



ONTO  
CHAIN

# Blockchain for the Next Generation Internet

**THE ONTOCHAIN OPEN CALL 1 TEXT**

12/11/2020



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# 1 ONTOCHAIN IN BRIEF

## 1.1 GENERAL FRAME

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 innovators and end users to develop blockchain-based knowledge management solutions that will be part of a novel protocol suite & software ecosystem for a better share of knowledge and value.

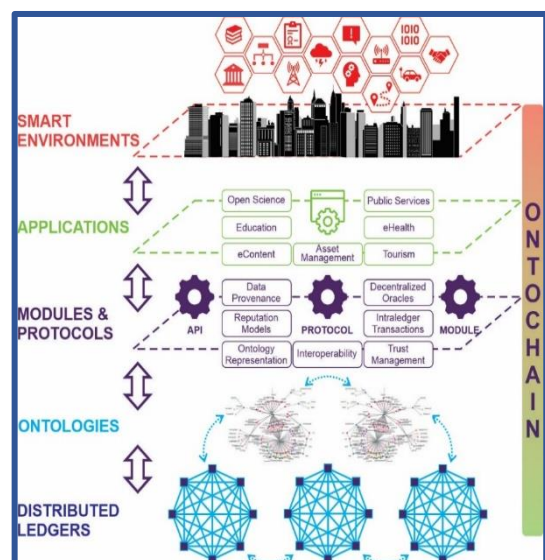
ONTOCHAIN offers through 3 Open Calls, up to 4,2M€ funding and mentoring programs with the best international experts in Semantic Web, Linked Data, Ontology engineering, Blockchain interoperability, knowledge management, distributed and decentralised computing and business models for trusted knowledge.

## 1.2 OBJECTIVE

Today, people should be empowered 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.

ONTOCHAIN aims to elaborate an ecosystem of novel software used to build trustworthy applications with advanced knowledge management mechanisms for various domains such as health, economy, mobility, public services, energy and sustainability, news, media, entertainment, Industry 4.0, tourism.

The merging of semantic web, trust and blockchain constitutes the backbone of the ONTOCHAIN ecosystem. Building it with relevant actors such as internet technologists, researchers and innovators from both industrial and academic sectors is the catalyst for the ONTOCHAIN ecosystem achievement.



ONTOCHAIN ECOSYSTEM

## 2 ONTOCHAIN OPEN CALL 1

### 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/social networks and for vital sectors of the European economy.

The specific objective of the ONTOCHAIN Open Call 1 is to establish the ONTOCHAIN Framework as a human centric, decentralized and trustworthy solution according to 6 technical topics:

- Applications
- Semantic interoperability
- On-chain data management
- Off-chain knowledge management
- Ecosystem economy
- Ecosystem scalability and integration

All six technical topics are presented in detailed tables hereafter. Each table elaborate in particular on the challenge, the requirements, the constraints to be addressed as well as on the expected deliverables, expected results and impacts of each activity.

#### 2.1.1 Topic 1-Applications

TITLE	APPLICATIONS
<p><b>CHALLENGE</b></p>	<ul style="list-style-type: none"> <li>○ Define a typical ONTOCHAIN application or service for trustworthy content handling and trustworthy knowledge and information exchange. Define and analyse in detail typical ONTOCHAIN use cases, such as: marketplace(s) setup and operation, fact checking against fake information, self-sovereign identity, trusted and secure data management, asset ownership management, secure and transparent</li> </ul>

	<p>copyright management and verification and similar.</p> <ul style="list-style-type: none"> <li>○ Analyse the potential of trustworthy ONTOCHAIN applications in various domains such as education, services orchestration, open science, eContent, Social Networks, eHealth, Tourism and similar.</li> <li>○ Analyse and define the functional, non-functional and system requirements that have to be addressed in the further stages of the ONTOCHAIN project.</li> </ul>		
<p><b>REQUIREMENTS</b></p>	<p>Describe particular ONTOCHAIN applications and use cases that support:</p> <ul style="list-style-type: none"> <li>○ Trustworthy content handling, trustworthy information exchange</li> <li>○ Trustworthy Service Orchestration, Trustworthy Web and Social Media, Trustworthy Crowdsensing, Trustworthy Social Networks</li> <li>○ Prepare detailed designs of use cases across all subject domains</li> </ul> <p>Explain how the applications will benefit from:</p> <ul style="list-style-type: none"> <li>○ Trustworthy, secure and safe operations over ontology data, metadata, knowledge and information</li> <li>○ Privacy mechanisms</li> <li>○ Transparency of the operations etc.</li> </ul> <p>Define interoperability and integration approach:</p> <ul style="list-style-type: none"> <li>○ Integration of applications with the ONTOCHAIN ecosystem</li> <li>○ Interoperability between applications and within applications' service components</li> </ul>		
<p><b>CONSTRAINTS</b></p>	<p>The applications design should rely on best practices and open standards in software engineering. The requirements analysis and specification document should follow best practices in software engineering.</p>		
<p><b>DELIVERABLES</b></p>	<table border="1" style="width: 100%;"> <tr> <td style="width: 15%;"><b>D1-M1</b></td> <td><b>Title:</b> State-of-the-Art and Ambition <b>Expected outcomes:</b> Comprehensive</td> </tr> </table>	<b>D1-M1</b>	<b>Title:</b> State-of-the-Art and Ambition <b>Expected outcomes:</b> Comprehensive
<b>D1-M1</b>	<b>Title:</b> State-of-the-Art and Ambition <b>Expected outcomes:</b> Comprehensive		



		<p>overview of the state of the art and clear descriptions on how your proposal will advance the SoA.</p> <p><b>Means for verification:</b> Evaluation of the submitted SoA and ambition report by the consortium.</p>
	D2-M2	<p><b>Title:</b> Full research and innovation project proposal.</p> <p><b>Expected outcomes:</b> Full proposal with extended topic description and all major requirements and constraints addressed. Proposed design specification and approach, with discussions with evaluators. On the basis of evaluators judgement, the project will be admitted or not at the following phase (D3 and D4).</p> <p><b>Means for verification:</b> Project proposal submitted, completeness checked, innovation assessed by the consortium.</p>
	D3-M4	<p><b>Title:</b> Proposed solution design</p> <p><b>Expected outcomes:</b> Design specification with approach.</p> <p><b>Means for verification:</b> Evaluation of the submitted specification by the consortium.</p>
	D4-M6	<p><b>Title:</b> Prototype demonstration.</p> <p><b>Expected outcomes:</b> Full design specification and working prototype.</p> <p><b>Means for verification:</b> Consortium evaluation, with two levels:</p> <ol style="list-style-type: none"> <li>1) results are adequate for 1st call</li> <li>2) the project can apply to the following 2nd call.</li> </ol>
	D5-M7	<p>A paper describing the activity carried in this project is submitted to a highly ranked journal or conference. Only accepted papers will receive the extra funding associated to an article publication.</p>
<b>Resources provided</b>		One or more mentors from the ONTOCHAIN consortium

<p><b>by ONTOCHAIN</b></p>	<p>will be assigned to each project and follow its updates on a weekly basis. All participants of the six project topics will also benefit of:</p> <ul style="list-style-type: none"> <li>○ Monthly plenary conference;</li> <li>○ Access to the iExec platform for free on the Ethereum Goerli testnet;</li> <li>○ Free access to the patent publication bases technical landscape maintained by IntelliSemantic;</li> <li>○ Fortnightly private discussion on their particular topic.</li> </ul>
<p><b>Expected outcomes and Key Performance Indicators</b></p>	<ul style="list-style-type: none"> <li>○ Design exemplified for at least 5 generic use cases, agreed with evaluators and selected between those suggested in the document "ONTOCHAIN background" or also new.</li> <li>○ Prototype implementation of at least 2 of the aforementioned use cases.</li> <li>○ When algorithms are proposed, complexity analysis should be submitted and complexity should render the algorithm(s) scalable.</li> <li>○ Suboptimal solutions are also welcome, while their approximation ratio should be clearly mentioned.</li> <li>○ Common KPIs for software evaluation will be also employed, such as code simplicity (e.g., compliant to Rubocop requirements) and high testability coverage (97%).</li> </ul>
<p><b>Possible impact on technologies</b></p>	<ul style="list-style-type: none"> <li>○ New generic components and protocols for trusted information sharing between Web 2.0 systems, blockchains, and between Web 2.0 systems and blockchains.</li> <li>○ Blueprints for complex decentralized oracles able to aggregate information from multiple sources at once, and transmit its trust to compatible systems (on- and off-chain).</li> </ul>
<p><b>Possible impact on applications</b></p>	<ul style="list-style-type: none"> <li>○ Reusable prototypes and MVPs of software components for trustworthy knowledge</li> </ul>

	<p>discovery, sharing, monetization and evaluation;</p> <ul style="list-style-type: none"> <li>○ Demonstration and showcasing of the software components in the context of real life applications.</li> </ul>
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### 2.1.2 Topic 2 -Semantic Interoperability

TITLE	SEMANTIC INTEROPERABILITY
<b>CHALLENGE</b>	<p>Develop a trustworthy, privacy-preserving, secure, transparent, democratic and traceable approach to manage access and operations over ontologies, metadata, data, knowledge and information in the ONTOCHAIN ecosystem. Particularly, provide practical solutions that rely on already successful Semantic Web approaches such as Linked Data, OWL Lite, OWL DL and other approaches and formats.</p> <p>Provide new ideas for on-chain and off-chain ontology management, which 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.</p> <p>The challenge is also to design possibilities 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. The research and innovation should also cover solutions for validation that ontology and on-chain and off-chain knowledge is logically consistent, or alerts in cases of inconsistencies. Moreover, on-chain reasoning approaches would be of great interest that would operate directly on top of on-chain ontologies. The challenge also includes the realisation of permissioned blockchains with blockchain ontology management; blockchain based semantic agreement process (ontology agreement, metadata schemata agreement), ontology types, such as: development of specific ontologies to be used</p>



	for the project use cases for each application domain, additional ontologies for reputation models, resource models for computing clusters, Service-Level Agreements, monitoring, certification, and the collection and maintenance of various ontologies useful for the project applications and use cases.	
<b>REQUIREMENTS</b>	<p>Design and develop a prototype for semantic interoperability with TRL-4 that will be based on less-costly, trustworthy &amp; secure semantics and reasoning mechanisms. The prototype should address as much as possible the above mentioned challenges.</p> <p>In this context:</p> <ul style="list-style-type: none"> <li>○ Design specific domain ontologies and populate them with related example data as needed by the project's use cases and applications</li> <li>○ Ontologies for resource models, reputation models</li> <li>○ Trustworthy information and knowledge management operations for content, services, clusters, hierarchies or similar</li> <li>○ Manage ontologies' operations (CRUD) through blockchain smart contracts</li> <li>○ Validate the correctness of ontology data instance via blockchain.</li> </ul>	
<b>CONSTRAINTS</b>	Compliance with W3C semantic interoperability standards and similar.	
<b>DELIVERABLES</b>	<b>D1-M1</b>	<p><b>Title:</b> State-of-the-Art and Ambition</p> <p><b>Expected outcomes:</b> Comprehensive overview of the state of the art and clear descriptions on how your proposal will advance the State of the Art.</p> <p><b>Means for verification:</b> Evaluation of the submitted State of the Art and ambition report by the consortium.</p>
	<b>D2-M2</b>	<p><b>Title:</b> Full research and innovation project proposal.</p> <p><b>Expected outcomes:</b> Presentation of a</p>

		document with the proposed design specification and approach, with discussions with evaluators. On the basis of evaluators judgement, the project will be admitted or not at the following phase (D3 and D4). <b>Means for verification:</b> Proposal submitted, completeness checked, innovation assessed by the consortium.
	<b>D3-M4</b>	<b>Title:</b> Proposed solution design <b>Expected outcomes:</b> Design specification and detailed approach description. <b>Means for verification:</b> Evaluation of the submitted specification by the consortium.
	<b>D4-M6</b>	<b>Title:</b> Prototype demonstration <b>Expected outcomes:</b> Full design specification and working prototype. <b>Means for verification:</b> Consortium evaluation, with two levels: 1) results are adequate for 1st call 2) the project can apply to the following 2nd call.
	<b>D5-M7</b>	A paper describing the activity carried in this project is submitted to a highly ranked journal or conference. Only accepted papers will receive the extra funding associated to an article publication.
<b>Resources provided by ONTOCHAIN</b>		One or more mentors from the ONTOCHAIN consortium will be assigned to each project and follow its updates on a weekly basis. All participants of the six project topics will also benefit of: <ul style="list-style-type: none"> <li>○ Monthly plenary conference;</li> <li>○ Access to the iExec platform for free on the Ethereum Goerli testnet;</li> <li>○ Free access to the patent publication bases technical landscape maintained by IntelliSemantic;</li> </ul>

	<ul style="list-style-type: none"> <li>○ Fortnightly private discussion on their particular topic.</li> </ul>
<p><b>Expected outcomes and Key Performance Indicators</b></p>	<p>The projects should fully address the requirements of the call topic. When algorithms are proposed, complexity analysis should be submitted and complexity should render the algorithm(s) scalable. Suboptimal solutions are also welcome, while their approximation ratio should be clearly mentioned. Proof of end-to-end security and privacy properties of the proposed solutions are to be provided. Common KPIs for software evaluation will be also employed, such as code simplicity (e.g., in analogy to Rubocop requirements) and high testability coverage (97%).</p>
<p><b>Possible impact on technologies</b></p>	<ul style="list-style-type: none"> <li>○ New open standards and decentralized implementations of existing standards, languages, file formats and databases for representing ontological models and ontologies;</li> <li>○ Decentralized byzantine tolerant query systems for ontologies;</li> <li>○ Protocols for ontology specific communications between on- and off-chain components;</li> <li>○ Smart contracts for storing ontologies and ontological metadata on blockchains;</li> <li>○ Benchmarks and performance analysis of decentralized ontology storage, exchange and query systems.</li> </ul>
<p><b>Possible impact on applications</b></p>	<ul style="list-style-type: none"> <li>○ New connectors between blockchains (e.g. Ethereum Smart Contracts) and production databases and ontological knowledge;</li> <li>○ Decentralized storage medium for ontologies in OWL and similar standard formats;</li> <li>○ Free software libraries for interconnecting existing ontological systems with ONTOCHAIN and associated decentralized services.</li> </ul>

### 2.1.3 Topic 3-On-chain data management

TITLE	ON-CHAIN DATA MANAGEMENT
<b>CHALLENGE</b>	<p>Design and develop a set of prototype functionalities for on-chain data management. Various studies have highlighted the possibility to record various data and information on blockchain, such as hashtags, or URIs to data resources that exist off-chain. The challenge here is to propose: novel ideas for implementation of on-chain data management methods, to identify suitable consensus protocols for implementation, to identify semantic formats particularly suitable for on-chain operations (e.g. Linked Data, OWL Lite etc.). New ideas for data management functionalities in the context of trustworthy content handling and trustworthy and transparent information exchange would be welcome.</p>
<b>REQUIREMENTS</b>	<p>Solutions that address the above mentioned challenges.</p> <p>In addition to this, solutions that support:</p> <ul style="list-style-type: none"> <li>○ identification, authorization and role management of enrolled entities;</li> <li>○ verification of data integrity on blockchain (e.g. hash comparison); functionalities for secure storage of encrypted ontology instances on the blockchain;</li> <li>○ solutions that keep track of the ontology history on the blockchain, such as data provenance mechanisms, and</li> <li>○ solutions that facilitate inter- and intra-ledger transactions.</li> </ul>
<b>CONSTRAINTS</b>	<p>The prototype should address one or more existing constraints, such as:</p> <ul style="list-style-type: none"> <li>○ High performance in on-chain data management in terms of transactions' cost/execution time;</li> <li>○ Amount of data stored on the blockchain;</li> </ul>

	<ul style="list-style-type: none"> <li>Securely feeding smart contracts with off-chain data;</li> <li>Smart contract limitations in the context of legal aspects of their application.</li> </ul>
<b>DELIVERABLES</b>	<b>D1-M1</b> <b>Title:</b> State-of-the-Art and Ambition <b>Expected outcomes:</b> Comprehensive overview of the state of the art and clear descriptions on how your proposal will advance the State of the Art. <b>Means for verification:</b> Evaluation of the submitted State of the Art and ambition report by the consortium.
	<b>D2-M2</b> The report will present the proposed design specification and approach, with discussions with evaluators. On the basis of evaluators judgement, the project will be admitted or not at the following phase (D3 and D4).
	<b>D3-M4</b> The report will document the design specification with prototype implementation.
	<b>D4-M6</b> Prototype demonstration; Full design specification to be passed for the 2nd Call; The project contribution.
	<b>D5-M7</b> A paper describing the activity carried in this project is submitted to a highly ranked journal or conference. Only accepted papers will receive the extra funding associated to an article publication.
<b>Resources provided by ONTOCHAIN</b>	<p>One or more mentors from the ONTOCHAIN consortium will be assigned to each project and follow its updates on a weekly basis. All participants of the six project topics will also benefit of:</p> <ul style="list-style-type: none"> <li>Monthly plenary conference;</li> <li>Access to the iExec platform for free on the Ethereum Goerli testnet;</li> </ul>



	<ul style="list-style-type: none"> <li>○ Free access to the patent publication bases technical landscape maintained by IntelliSemantic;</li> <li>○ Fortnightly private discussion on their particular topic.</li> </ul>
<p><b>Expected outcomes and Key Performance Indicators</b></p>	<p>The projects should fully address the requirements of the call topic. When algorithms are proposed, complexity analysis should be submitted and complexity should render the algorithm(s) scalable. Suboptimal solutions are also welcome, while their approximation ratio should be clearly mentioned. Proof of end-to-end security and privacy properties of the proposed solutions are to be provided. Common KPIs for software evaluation will be also employed, such as code simplicity (e.g., in analogy to Rubocop requirements) and high testability coverage (97%).</p>
<p><b>Possible impact on technologies</b></p>	<p>Protocols, reference implementations and frameworks for: multi-source decentralized oracles; advanced decentralized oracles (e.g. machine learning, images recognition, sound recognition, speech recognition, etc.); AI/ML decentralized oracles with multi-model aggregation. Reference smart contracts for embedding governance rules in on-chain data ingestion (e.g. minimum number of data sources, minimum quorum on ingestion, presence of signed or authenticated data sources, etc.) fitting large classes of applications (e.g. voting and democracy, AI/ML, aggregation from sensor networks, etc.).</p>
<p><b>Possible impact on applications</b></p>	<p>Trusted services providing aggregating scoring of AI/ML fitting results over multiple models (e.g. with images recognition, sound recognition, speech recognition, etc.).</p>

#### 2.1.4 Topic 4-Off-chain knowledge management

TITLE	OFF-CHAIN KNOWLEDGE MANAGEMENT
<b>CHALLENGE</b>	<p>The challenge is to rely on, extend and pioneer new methods that provide a trust-less interface to the trustworthy blockchain environment. Research and innovation activities may focus on the design and development of initial prototypes for off-chain knowledge management that support the various identified use cases and application domains of the ONTOCHAIN project. Various decentralised reputation models, decentralised oracles and other approaches are to be considered.</p>
<b>REQUIREMENTS</b>	<p>This goal is to define and specify suitable protocols of the ONTOCHAIN architecture that realise off-chain knowledge management for implementation.</p> <p>Specific solutions may support:</p> <ul style="list-style-type: none"> <li>○ feeding smart contracts with off-chain data by using decentralized oracles,</li> <li>○ building reputation models and integrating them with data provenance,</li> <li>○ building and/or relying upon authorization/identification components, integration of trustless structured and other knowledge base technologies,</li> <li>○ application of decentralised computing technologies for storing and accessing data (e.g. OAI-PMH),</li> <li>○ trusted execution environments,</li> <li>○ code/data integrity based on proof of executions and code signatures; governance approaches, which define the rules for pushing/publishing data to smart contracts.</li> </ul>
<b>CONSTRAINTS</b>	<p>The prototype should address one or more existing constraints, such as:</p> <ul style="list-style-type: none"> <li>○ reduce operational expenses when using decentralised oracles;</li> <li>○ apply security protocols and standards for trusted operations;</li> <li>○ apply means to reduce computational complexity of reputation-based algorithms.</li> </ul>

<b>DELIVERABLES</b>	<b>D1-M1</b>	<p><b>Title:</b> State-of-the-Art and Ambition</p> <p><b>Expected outcomes:</b> Comprehensive overview of the state of the art and clear descriptions on how your proposal will advance the State of the Art.</p> <p><b>Means for verification:</b> Evaluation of the submitted State of the Art and ambition report by the consortium.</p>
	<b>D2-M2</b>	<p>Presentation of a document with the proposed design specification and approach, with discussions with evaluators. On the basis of evaluators judgement, the project will be admitted or not at the following phase (D3 and D4).</p>
	<b>D3-M4</b>	<p>Design specification with prototype implementation.</p>
	<b>D4-M6</b>	<p>Prototype demonstration; Full design specification to be eligible for the 2nd Call; The project contributions will be evaluated by the ONTOCHAIN consortium.</p>
	<b>D5-M7</b>	<p>A paper describing the activity carried in this project is submitted to a highly ranked journal or conference. Only accepted papers will receive the extra funding associated to an article publication.</p>
<b>Resources provided by ONTOCHAIN</b>	<p>One or more mentors from the ONTOCHAIN consortium will be assigned to each project and follow its updates on a weekly basis. All participants of the six project topics will also benefit of:</p> <ul style="list-style-type: none"> <li>○ Monthly plenary conference;</li> <li>○ Access to the iExec platform for free on the Ethereum Goerli testnet;</li> <li>○ Free access to the patent publication bases technical landscape maintained by IntelliSemantic;</li> <li>○ Fortnightly private discussion on their particular topic.</li> </ul>	

<b>Expected outcomes and Key Performance Indicators</b>	<p>The projects should fully address the requirements of the call topic. When algorithms are proposed, complexity analysis should be submitted and complexity should render the algorithm(s) scalable. Suboptimal solutions are also welcome, while their approximation ratio should be clearly mentioned. Proof of end-to-end security and privacy properties of the proposed solutions are to be provided. Common KPIs for software evaluation will be also employed, such as code simplicity (e.g., in analogy to Rubocop requirements) and high testability coverage (97%).</p>
<b>Possible impact on technologies</b>	<p>Possible requirements or dependencies that off-chain knowledge management solutions pose for the rest of the ONTOCHAIN ecosystem, underlying assumptions or technological dependencies should be discussed in detail in the final report of the project.</p>
<b>Possible impact on applications</b>	<p>Possible implications or requirements set by the off-chain knowledge management solutions to the different app developers of the different vertical domains of ONTOCHAIN have to be fully stated and discussed in the final report of the project.</p>

### 2.1.5 Topic 5-Ecosystem Economy

TITLE	ECOSYSTEM ECONOMY
<b>CHALLENGE</b>	<p>Existing business ecosystems that are developed over the Internet (and practically span all application domains) are semantically very complex and dynamically evolving. The challenge here is to provide a market framework and business models for supporting/facilitating the operation of such ecosystems with the help of the ONTOCHAIN solution. Existing and novel approaches and business models for business ecosystem development emanating from the technology areas of blockchain, Semantic Web, Internet of Things and similar should be analysed</p>

	<p>in detail, and best practices (innovative or existing ones) should be proposed for their implementation.</p>
<p><b>REQUIREMENTS</b></p>	<p>The outcome of this work will be a blockchain-based market design and prototype implementation of an ONTOCHAIN ecosystem economy. The key value provided in this economy is trustworthy content handling and trustworthy knowledge and information exchange and trading. The work should cover, as much as possible, models, specification, and prototypes (whenever applicable) of the following topics:</p> <ul style="list-style-type: none"> <li>○ The value chains and value networks in this economy among all relevant stakeholders;</li> <li>○ Facilitation mechanisms for actors to participate in the economy;</li> <li>○ Business models that can be used by the various actors;</li> <li>○ The definition of a marketplace that is flexible and extensible and supports the ONTOCHAIN use cases and applications;</li> <li>○ Specific support to the various use cases in the definition of their business models;</li> <li>○ Token distribution strategies for the sustainable development of the ecosystem;</li> <li>○ Value sharing for sustainable growth of the ecosystem;</li> <li>○ Incentive structure should be carefully analysed and prototyped;</li> <li>○ Asset management solutions by implementing different business models for selling/sharing/renting ontology data;</li> <li>○ Design of new trustworthy approaches for maintaining privacy and security in the data pipelines, and similar.</li> </ul> <p>The interdependence of the market framework to different components of the ONTOCHAIN architecture or underlying market mechanisms should be specified in detail; however, detailed specification or prototyping is needed only for</p>



	those components that are in the core of the aforementioned functionality.	
<b>CONSTRAINTS</b>	The design of the ecosystem economy, simulations and prototypes should be based upon analysis of applications' business processes that include the use of ONTOCHAIN operations, such as data encryption, validation, verification, different ledger technologies and protocols.	
<b>DELIVERABLES</b>	<b>D1-M1</b>	<p><b>Title:</b> State-of-the-Art and Ambition</p> <p><b>Expected outcomes:</b> Comprehensive overview of the state of the art and clear descriptions on how your proposal will go beyond.</p> <p><b>Means for verification:</b> Evaluation of the submitted State of the Art and ambition report by the consortium.</p>
	<b>D2-M2</b>	<p><b>Title:</b> Full research and innovation project proposal.</p> <p><b>Expected outcomes:</b> Presentation of a document with the proposed design approach and specification, with discussions with the ONTOCHAIN consortium. On the basis of ONTOCHAIN evaluators' judgement, the project will be admitted or not at the following phase (D3 and D4).</p> <p><b>Means for verification:</b> Project proposal submitted, completeness checked, innovation assessed by the consortium.</p>
	<b>D3-M4</b>	Design specification with implementation approach.
	<b>D4-M6</b>	Prototype demonstration; Full design specification to be eligible for the 2nd Call; The project contributions will be evaluated by the ONTOCHAIN consortium.
	<b>D5-M7</b>	A paper describing the activity carried in this project is submitted to a highly ranked journal or conference. Only

	accepted papers will receive the extra funding associated to an article publication.
<b>Resources provided by ONTOCHAIN</b>	<p>One or more mentors from the ONTOCHAIN consortium will be assigned to each project and follow its updates on a weekly basis. All participants of the six project topics will also benefit of:</p> <ul style="list-style-type: none"> <li>○ Monthly plenary conference;</li> <li>○ Access to the iExec platform for free on the Ethereum Goerli testnet;</li> <li>○ Free access to the patent publication bases technical landscape maintained by IntelliSemantic;</li> <li>○ Fortnightly private discussion on their particular topic.</li> </ul>
<b>Expected outcomes and Key Performance Indicators</b>	<p>The projects should fully address the requirements of the call topic. Techno-economic analysis of the proposed business models should be performed so as to identify key decisions for win-win scenarios for the involved stakeholders. Incentive structure should be carefully analysed and exemplified. When algorithms are proposed, complexity analysis should be carried out, and algorithm scalability should be ensured on this basis. Suboptimal solutions are also welcome, but their approximation ratio should be clearly justified. Proof of end-to-end security and privacy properties of the proposed solutions is to be provided. Common KPIs for software evaluation will be also employed, such as code simplicity (in analogy to Rubocop requirements) and high testability coverage (97%).</p>
<b>Possible impact on technologies</b>	<p>Possible dependencies or impact of the market framework to the rest of the ONTOCHAIN ecosystem, underlying components or existing technologies should be discussed in detail in the final report of the project.</p>
<b>Possible impact on applications</b>	<p>Possible implications or requirements set by the market framework to the different app developers of the different vertical domains of ONTOCHAIN</p>

	have to be fully stated and discussed in the final report of the project.
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### 2.1.6 Topic 6-Ecosystem scalability and integration

TITLE	ECOSYSTEM SCALABILITY AND INTEGRATION	
<b>CHALLENGE</b>	The challenge is to actually build a semantically complex and dynamic ecosystem and decentralised testing environment with the participation of various project related and external organisations and individuals. The key requirement is to integrate and support the initial ONTOCHAIN applications. In addition to this, various scalability and integration aspects should be considered.	
<b>REQUIREMENTS</b>	Develop an ONTOCHAIN testbed and software ecosystem: <ul style="list-style-type: none"> <li>○ Including blockchain testbed, e.g. with Ethereum, Hyperledger Fabric or/and other ledgers</li> <li>○ Develop a software repository with the initial ONTOCHAIN baseline technologies</li> <li>○ Develop and maintain a framework of agreed ontologies and workflows for the application design, data, metadata.</li> <li>○ Align exchange formats between components of the software ecosystem. Communication protocols between components.</li> <li>○ Interoperability between the software ecosystem and the applications.</li> </ul>	
<b>CONSTRAINTS</b>	Interoperability, integration and scalability aspects must be addressed.	
<b>DELIVERABLES</b>	<b>D1-M1</b>	<b>Title:</b> State-of-the-Art and Ambition <b>Expected outcomes:</b> Comprehensive overview of the state of the art and clear descriptions on how your proposal will go beyond.

		<b>Means for verification:</b> Evaluation of the submitted State of the Art and ambition report by the consortium.
	<b>D2-M2</b>	Presentation of a document with the proposed design specification and approach, with discussions with evaluators. On the basis of evaluators judgement, the project will be admitted or not at the following phase (D3 and D4).
	<b>D3-M4</b>	Design specification with implementation approach.
	<b>D4-M6</b>	Prototype demonstration; Full design specification to be passed for the 2nd Call; The project contribution.
	<b>D5-M7</b>	A paper describing the activity carried in this project is submitted to a highly ranked journal or conference. Only accepted papers will receive the extra funding associated to an article publication.
<b>Resources provided by ONTOCHAIN</b>		One or more mentors from the ONTOCHAIN consortium will be assigned to each project and follow its updates on a weekly basis. All participants of the six project topics will also benefit of: <ul style="list-style-type: none"> <li>○ Monthly plenary conference;</li> <li>○ Access to the iExec platform for free on the Ethereum Goerli testnet;</li> <li>○ Free access to the patent publication bases technical landscape maintained by IntelliSemantic;</li> <li>○ Fortnightly private discussion on their particular topic.</li> </ul>
<b>Expected outcomes and Key Performance Indicators</b>		The projects should fully address the requirements of the call topic. When algorithms are proposed, complexity analysis should be submitted and complexity should render the algorithm(s) scalable. Suboptimal solutions are also welcome, while their approximation ratio

	<p>should be clearly mentioned. Proof of end-to-end security and privacy properties of the proposed solutions are to be provided. Common KPIs for software evaluation will be also employed, such as code simplicity (in analogy to Rubocop requirements) and high testability coverage (97%).</p>
<p><b>Possible impact on technologies</b></p>	<p>Possible requirements or dependencies that ecosystem scalability and integration solutions pose for the rest of the ONTOCHAIN ecosystem, underlying assumptions or technological dependencies should be discussed in detail in the final report of the project.</p>
<p><b>Possible impact on applications</b></p>	<p>Possible implications or requirements set by the ecosystem scalability and integration solutions to the different app developers of the different vertical domains of ONTOCHAIN have to be fully stated and discussed in the final report of the project.</p>



## 2.2 ANNOUNCEMENT

<b>Call title:</b>	<b>ONTOCHAIN Open Call 1 - RESEARCH</b>
<b>Full name of the EU funded project:</b>	Trusted, traceable and transparent ontological knowledge on blockchain
<b>Project acronym:</b>	ONTOCHAIN
<b>Grant agreement number:</b>	H2020-957338
<b>Call publication date:</b>	16th November 2020 at 12:00 PM CET
<b>Call deadline:</b>	15th January 2021 at 17:00 CET
<b>Expected duration of participation:</b>	7 months programme split in 3 phases (2 + 4 + 1 months)
<b>Total EU funding available:</b>	1.140.000€
<b>Task description:</b>	<p>ONTOCHAIN will deliver a new software ecosystem for trusted, traceable and transparent ontological knowledge management.</p> <p>The objective of the ONTOCHAIN open call 1 is to establish the ONTOCHAIN framework as a human centric decentralised &amp; trustworthy solution based on available technologies for applications in various domains such as health, economy, mobility, public services, energy and sustainability, news, media, entertainment, Industry 4.0, tourism ...</p> <p>In other terms, it is about designing the ONTOCHAIN architecture for implementation around 6 topics: Applications, semantic interoperability, on-chain data management, off-chain knowledge management, ecosystem economy, ecosystem scalability and integration.</p>
<b>Submission &amp; evaluation process:</b>	<p>The open call is broken down in 3 phases:</p> <ul style="list-style-type: none"> <li>○ Phase 1. Research proposal (2 months),</li> <li>○ Phase 2. Research awards (4 months),</li> <li>○ Phase 3. Challenges for conferences (1 months).</li> </ul> <p>For phase 1, up to 18 projects will be selected to conceptualize a research project for 1 of the 6 topics aforementioned (first three proposals per topic will be retained).</p>

	<p>Then, for phase 2, from the initial pool of 18 projects, a subset of 6 projects will be retained based on their quality to elaborate the concept proposed in phase 1 and prepare design specifications to be implemented in the Open call 2.</p> <p>For phase 3, the best publications, outcomes of phase 1 or phase 2 will be selected and awarded. The modalities to receive the award will be stipulate in the grant document signed with the third party.</p> <p>The evaluation of proposals is carried out by the ONTOCHAIN Consortium with the assistance of independent experts.</p> <p>The maximum amount of funding that each beneficiary may receive during the ONTOCHAIN call 1 is subject to the legal status of the applicant (cf. Annex 3 - Guide for applicant).</p> <p>The submission will be done via the F6S platform:  <a href="https://www.f6s.com/ontochain/apply">https://www.f6s.com/ontochain/apply</a>          The applicants are required to register first a profile at FS6 to be able to submit their proposal.</p>
<b>Further information:</b>	<p>Further details are available at:  <a href="https://ontochain.ngi.eu/apply">https://ontochain.ngi.eu/apply</a></p>

### 3 SUPPORT TO APPLICANTS & KIT FOR APPLICATION

#### 3.1 SUPPORT TO APPLICANT

The ONTOCHAIN consortium will provide information to the applicants only via [ontochain@ngi.eu](mailto: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/apply>
- **Support team:** [ontochain@ngi.eu](mailto:ontochain@ngi.eu)

- **Personal Data Protection Policy available at:**

[https://ontochain.ngi.eu /data-protection](https://ontochain.ngi.eu/data-protection)

The ONTOCHAIN consortium has also organised 5 webinars to connect with interested applicants. They are available at: <https://www.youtube.com/channel/UCcF70vd991OKcjMGQdnhIvA>

## 3.2 KIT FOR APPLICATION

The ONTOCHAIN Open Call 1 supported material is the following:

- **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.

- It is available at: <https://ontochain.ngi.eu/apply>

- **The ONTOCHAIN Open Call 1 text**

The present document.

- **The ONTOCHAIN Guide for applicant**

This document provide in details the information to help apply to the ONTOCHAIN Open Call 1 such as an abstract of the ONTOCHAIN action, a description of the ONTOCHAIN open call 1, 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:

It is available at: <https://ontochain.ngi.eu/apply>

This document also contains in annex the Administrative forms preparation template, the proposal description template and the ONTOCHAIN additional applicant's template.

- **The ONTOCHAIN Application material**

- Administrative forms preparation template:  
available at: <https://ontochain.ngi.eu/apply>
- Proposal description template:  
available at: <https://ontochain.ngi.eu/apply>
- ONTOCHAIN additional applicant's template:  
available at: <https://ontochain.ngi.eu/apply>