVAGG will operate as a middleman between users and grid operators) and others such as Transmission System Operator (TSO), Distribution Network Operator (DNO), Data Communications Company (DCC) and suppliers. Some of these stakeholders may take actions that are incompatible with the interest of the other entities in order to maximize their own profits. Moreover, despites some benefits the new era of the automotive industry can also have drawbacks for example: allowing individuals to charge their EV in an unregulated manner might affect the grid. The peak load may dramatically increase, requiring more generating capacity as well as transmission and distribution network modification. The gap between base and peak load might become larger, resulting in inefficient use of available generating capacity. Moreover, balancing the grid (e.g., matching supply with the demand), will be more challenging, requiring more spinning reserve. The proposed solution will have to tackle these challenges by for e.g. o Embedding mechanisms that can prevent or minimize the chances of any unfair play by any of the stakeholders, as well as provide proper security against any threats or attacks made by third parties. o Rethinking some infrastructures to reach the full potential of EV and autonomous vehicles
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Decentralized Oracle Network (e.g Dart, Ados, Desmo-LD) o Reputation mechanisms (e.g REPUTABLE) o Identity management and verifiable credentials (e.g OntoSSIVault, HiBi) o Multi Factor Self Sovereign Authentication (e.g MFSSIA). Support different ambitious use-case scenarios.
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. Examples are many: EV charging system enabling grid balance, vehicle tracking system, decentralized ride hailing, convenient city transportation, decentralized manned deliveries, autonomous drone deliveries, autonomous carriers, autonomous ride/care sharing, using Blockchain's decentralized ledger driverless cars to have access to key traffic data almost instantly and more precisely, using Blockchain Smart Contracts to simplify many aspects of driving such as paying for car insurance, repairs, and tolls, offering Blockchain solution that allows autonomous cars to connect to their surrounding environment, solution that provides better vehicle tracking and

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	communication to improve overall connectivity, improving transactions that happen on a regular basis between vehicles and the infrastructure around them, using token (e.g., ONTOCHAIN token) to pay for data (weather forecasts, gas prices nearby, congestion data and so on) that requires from other cars, vehicles might potentially earn tokens by simply giving or selling their data to advertising or manufacturers. Solution should provide like this strategy within Blockchain technology to establish a V2V closed ecosystem that encourages and rewards participants simultaneously. Vehicle to infrastructure (V2I), a Blockchain based solution can significantly improve many aspects of driving such as car maintenance, tolls, insurance. Drivers might automate their insurance to be paid based on usage rather than paying yearly insurance rates that can change due to unknown variables. Ride-sharing is another intriguing use of blockchain-based microservices for vehicles.

TOPIC B7

Title	Distribution Logistics / Supply Chains Using Trustworthy Semantic Data
Definition	Distribution logistics, also known as sales logistics, deals with the planning, realisation and control of the movement of goods. It also includes the inventory stock management, the production planning forecasting and the cost control of the supply chain. Depending on the product, the supply chain can include many phases, multiple geographic locations, several accounts and payments, several individuals, entities, and means of transport. Blockchain has many potential advantages in this industry. It enables companies to increase efficiency (e.g. process automation, reduced paperwork, etc.), transparency and traceability, while also making supply chains more secure as the origin and authenticity of products is known, proven and shared. Moreover, applications of distribution logistics can involve different kinds of actors, in particular those typically working in any part of the e-commerce supply chain. Cost controls over the supply chain, certification of the provenance of goods, price control to the final customers are building blocks suitable for a number of business cases needed by e-commerce portals, good producers (as local food) and distribution logistic transport actors. A relevant issue that is possible to face is taking into account the pollution produced by the supply chain itself in order to minimize the environmental impact and maximize the green sustainability of the supply chain. Overall, it involves mechanisms for data accountability, data interoperability, data anonymization, data privacy control, data orchestration, permission management and tokenomics.

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Challenges	The challenges here are to proposed and implement a solution for distribution logistics that can for example help: o Optimising the delivery process and reducing delays o Tracing the products from their source, throughout various phases and processes of the supply chain, from the physical condition of the consignment at any given moment, through various variations of the goods (e.g., temperature deviations) and to support the decision making of logistics operators, o Reducing transportation costs, o Improving business processes, o Reducing stock cost and optimising service level agreement.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Semantic distributed oracles (e.g., ADOS, DESMO), o Ontologies (e.g., POC4COMMERCE), o Reputation mechanisms (e.g., REPUTABLE), o Tokenomics (e.g., NFTSwap, PRINGO).
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. Examples are the following: supply chain management, e.g. spare parts distribution, e.g. in consumer electronics, car spare part management, e-commerce, food delivery, vehicle routing optimization, health products delivery, etc.

TOPIC B8

Title	Data/Digital content /Multimedia marketplace, including social media
Definition	Data marketplaces centralized, decentralized or federated are currently very popular for exchanging private/proprietary data in a secure, privacy-aware manner. Dealing with data identification, data ownership, data provenance, data handling in compliance to GDPR, privacy-aware data processing, data valuation, data value sharing among data owners comprise issues to be dealt with in these marketplaces. Multimedia/digital content exchange could also be of relevance in these marketplaces with similar issues, e.g., video streaming exchange.
Challenges	The challenges here are to proposed and implement a solution that demonstrate a good potential for multimedia providers and users (fair and self-sustaining business model, ease of retrieval information

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	of interest also by the proper use of semantics, more in general easy to use and attractive service, properly addressing the long tail of contents).
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Ontologies and suitable use of semantics (e.g. POC4COMMERCE), o Copyright management (e.g. Copyrightly), o Data provenance (e.g., PS-SDA, ONTOROPA), o Data ownership/watermarking (e.g., DW-marking) o Decentralised reputation management (e.g., REPUTABLE), o Decentralised identities (e.g., ONTOSSIVault, HIBI, MFSSIA), o Data price determination mechanisms (e.g., NFTSwap), o Decentralised knowledge data indexing (e.g. OriginTrail DKG), o Privacy-aware data processing (e.g., KnowledgeX).
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. Examples are the following: Streaming media services, copyright management, including social media, untraceability of user opinion in social media, neutrality, and anonymity.

TOPIC B9

Title	Semantics-based DAO
Definition	DAO is an organization that is represented by rules encoded as a computer program, is transparent, managed by its members, and is not affected by a central government. The financial transaction and program rules of a DAO can be maintained on a Semantic Blockchain. We can think of DAOs as internet-native business model which is collectively owned and controlled by its members. This includes the use of high-quality semantic data (on-chain or off-chain) concerning all aspects of the DAO. They have built-in treasuries to which no one can have access without the group's permission. Proposals and voting are used to make decisions, ensuring that everyone in the company gets a say. Starting an organization with someone that involves funding and money requires a lot of trust. However, it's hard to trust someone you've only ever interacted with on the internet. With DAOs you don't need to trust anyone else in the group, just the DAO's code, which is 100% transparent and verifiable by anyone.

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Challenges	The adoption of Semantics-based DAOs is still being debated, raising difficult governance issues that might limit their growth and development. DAOs are not formally recognized and do not exactly fit into established forms of business organizations, making interaction with regular commercial entities problematic and putting members at risk. In certain instances, interests in DAOs may be difficult to classify, raising regulatory concerns when it comes to securities laws. The risks of distributed governance: DOAs rely on Blockchain Smart Contracts (SCs), however, SCs may improve operational efficiency, but they don't remove the social and political aspects of governance. Humans do not have an infinite capacity for information and exhibit well-understood bounds to rationality, limiting the capacity of DAO-members to engage fully in an organization's governance structure. Gathering all of the information needed to make an informed decision may be too time-consuming and difficult for others, discouraging participation. Questions thus emerge as to whether DAOs will operate with the same degree of efficiency, or even comparable efficiency, as more hierarchical organizations. Another challenge is that, If the underlying software structuring the DAO contains a bug, mistake, or other vulnerability, DAO members are presented with a limited set of options. Limitation of Liability: Besides from governance issues, DAOs lack official legal registration, thereby exposing DAO members to the organization's liabilities and duties. DAOs are also outside of regular systems, making it difficult for them to deal with more traditional legal entities. If characterized as a general partnership, DAOs may struggle to attract members, especially those with significant assets. Large businesses, investors and other regulated entities may hesitate to engage in or otherwise support a DAO for fear that membership would put other assets at risk. Security and vulnerabilities are other challenges e.g. the famous attack that happened shortly after the lunch of TheDAO in June 2016. An unknown hacker was able to drain away 3.6 million ETH (50 $ million at the time), approximately a third of the 11.5 million ETH that was devoted to TheDAO.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Decentralised Oracle Network (e.g Dart, Ados, Desmo-LD) o Reputation mechanisms (e.g REPUTABLE) o Identity management and verifiable credentials (e.g OntoSSIVault, HiBi) o Multi Factor Self Sovereign Authentication (e.g MFSSIA). It will have to support different ambitious use-case scenarios.
Expected outcomes	An open source software application from different domains (e.g., gaming crypto exchange, legal engineering, art, Defi products, governance of dapps, investment, worker collection, social media,

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	asset management, insurance, trust funds, ownership, media, entertainment, politics) is expected that is based on the DAO philosophy and existing well-known blockchain networks. The application must target a wide range of users and offer a low cost service for the participants. The rules on how the DAO membership of the application will be developed must be defined in a clear way. The DAO based application must offer a safe and optimized frame. The software must implement modern security protocols and standards and provide the highest level of security to the clients. Some examples are as follows: investment, charity, fundraising, borrowing, buying NFTs, donations acceptance, freelancer network etc.

TOPIC B10

Title	Decentralised Public Services & Common Goods
Definition	This topic aims to produce tools and services for supporting trusted information exchange at the local level, in communities and small organizations. Many local initiatives spawn at the local level to build and support social cohesion : local currencies support sustainable businesses; online platforms connect people who need help with school support, finding a job, lending tools, avoiding food waste and helping refugees. DLTs and Web3 applications can bring many tools that will help build stronger local organizations: Decentralized Autonomous Organizations (DAO) can support democratic debate and transparent voting in local decisions; local crypto-currencies can support local businesses, fund local projects, track the way public money is being used and create incentives for local good; trusted information sharing, decentralized reputation, Web3 social media platforms can help organized local events and make local data open and traceable.
Challenges	The challenges here are to propose and implement a solution that makes services accessible by citizens of all backgrounds and age as well as to convince users of the value of Web3 alternatives compared to centralized ones.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Reputation mechanisms (e.g. REPUTABLE), o Identity management and verifiable credentials (e.g. OntoSSIVault, HiBi, MFSSIA), o Proof of location (e.g., GEONTOLOGY),

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	o Oracles systems (e.g., ADOS, DESMO-LD).
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. The output should be new applications deployed publicly and accessible to European citizens, administrations and organizations. Examples are as follows: o Management system for associations (accountability, voting, data sharing, communication.) o Local currencies tied to incentives mechanisms for social good (e.g. supporting local businesses, sustainable agriculture…) o Event system with ticketing, Proof-of-Attendance tokens, etc.

TOPIC B11

Title	Remote Presence/Working and Metaverse
Definition	The COVID-19 crisis has shown how important distance and innovative learning is for society, our children, their parents and their teachers, maintaining social and educational links under challenging circumstances. Emerging technologies such as virtual reality, eXtended reality or immersive environments provide numerous opportunities for personalised, innovative, efficient and inclusive learning, for learners of all ages, gender and condition. In Xverse applications, people may need to interact in virtual environments with third-party real-world data or avatars, which may be trustworthy or not. For example, remote engineers working on a disaster site with data from the field of interest and interacting with remote/on-site colleagues or remote/on-site workers. Applications that enable metaverse, Xverse interactions and remote working in a trustworthy, privacy-aware and transparent manner are needed.
Challenges	The challenges here turn around trustworthy identities, trustworthy data, trustworthy interactions and accountability in augmented/virtual reality applications, in remote presence/working and in the metaverse.
Requirements	The proposed solution will have to use standard technology for full stack development and the results will have to be open source. It will have to use mechanisms that are already part of ONTOCHAIN services such as : o Value exchange by means of using various tokens; o Ability to find and use help of different experts directly in the working process (e.g. software development); o The use of blockchain-based semantic metadata to generate and exchange various proofs in the working process;

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	o Applications connecting trustworthy reality with AR/VR environments.
Expected outcomes	An attractive Level 7 solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. The output should be a semantic-blockchain enabled working environment involving AR/VR and similar notions of the metaverse.

OPEN TOPICS

The B1-B11 examples above are only indicative. Applicants can submit a proposal under any different topic, as long as it serves the overall ONTOCHAIN vision and objectives and fits within the formula Semantic Web + Blockchain. It should use as much as possible existing concepts and technologies of ONTOCHAIN and fit within its vision and objectives. It can be for example in relation with decentralised market places, DeFi and for the healthcare, tourism, agriculture sectors etc. In any case, an attractive Level 7 open source solution, tested and evaluated by an adequate pool of potential users, with a self-sustaining business model to be exploited after the end of the project is expected. The proposed solution will have to use standard technology for full stack development, mechanisms that are already part of ONTOCHAIN services.

2.2.3 Deliverables

Whatever the topic, the projects funded by the ONTOCHAIN consortium must deliver four deliverables during their participation process in ONTOCHAIN. They are defined below:

- **D1:** SoA overview, use case analysis and preliminary technical specification of the solution.
- **D2:** Detailed technical specification of the solution, software implementation work plan, and demo scenarios, preliminary business plan.
- **D3:** Implementation, deployment in appropriate ONTOCHAIN platform, testing, demonstration and validation.
- **D4:** Modularised software components ready for distribution, full documentation for developers/users, final business plan.

2.2.4 Support services provided by ONTOCHAIN to third parties

All selected third parties will benefit of:

- **Access to Infrastructure:**
  -All the teams selected will have access if willing and needing so, to the iExec blockchain platform, for their off-chain developments and to the MyIntelliPatent web application, populated with updated blockchain applications, for patent

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analysis and monitoring . The use of these infrastructure is not mandatory. Applicants shall bear in mind that interoperability of the solutions built within the ONTOCHAIN project is a paramount requirement.
-The use of a full-fledged ONTOCHAIN Network under OC3 topic A.3.

- **Business support services:** To support the teams to exploit their use cases and successfully reach the market, different trainings and sessions with mentors will be organised. Depending on the team profile, aspects such as Value Proposition, pitching or IPR (among others) will be explored.
- **Communication support services:** Major visibility, promotion and networking opportunities are offered as part of the ONTOCHAIN project and the Next Generation Internet initiative. Selected teams will:
    - Have access to communication tool kits and co-branding materials,
    - Be showcased in the ONTOCHAIN project website,
    - Be interviewed and promoted on relevant media channels
    - Be invited to participate in top events
    - Connect with a vibrant ecosystem of innovators, investors, industry players and public authorities.

Each third party selected will be assigned one or more mentors from the ONTOCHAIN consortium that will follow its updates on a weekly basis.

3 ANNOUNCEMENT

Submission to the ONTOCHAIN Open Call 3 will open on the 23rd of May 2022 at 12:00 PM CEST and close on the 25th of July 2022 at 17:00 CEST. Dates for the different phases are outlined below but may be subject to change if any modifications in the project's schedule occur.

Call title:	**ONTOCHAIN Open Call 3 - Application and experimentation**
Full name of the EU funded project:	Trusted, traceable and transparent ontological knowledge on blockchain
Project acronym:	ONTOCHAIN
Grant agreement number:	H2020–957338
Call publication date:	23 May 2022 at 12:00 PM CEST

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Call deadline:	25 July 2022 at 17:00 CEST
Expected duration of participation:	10 months programme
Total EU funding available:	1 673 000 €
Task description:	ONTOCHAIN will deliver a new software ecosystem for trusted, traceable and transparent ontological knowledge management. The specific objectives of the ONTOCHAIN Open Call 3 are twofold: Objective A- To complete the missing blocks of the ONTOCHAIN infrastructure in particular those related to : o Service Integration (Gateways APIs) for ONTOCHAIN applications, o Semantic Matching and Reasoning, o Energy-efficient and sustainable hosting infrastructure for the ONTOCHAIN software ecosystem and services Objective B- To exploit the ONTOCHAIN infrastructure designed and implemented respectively through ONTOCHAIN OC1 and ONTOCHAIN OC2 for real life use cases that cover real need of individuals in terms of trustworthy data/services exchange and trustworthy content handling from various vertical domains/vital sectors of the European economy.
Submission & evaluation process:	Proposals are submitted in a single stage and the evaluation process is composed of three phases as presented hereafter: o Phase 1: Admissibility & eligibility check o Phase 2: Proposals evaluation carried out by the ONTOCHAIN Consortium with the assistance of independent experts. o Phase 3: Online interviews (10 minutes pitching & 20 minutes of Q&As) and final selection carried out by the ONTOCHAIN Consortium and the ONTOCHAIN Advisory Board Members.
Further information:	Further details are available at: **https://ontochain.ngi.eu/apply**

4 SUPPORT TO APPLICANT

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The ONTOCHAIN consortium will provide information to the applicants only via ontochain@ngi.eu. No binding information will be provided via any other means (e.g., telephone or email).

- More info at: **https://ontochain.ngi.eu/apply**
- Apply via: **https://www.f6s.com/ontochain-open-call-3/apply**
- Support team: **ontochain@ngi.eu**
- Personal Data Protection Policy available at: **https://ontochain.ngi.eu/Terms_of_Service_and_Privacy_Policy_v0.2**

The ONTOCHAIN consortium will also organise webinars to connect with interested applicants. Stay update by following the ONTOCHAIN project on the following channels:

- Website
- Newsletter
- Twitter
- LinkedIn
- Facebook
- YouTube

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5 KIT FOR APPLICATION

The ONTOCHAIN Open Call 3 supported material is described below, and all documents are available at https://ontochain.ngi.eu/apply.

- The ONTOCHAIN Background

This document describes the ONTOCHAIN project context and the need for means for collective organisation as well as for contribution and use of knowledge thanks to smart solutions that support transparency, trust, plurality and democracy.

- The ONTOCHAIN Open Call 3 text

The present document.

- ONTOCHAIN Guide for applicant

This document provides in details the information to help apply to the ONTOCHAIN Open Call 3 such as an abstract of the ONTOCHAIN action, a description of the ONTOCHAIN open call 3, the modalities for application, the evaluation process, the scheme of the funding support, the IPR aspects related to ONTOCHAIN and how to prepare and submit a proposal.

- The ONTOCHAIN Application material
  - Administrative form preparation template, which presents the list of administrative information that you need to fill in directly in the F6S portal.
  - Proposal description template: a mandatory and editable document to describe your proposal.
  - ONTOCHAIN additional applicant's template: In case your proposal has more than 3 applicants participating as individuals (Natural persons) or/and more than 3 applicants participating as organisations (Legal entities), you will have to fill in this document and upload it in section 3 of the F6S form.

- Indicative sub-grant agreement form

This document provides a template of the sub-grant agreement that only the selected applicants will be requested to sign. It is not necessary to send this document at the time of application.

All documents are available at: https://ontochain.ngi.eu/apply

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