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| ToR STF 627 (Ref. Body ISG CIM) |
| *Version: 1.2* |
| *Author: Franck le Gall – Date: 2021-08-24* |
| *Last updated by: ETSI Secretariat – Date: 2021-09-08* |
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Terms of Reference –Specialist Task Force Proposal

STF 627 (Ref. Body ISG CIM)

Data-handling improvement

Summary information

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| Approval status | Approved by ETSI ISG CIM (doc ref: [CIM(21)000140r5](https://docbox.etsi.org/ISG/CIM/05-CONTRIBUTIONS/2021/CIM(21)000140r5_CIM_STF_proposal_2021_release_candidate.docx) ) | | YES |
| Approved by Board#134 (date: 21-23 Sep 2021) | | YES |
| Reference Body | Ref. Body ETSI ISG CIM | | |
| ETSI Funding | Maximum budget : 118 000 EUR  115 000 EUR + 3 000 EUR Travel | | |
| Minimum of 4 ETSI Members Support | YES | | |
| Time scale | From | 2022-02-01 | |
| To | 2022-12-31 | |
| Work Items | [DGR/CIM-0018](http://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=63594) “Enabling chain of trust from Content Sources to Content Consumers”  [DGS/CIM-0019](http://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=63595) “Handling of provenance information in NGSI-LD”  [DGR/CIM-0020](http://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=63596) “Guidelines for the deployment of Smart City and Communities data platforms”  [DGR/CIM-0021](http://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=63597) “Usage of external data models with NGSI-LD API”  [DGR/CIM-0022](http://portal.etsi.org/webapp/WorkProgram/Report_WorkItem.asp?WKI_ID=63598) “NGSI-LD/oneM2M interworking proxy proposal” | | |
| Board priority | [ETSI STF funding criteria](https://portal.etsi.org/STF/STFs/Funding/ETSIbudget.aspx)   |  |  | | --- | --- | | Priority Criteria |  | | Maintenance of standards in mature domains |  | | Innovation in mature domains |  | | Emerging domains for ETSI | X | | Horizontal activities (quality, security, etc.) |  | | Societal good / environmental |  | | | |

Part I – STF Technical Proposal

# Rationale & Objectives

## Rationale

The ISG CIM group has defined an API for exchange of information (data and metadata, including e.g. relationships between entities and properties of properties) with the intent that the associated specification (called NGSI-LD) become the “glue” between all kinds of applications, platforms and databases associated with services for Smart Cities, Smart Agriculture, etc. Furthermore, the protocol makes it mandatory but easy to reference the definitions of all the terms and parameters in the data, hence overcoming one of the biggest issues with data exchange: namely that the precise meaning and provenance of the initial information is lost. This enables a huge improvement for reliability of analytics and AI systems which need to control the scope and quality of their input data. Furthermore, the protocol is being adopted by a very wide range of developers desiring a simple means to let their Apps interact with a variety of data sources.

Beyond interoperability, new challenges are appearing. The twin challenges of digital transformation *and* green transformation (counterbalancing climate-change) require more control by Citizens over their personal data and more sharing of (industrial) data along so-called value chains and in data spaces. All kinds of practical and commercial re-use of data requires tracking the accuracy and reliability of data, as well as the ownership and allowed re-use of the data, in verifiable ways – not only to detect "fake news" but also "badly collected data" or "incorrect attribution of data" which can lead to wrong or dangerous conclusions by humans or by AI systems.

The ISG CIM committee has neither all the required resources nor all the competencies to tackle all these aspects.

In addition, an acceleration of NGSI-LD adoption is appearing, especially in domains such as smart cities, agriculture, utilities. At the EU level, initiatives building upon NGSI-LD are appearing and need to be accompanied to allow proper understanding and adoption of the capabilities of NGSI-LD.

## Objectives of the work to be executed

This STF request concentrates on improving four aspects of data-handling:

1. leveraging and improving interoperability of existing information structures (ontologies and taxonomies) that already have value in society, smart community platforms and industry platforms
2. leveraging the NGSI-LD protocol for exchanging such data/metadata
3. providing guidelines and means to reliable and verifiable record and exchange data and especially the metadata about the data source and data processing (provenance information)
4. improving interworking with existing platforms for accessing Linked Open Data and for IoT data collection (e.g. oneM2M)

This effort is aimed at complementing on-going activities in the IoT domain and taking place in SmartM2M and oneM2M to provide a comprehensive set of specifications and guidelines to handle context information.

The timescale of the STF is voluntary short (11 months) to keep aligned with market pace adoption of data platforms.

## Previous funded activities in the same domain

There have not been any other STF funded activities for ISG CIM.

## Market impact

As implied by the "rationale" section, there is a huge social impact of data, in positive or negative ways, if the data is not reliable or not reliably used. We can literally no longer imagine modern life without digital data. In the very, very narrow sense of "what is the value-at-risk of the data exchanged, if it is inaccurate/wrong/not-findable?", there are valuation methodologies that can give guidance, but each valuation depends of course on the use case: see for example Deloitte ([link](https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Finance/Valuation-Data-Digital.pdf)) or PriceWaterhouseCoopers ([link](https://www.pwc.co.uk/data-analytics/documents/putting-value-on-data.pdf)). The monetary value in the USA of business intelligence (not google or facebook etc) was estimated to exceed $20 Billion last year ([link](https://www.gooddata.com/blog/data-driven-bi-market-expected-to-reach-265-billion-by-2021/)). Inside Europe, the EC JRC reported in 2019 that the total value of *services* across 6 ecosystems were valued at €124.87 billion for 2012 (last data available), and most of the services *rely on data* for coordinating, advertising, logistics, etc. ([link](https://ec.europa.eu/jrc/en/science-update/eu-ecosystem-services-valued-almost-125-billion-year)) For the whole OECD, one estimate for business value created in personal is around € 330 billion in 2020 ([link](https://www.researchgate.net/publication/329809061)).

The work from ISG CIM is gaining interest in several domains such as smart cities, agriculture and water management, from several initiatives in Europe such as the European Data Spaces, Gaia-X and also at the international level with the Indian Urban Data Exchange (IUDX) program sponsored by the Indian Central Government[[1]](#footnote-2) or the South-Korea[[2]](#footnote-3) building upon NGSI-LD for its smart city experimental program. Making the use of NGSI-LD more accessible and better aligned with current (global) practices for data usage and connectivity with external platforms, is the ultimate purpose of this STF.

## Consequences if not agreed

A small fraction of the work described in this STF request is possible within ISG CIM, however the key missing factor which ISG CIM members cannot supply is in-depth expertise in several of the external data modelling and data platform topics addressed in this STF as described in detail later in this report. Since the key goal of this STF is to leverage the ETSI work on NGSI-LD, to provide guidance on interworking with existing "digital ecosystems" in Europe, the disadvantage of not completing this STF is that interoperability remains fragmented and ETSI's role "at the heart of digital" is not fully realized. There is no specific "deadline" to realize the goals of the STF, however it is very clear that commercial and proprietary offerings will meanwhile proliferate (for example Microsoft is promoting their solutions for similar use cases discussed below).

# Relation with ETSI strategy and priorities

The activity to be performed by this STF directly relates to the ISG mission of enabling cross-domain interoperability of data sharing. It supports the ETSI Strategy ([link](https://www.etsi.org/images/files/Brochures/ETSI_Strategy-brochure.pdf)) mission to develop standards that enable a sustainable and securely connected society to:

* create high quality standards for global use and with low time-to-market, and
* establish leadership in key areas impacting members’ future activities.

This action is of strategic interest for ETSI because of the potential to attract new members in the SmartCity, SmartAgriculture domains and in particular organisations associated with ongoing large government projects in Europe as well as India, South Korea and Japan. A promotion of ETSI standards in those countries is also a strategic activity of ETSI.

This activity falls into the “Emerging domains for ETSI” criteria identified in [BOARD(19)123\_014](http://docbox.etsi.org/Board/2019_Board/BOARD(19)123_014_STF_priority_criteria_update.docx) as explained in the following table.

|  |  |
| --- | --- |
| **Priority Criteria** | **Rationale** |
| Maintenance of standards in mature domains |  |
| Innovation in mature domains |  |
| **Emerging domains for ETSI** | * **potential to attract new members in the SmartCity, SmartAgriculture domains** * **relates to large government “smart” projects in India, South Korea and Japan** |
| Horizontal activities (quality, security, etc.) |  |
| Societal good / environmental |  |

Note. 'Horizontal activities (quality, security, etc.)' also applies, because there is a need for showing the various verticals how to create interoperability in a multi-vendor, multi-provider, multi-operator, federated data ecosystem, based on ETSI standards.'

# ETSI Members Support

The following ETSI Members are supporting the request for this STF (minimum 4):

|  |  |  |
| --- | --- | --- |
| # | ETSI Member | Supporting delegate |
| 1 | NEC | Lindsay Frost |
| 2 | EGM | Franck Le Gall |
| 3 | ORANGE | Gilles Privat |
| 4 | CNIT | Giuseppe Tropea |
| 5 | KETI | SeungMyeong JEONG |
| 6 | UBIWHERE | Ricardo Vitorino |
| 7 | University of Murcia | Juan Antonio Martínez Navarro |
| 8 | FIWARE | Ken Gunnar Zangelin |

# Deliverables

## Base documents

|  |  |  |
| --- | --- | --- |
| Document | Title | Status |
| ETSI GS CIM 009 V1.5.1 | Context Information Management (CIM); NGSI-LD API | Draft (planned for publication 2021-10) |
| ETSI GS CIM 006 V1.1.1 (2019-07) | Context Information Management (CIM); Information Model | Published |
| GR CIM 007 | Context Information Management (CIM); Security and Privacy | Draft (planned for publication 2021-10) |
| oneM2M TS-0012-V3.7.3 (2019-02) | Base Ontology | Published |
| ETSI TS 103 264 V3.1.1 (2020-02) | SmartM2M;  Smart Applications;  Reference Ontology and oneM2M Mapping | Published |
| ETSI SR 003 680 V1.1.1 (2020-03) | SmartM2M;  Guidelines for Security, Privacy and  Interoperability in IoT System Definition;  A Concrete Approach | Published |
| ETSI TS 103 548 V1.1.2 (2020-06) | SmartM2M;  SAREF consolidation with new reference ontology patterns,  based on the experience from the SEAS project | Published |
| ETSI TS 103 673 V1.1.1 (2020-08) | SmartM2M;  SAREF Development Framework and Workflow,  Streamlining the Development of SAREF and its Extensions | Published |
| ETSI TS 103 485 V1.1.1 (2020-08) | CYBER; Mechanisms for privacy assurance and verification | Published |
| ETSI TS 119 182-1 V1.1.1 (2021-03) | Electronic Signatures and Infrastructures (ESI); JAdES digital signatures | Published |
| ETSI GR SAI 002 V1.1.1 (2021-08) | Securing Artificial Intelligence (SAI);  Data Supply Chain Security | Published |
| IETF RFC 7515 (2015605) | JSON Web Signature (JWS) | Proposed Standard RFC |
| EC D2.5Version 3.4 (2014-04) | INSPIRE Generic Conceptual Model | Published |

## New deliverables

|  |  |  |  |
| --- | --- | --- | --- |
| Deliv. | Work Item code  Standard number | Working title  Scope | Expected date for publication |
| D1 | DGR/CIM-0018 (GR CIM 018) | **Working title**: Enabling chain of trust from Content Sources to Content Consumers  **Scope**: survey and design technical means for enabling a chain of trust from Content Sources to Content Consumers that helps endorsing documents, by connecting or embedding verifiable credentials into NGSI-LD documents. | 2022-12-31 |
| D2 | DGS/CIM-0019 (GS CIM 019) | **Working title**: Handling of provenance information in NGSI-LD  **Scope**: definition, specification and documentation of solutions to verify integrity, and to precisely evaluate attribution and authenticity of NGSI-LD Context Information, throughout its lifecycle. | 2022-12-31 |
| D3 | DGR/CIM-0020 (GR CIM 020) | **Working title**: Guidelines for the deployment of Smart City and Communities data platforms  **Scope**: guidelines for the deployment of Smart City and Communities data platforms based on NGSI-LD context information management and its integration with other platform services (i.e. LOD publication, GIS interaction, IoT layer). | 2022-12-31 |
| D4 | DGR/CIM-0021 (GR CIM 021) | **Working title**: Usage of external data models with NGSI-LD API  **Scope**: selection of relevant and representative knowledge organisation systems, to provide an illustrative basis of data schemas and vocabularies relevant to be used in a NGSI-LD context. Illustration of their use with the NGSI-LD API in complex environments, such as system-of-system models for Digital Twins. Provide recommendations for changes or enhancements to the NGSI-LD specification (API and data model). | 2022-12-31 |
| D5 | DGR/CIM-0022 (GR CIM 022) | **Working title**: NGSI-LD/oneM2M interworking proxy proposal  **Scope**: analyse and propose a NGSI-LD/oneM2M interworking proxy, using existing oneM2M features. Where appropriate, provide recommendations to improve the interworking. | 2022-12-31 |

STF experts will be appointed as deliverables rapporteurs based on their allocated budget over the corresponding tasks.

# Maximum budget

## Task summary/Manpower Budget

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| Task short description | Budget (EUR) |
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| T0 - Project Management | 10 000 |
| T1 - Specification development for handling of provenance information in NGSI-LD | 27 000 |
| T2 - Develop guidelines for use of NGSI-LD in Smart cities and Communities (SCC) data platforms | 27 000 |
| T3 - Document usage of external taxonomies, data models and ontologies with NGSI-LD, including exploration of new approaches | 27 000 |
| T4 - Study possibilities and limitation of interworking of NGSI-LD on top of the oneM2M platform | 24 000 |
| TOTAL | 115 000 |

## Travel budget

An amount of 3 000€ is required for STF experts to participate in 2 or 3 **external** events.

Part II – Details on STF Technical Proposal

# Tasks, Technical Bodies and other stakeholders

## Organization of the work

ETSI will perform this work by the creation of an ETSI STF, reporting the milestones to the ETSI ISG CIM, according to the planned ISG meeting and additional dates agreed by the ISG officials. ISG CIM will have an active role providing technical guidance and contributing to this work.

The STF will report to the ISG CIM during Ordinary or Plenary meetings, on demand. The STF will have regular access to technical advice by attending rapporteur calls (currently weekly) for the NGSI-LD API.

An STF Steering Committee (STF-SC) and mailing list will be set up by STF in order to perform the steering of the STF, verifying progress and proposing intermediate reporting needs. The STF-SC will consist of

* ISG CIM Chair and Vice-Chairs,
* ETSI Secretariat Support Officer
* STF Leader (*after* selected),

The technical content described in section 7 relies on reviewing materials about external platforms and ontologies, which will be acquired and analysed through liaisons of ISG CIM, consultation, workshops, and close collaboration with some members of the main external organizations listed in sections 6.3 and 6.4.

In particular the STF will:

* organize periodic internal meetings of the STF to share the latest content produced
* organize periodic meetings with the STF-SC to consult on the latest advances
* attend the ISG CIM meetings and report on its activities, presenting drafts of the latest technical content produced for comments
* organize reviews of its draft documents by the stakeholders described in sections 6.3 and 6.4, in addition to the ISG CIM members
* organize workshop and participate to events with the scope to disseminate, facilitate and assist the understanding and the adoption of NGSI-LD by the industry and widespread the use of cross-domain data model and API for exchange of context information.

## Tasks for which the STF support is necessary

It has become apparent within ISG CIM that the identified acceleration in market adoption of the NGSI-LD specification needs to be accompanied with new specifications and usage guidelines to comply with emerging requirements related to increase usage of data platforms and data spaces over the world.

The ISG CIM cannot perform this additional work in a reasonable timeframe on the sole basis of voluntary resources.

## Other interested ETSI Technical Bodies

Interactions are foreseen with the following ETSI Reference Bodies:

* **ETSI TC SmartM2M**: interactions are foreseen to gain feedback from SmartM2M in respect to the use of SAREF and its cross-domain ontology within a NGSI-LD context. This will mostly take place in the context of task T2 and T3.
* **ETSI TC Cyber**: interactions will take place mostly in the context of the proposed task T1 for all topics related to security and privacy management.
* **ETSI ISG SAI**: will be consulted regarding threat surfaces for data-poisoning of AI systems and how secure provenance information can mitigate them

## Other stakeholders

* **oneM2M Partnership Project**: liaise results of Task4 and present by invitation to a oneM2M meeting
* **Coalition for provenance and authenticity** (c2pa.org): consult regarding their data and process models, as well as use of certificates
* **OGC**; consult regarding their data and API specification for geographical information systems
* **W3C**: consult regarding their data models for semantic web, as well as use of certificates and definition of Verifiable Credentials

other interesting groups for later consideration

* **ISO/IEC JTC1/SC 32** (Data management and interchange): in respect with the work being done on GQL Graph Query Language
* **AIOTI (the Alliance for the Internet of Things Innovation**: in particular AIOTI WG on Standardization (https://aioti.eu/wg\_standardisation/)

Part III: Execution of Work

# Work plan, time scale and resources

## Task description

5 Tasks are envisioned in this STF. except for Task T0 which deals with project management, all tasks are independent and target a different purpose. They are expected to run in parallel with slightly sequenced starting date to avoid management bottlenecks within ISG CIM.

### Task 0 – Project management

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| **Task 0 (T0)** | **Project management** |
| **Objectives** | 1. Technical lead of the STF  2. Manage the resources assigned to this project  3. Chair periodic meetings of the STF  4. Ensure that the project stays on track and meets all milestone delivery dates  5. Identify if/when there are impediments that may affect the delivery of the project at an early stage so that stakeholders can help mitigate potential risks |
| **Input** | * Periodic meetings of this STF, reflecting interactions (as shown below). * The tasks and schedule in this STF. |
| **Output** | * Progress reports, including report to the ISG CIM after each Steering Committee meeting summarizing the current status of this STF. * Intermediate reports to the STF Steering Committee * Final report |
| **Interactions** | The Steering Committee for this STF will be consulted for guidance throughout the STF. There will be regular interactions between the experts and the STF Steering Committee.  The ISG CIM will review the progress of the ToR tasks. |
| **Resources required** | Skills in agile project management, resource planning, reporting, and coordination |

### Task 1 - Specification development for handling of provenance information in NGSI-LD

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| **Task 1 (T1)** | **Specification development for handling of provenance information in NGSI-LD** |
| **Objectives** | Provide solutions to verify integrity, and to precisely evaluate attribution and authenticity of NGSI-LD Context Information, throughout its lifecycle. Design technical means for enabling a chain of trust from Content Sources to Content Consumers that helps endorsing documents, by connecting or embedding verifiable credentials into NGSI-LD documents.  Rationale: Until now there is no widespread approach for ensuring over federated systems the integrity and source of information elements. But this is absolutely needed for scalability of non-proprietary solutions and ensuring privacy-by-design and data interoperability within and across sectors'  The framework goal is to work in a decentralized way, enabling users to self-determine authenticity without the need to contact the issuers of the authenticity credentials, by using delegation chains, Distributed Ledgers or other decentralized technologies.  The specifications will try to harmonize a subset of W3C’s PROV standards with Linked Data signatures for JSON-LD (hence also NGSI-LD) messages. This will make possible to have a digital signature that includes provenance information too. Then it will define the methodology for having chains of signatures, when multiple Agents are processing data (creators and then processors). This will need a definition of how to handle merging of fragments, and their respective credentials, coming from multiple sources, into bigger verifiable entities, and will leverage the W3C Verifiable Credentials and the concept of Verifiable Presentation.  Existing NGSI-LD users such as smart cities and smart manufacturing will greatly benefit from a specification for handling provenance and authenticity information, but new use-cases for labelling and detection of false attribution, and a more decentralized approach for applications in eHealth, finance, insurance and social services would be possible, for instance.  Gaining insights about which Context Information is to be considered private will also be possible, but access control policies based on provenance and authenticity tags are outside of the scope of this work. |
| **Input** | The main input will be ISG GR CIM 007 'NGSI-LD Security and Privacy'  It will be completed by the following inputs which are of crucial relevance:   * Cryptographic digital signatures techniques for JSON, such as:   + IETF JSON Web Signatures (RFC7515)   + ETSI JAdES. (ETSI TS 119 182-1) * Cryptographic digital signatures techniques for JSON-LD from W3C’s proposed Linked Data Signatures Working Group (<https://w3c.github.io/lds-wg-charter/>) * W3C 'Verifiable Credentials Data Model 1.0' (see <https://www.w3.org/TR/vc-data-model/>) from Verifiable Credentials WG (<https://www.w3.org/2017/vc/>) * W3C PROV standard, which defines a data model, serializations, and definitions to support the interchange of provenance information on the Web (see PROV-Overview at <https://www.w3.org/TR/2013/NOTE-prov-overview-20130430/>) * eIDAS (electronic IDentification, Authentication and trust Services) EU regulation |
| **Output** | One report and one specification will be published:   * D1 (DGR/CIM-0018 GR CIM 018) to survey approaches for authenticity/verification and provenance, resulting in guidelines for using NGSI-LD to annotate the accuracy of information, also in aggregated data * D2 (DGS/CIM-0019 GS CIM 019) for a specification on Provenance, Authenticity and Accuracy using NGSI-LD |
| **Interactions** | Interaction with the ISG CIM will take place as needed and at least following the reporting process defined in §6.1.  In addition, interactions are expected to take place with:   * W3C Verifiable Credentials WG (<https://www.w3.org/2017/vc/>) * W3C Credentials Community Group ([https://www.w3.org/community/credentials/)](https://www.w3.org/community/credentials/) * Coalition for Content Provenance and Authenticity ([https://c2pa.org](https://c2pa.org/)) * OpenAttestation ([www.openattestation.com](http://www.openattestation.com)) |
| **Resources required** | Contributions from 1 to 2 experts with proven knowledge of NGSI-LD and expertise in data privacy and security are expected to cover that task.  The estimated effort is as follows:   * 4 person.weeks (p.w) for D1 (DGR/CIM-0018 GR CIM 018) including external reviews and a stakeholder workshop (including ISG CIM members) to collect stakeholder requirements' * 5 person.weeks for D2 (DGS/CIM-0019 GS CIM 019) drafting (including 2 p.w for defining the signature-function) |

### Task 2 - Develop guidelines for use of NGSI-LD in Smart cities and Communities (SCC) data platforms

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| **Task 2 (T2)** | **Develop guidelines for use of NGSI-LD in Smart cities and Communities (SCC) data platforms** |
| **Objectives** | The experience of mature standards shows that it is not enough to make good technical standard, it is essential to show how to use it.  The value proposition and applicability statements of NGSI-LD for the deployment of Interoperable European ecosystem of platforms and application for cities and communities will be refined and application guidelines will be drafted and disseminated considering both data model generation and API usage.  The analysis will consider the complementary approaches of the EIP SCC Reference architecture and design principles for urban platform, the OASC Minimum Interoperability Mechanisms. In addition, it will evaluate joint use and potential connectivity to other urban data platform components such as LOD (linked open data platforms), GIS (Geographical information Systems) and IoT platforms.  Rationale: cities and communities are facing the challenge of connecting their legacy systems (including GIS and internal information systems) to new one (e.g. IoT) and fulfil regulatory constraints such as providing (linked) open data access. |
| **Input** | An analysis of the current state of open offers for urban data platform will be realised. It will consider architectures and interoperability mechanisms (e.g. OASC Minimum Interoperability Mechanisms) as well as connectivity to assets of a urban data platform including LOD (Linked Open Data) publication mechanisms as well as connectivity with GIS (Geographical information Systems). Connectivity to IoT services will be included using outcomes of task T4.   * W3C Semantic web standards[[3]](#footnote-4) including linked data fragment interface[[4]](#footnote-5) * OGC specifications relevant for web based GIS services (e.g. WMS, netCDF)[[5]](#footnote-6), OGCAPI[[6]](#footnote-7) * Specifications relevant to Building information management in the urban area: OGC CityGML, Industry Foundation Classes (ISO 16739-1:2018) * IoT relevant specifications: oneM2M, OMA LwM2M |
| **Output** | The main expected output is a report D3 (DGR/CIM-0020 GR CIM 020) providing guidelines for the deployment of Smart City and Communities data platforms based on NGSI-LD context information management and its integration with other platform services (i.e. LOD publication, GIS interaction, IoT layer). The first part of the report D3 will provide a review of these services, the existing specifications and standards as well as known implementations. It will then derive guidelines for NGSI-LD based urban data platform deployments.  In addition, a synthetic booklet will be published in cooperation with ETSI Communications team and results presented in at least 1 public event. |
| **Interactions** | Interaction with the ISG CIM will take place as needed and at least following the reporting process defined in §6.1.  In addition, interactions are expected to take place with:   * OASC (open and agile Smart cities): to be consulted at least twice along the study. 1. to review the OASC Minimum interoperability mechanisms and 2. To get feedback upon produced recommendations * CEF (Connecting Europe Facility)[[7]](#footnote-8): to be consulted along the study for aspects related to transport, digital and energy infrastructure * Living-in.EU movement[[8]](#footnote-9): to be consulted in respect with interoperability frameworks for Smart cities and communities. |
| **Resources required** | Contributions from 1 to 2 experts with proven knowledge of NGSI-LD and expertise in SCC relevant standards, especially GIS and LOD, are expected to cover that task.  The estimated effort is as follows:   * 3 person.weeks for survey * 5 person.weeks for development of guidelines for usage of NGSI-LD in urban data platform * 1 person.weeks for dissemination and interactions |

### Task 3 - Usage of external data models with NGSI-LD API

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| **Task 3 (T3)** | **Usage of external data models with NGSI-LD API** |
| **Objectives** | There is a tremendous amount of data models being developed the needs of businesses in all verticals. The complexity of these models and the associated technologies can vary from simple tabular files (e.g. .csv) to complex OWL 2 ontologies. NGSI-LD aims at providing a cross-domain meta model based on property graphs together with an API to interact with context information.  The goal is to empower NGSI-LD users how to use various ontologies: it is not the intent to create new ontologies. The purpose of the study is to describe options to make use of external vocabularies, taxonomies, thesauri and ontologies within an NGSI-LD context and how to articulate them with the NGSI-LD graph-based meta-model and cross-domain ontology. Some are relatively simple, providing multi-lingual definitions of terms in a structure way. This is the case of the Agrovoc thesaurus based on SKOS. Others adds restrictions on the fields of a data model, such as defining the allowed data range of a data field. This is the case of the schema.org initiative. And others go further providing means for reasoning over the data structure which can provide means for data quality control, new properties discovery, etc. This is provided by e.g; OWL 2 ontologies.  It is thus required to make clear the potential of approaches listed above and illustrate their use within a NGSI-LD deployment to increase the usage of the cross-domain capabilities of NGSI-LD, by using working examples.  Rationale: understanding technicity of knowledge organisation systems is a strong entry barrier for cities and communities’ stakeholders being knowledgeable in their domain but not in data modelling aspects. Lowering these barrier is among the key objectives of the NGSI-LD specification. |
| **Input** | The work will be based on the following documents from ETSI ISG CIM expected to be available at the time of the study:   * ETSI GS CIM 009 V1.5.1 - Context Information Management (CIM);.NGSI-LD API - Draft (planned for publication 2021-10) * ETSI GS CIM 006 V1.1.1 - Context Information Management (CIM); Information Model - (Published) * [ETSI White paper #42 Guidelines for modelling with NGSI-LD](https://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp_42_NGSI_LD.pdf)   It will also consider the following models or specifications:   * Leverage the SAREF (SmartM2M): using of SAREF family of ontology as an example (e.g. SAREF4ENER) * Schema.org: illustrating how schemas can be used in conjunction with NGSI-LD models * INSPIRE directive: analysing the [INSPIRE model](https://inspire.ec.europa.eu/data-model/approved/r4618-ir/html/)[[9]](#footnote-10) * Agrovoc: analysing the use of the [agrovoc taxonomy](file:///C:/Users/flegall/AppData/Local/Temp/HYPERLINK%20%22https:/agrovoc.fao.org/%22%20https:/agrovoc.fao.org/)[[10]](#footnote-11) * SmartDataModels (collaborative activity from GSMA, TMForum, FIWARE): analysing the NGSI-LD models made available and the way they connect to other models * The Property Graph information model being specified by ISO/IEC JTC1 SC32/WG3 in association with their GQL (Graph Query Language) standard   The following activities are highly relevant but will be covered on a case-by-case decision   * OGC sensorthings[[11]](#footnote-12) * SSN SOSA ontology from W3C[[12]](#footnote-13) * European Initiatives such as   + [European Strategy for Data](https://digital-strategy.ec.europa.eu/en/policies/strategy-data)   + [International Data Space Association (IDSA)](https://internationaldataspaces.org), focusing on the relations with European data spaces   + [GAIA-X](https://www.data-infrastructure.eu/) |
| **Output** | A report D4 (DGR/CIM-0021 GR CIM 021) will be drafted and will contain, in its first part, a review of "relevant/important" taxonomies, thesauri, ontologies, etc. (models). The importance will be determined by the relevance in terms of market adoption level as well as technical differentiation for the purpose of identifying structures of models/taxonomies which NGSI-LD might be required to interwork with.  The second part of the report D4 will provide practical guidelines on how to (re)use external models in a NGSI-LD system for e.g. Smart City, Agriculture, environment, and other domains. A special analysis will be made on the benefits expected from the use of graph-based models to interact with and federate diverse models or to handle complex environments such as system of systems models for Digital Twins.  Recommendations for changes or enhancements for the NGSI-LD specification (API and data model) may be provided. |
| **Interactions** | Interaction with the ISG CIM will take place as needed and at least following the reporting process defined in §6.1.  In addition, interactions are expected to take place with:   * ETSI SmartM2M: to discuss alignment options between the NGSI-LD cross-domain model and the SAREF cross-domain ontology for IoT (Internet of Things)/M2M applications * Consultation of the Smartdatamodels[[13]](#footnote-14) initiative to review the recommendations |
| **Resources required** | Contributions from 1 to 2 experts with proven knowledge of property graph information models (used by most existing graph databases and the future GQL standard) and expertise in knowledge organisation systems based on data schemas and vocabularies are expected to cover that task. A knowledge of on-going standardisation activities for a graph query language (GQL) is a plus.  The estimated effort is as follows:   * 3 person.weeks on D4 (DGR/CIM-0021 GR CIM 021) for interacting with stakeholders, reviewing relevant ontologies and models, especially in domains of SmartCity and SmartAgriculture, * 4 person.weeks on D4 (DGR/CIM-0021 GR CIM 021) recommending how to use them in a NGSI-LD system * 2 person.weeks for interactions (before/after) and promotion of the work with stakeholders |

### Task 4 (T4) - Study possibilities and limitation of interworking of NGSI-LD on top of the oneM2M platform

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| **Task 4 (T4)** | **Study possibilities and limitation of interworking of NGSI-LD on top of the oneM2M platform** |
| **Objectives** | NGSI-LD API enables exchange of information (data and metadata i.e. context) between different systems. ISG CIM has identified M2M/IoT as a key data source for its use cases. oneM2M defines technical specifications for a M2M service layer which can be embedded within hardware and software to connect the wide range of devices worldwide with M2M application servers. The objective of this study is to analyse the interworking scheme when using NGSI-LD on top of a oneM2M platform, targeting wider dissemination of both standards. Work will be based on concrete examples considering deployments using Digital Twins and AI/ML in order to leverage current interests in the standardisation, implementation and research ecosystems.  Rationale: Some IoT systems which are using oneM2M are also using NGSI-LD, but with individual solutions, and it is more than time to (e.g. in EU projects like living-in.EU[[14]](#footnote-15), in India, and in S. Korea) |
| **Input** | * DGR/CIM-0010 Recommendations for NGSI-LD Interworking (schedules for publication 2012-10[[15]](#footnote-16) * oneM2M Drafting Rules. See http://www.onem2m.org/imagefiles/oneM2M-Drafting-Rules.pdf. * oneM2M TS-0001 (V2.6.0): "Function Architecture". * oneM2M TS-0012 (V1.0.0): "Base Ontology". * oneM2M TS-0033-V3.0.0 Interworking Framework (2019-04-03). See https://www.onem2m.org/images/files/deliverables/Release3/TS-0033-Interworking-Framework-V3\_0\_0.pdf   Examples:   * ETSI TS 118 114 V2.0.1 (2020-12); oneM2M; LWM2M Interworking (oneM2M TS-0014 version 2.0.1 Release 2A) * ETSI TS 118 124 V2.0.0 (2016-09); oneM2M; OIC Interworking (oneM2M TS-0024 version 2.0.0 Release 2) |
| **Output** | A report D5 (DGR/CIM-0022 GR CIM 022) will be drafted to provide an analysis and proposal for a NGSI-LD/oneM2M interworking proxy, using existing oneM2M features, plus recommendations if appropriate for TR or TS documents inside oneM2M to enable significantly better interworking, and if feasible a oneM2M TR draft in a format ready for submitting to oneM2M by joint members |
| **Interactions** | Interactions will mostly take place with the ETSI TC SmartM2M and the oneM2M members. |
| **Resources required** | Contributions from 1 to 2 experts with proven knowledge of NGSI-LD and oneM2M specifications are foreseen.  The estimated effort is as follows:   * 3 person.weeks for reviewing oneM2M recent specs * 2 person.weeks for attending oneM2M to understand "the players" and to promote the ideas through contributed presentations * 3 person.weeks to write the report D5 |

## Milestones

Milestone A – Initial detailed outline of deliverables available (early draft)

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| --- | --- | --- |
| Milestone | Description | Cut-Off Date |
| A | Early drafts (detailed outline and scopes) of deliverables D1, D2 and D4 are available | 2022-02-28 |
| Reference Body Deliverable | Early Drafts accepted by Reference Body ISG CIM.  Documents must be uploaded on the ISG CIM docbox at least two weeks before the start of the Ref. Body plenary |
| ETSI Deliverable | Progress Report of Milestone A approved by ISG CIM |

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| --- | --- | --- |
| Milestone | Description | Cut-Off Date |
| B | Stable drafts of deliverables D1, D2 and D4 available  Early draft of deliverable D3 is available | 2022-05-31 |
| Reference Body Deliverable | Stable and early drafts accepted by Reference Body ISG CIM  Documents must be uploaded on the ISG CIM docbox at least two weeks before the start of the Ref. Body plenary |
| ETSI Deliverable | Progress Report of Milestone B approved by Reference Body ISG CIM |

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| Milestone | Description | Cut-Off Date |
| C | Final drafts of deliverables D1, D2 and D4 are available  Stable draft of deliverable D3 is available  Early drafts of deliverables D5 are available | 2022-07-31 |
| Reference Body Deliverable | Final, stable and early drafts accepted by Reference Body ISG CIM  Documents must be uploaded on the ISG CIM docbox at least two weeks before the start of the Ref. Body plenary |
| ETSI Deliverable | Progress Report of Milestone C approved by Reference Body ISG CIM |

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| Milestone | Description | Cut-Off Date |
| D | Final drafts of deliverable D3 available  Stable drafts of deliverable D5 available | 2022-10-31 |
| Reference Body Deliverable | Final and stable drafts approved by Reference Body ISG CIM  Documents must be uploaded on the ISG CIM docbox at least two weeks before the start of the Ref. Body plenary |
| ETSI Deliverable | Progress Report of Milestone D approved by Reference Body ISG CIM |

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| Milestone | Description | Cut-Off Date |
| E | Deliverables D1, D2, D3, D4 and D5 published | 2022-12-31 |
| Reference Body Deliverable | All deliverables D1, D2, D3, D4 and D5 are published  Documents must be uploaded on the ISG CIM docbox at least two weeks before the start of the Ref. Body plenary |
| ETSI Deliverable | Final Report of Milestone E approved by Reference Body ISG CIM |

## Task summary

| Code | Task / Milestone | Target Date | | Estimated Cost (EUR) |
| --- | --- | --- | --- | --- |
| From | To |
| M0 | Start of work | 2022-02-01 |  |  |
| T0 | Project Management | 2022-02-01 | 2022-12-31 | 10 000 |
| T1 | Specification development for handling of provenance information in NGSI-LD | 2022-02-01 | 2022-07-31 | 27 000 |
| T2 | Develop guidelines for use of NGSI-LD in Smart cities and Communities (SCC) data platforms | 2022-05-01 | 2022-10-30 | 27 000 |
| T3 | Usage of external data models with NGSI-LD API | 2022-02-01 | 2022-07-31 | 27 000 |
| T4 | Study possibilities and limitation of interworking of NGSI-LD on top of the oneM2M platform | 2022-07-01 | 2022-11-30 | 24 000 |
| Milestone A | Initial detailed outline of deliverables D1, D2 and D4 (early draft) available  Progress report#1approved by ISG CIM | 2022-02-28 |  |  |
| Milestone B | Stable drafts of deliverables D1, D2 and D4 available  Initial detailed outline of deliverables D3 (early draft) available  Progress report#2 approved by ISG CIM | 2022-05-31 |  |  |
| Milestone C | Final drafts of deliverables D1, D2 and D4 approved by ISG CIM  Stable drafts of deliverable D3 available  Initial detailed outline of deliverables D5 (early draft) available  Progress report#3 approved by ISG CIM | 2022-07-31 |  |  |
| Milestone D | Final draft of deliverable D3 approved by ISG CIM  Stable draft of deliverable D5 available  Progress report#4 approved by ISG CIM | 2022-10-31 |  |  |
| Milestone  E | All deliverable published.  Final report approved by ISG CIM  STF Closed | 2022-12-31 |  |  |
|  | | | | 115 000 |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Task/ Mil. | J | F | M | A | M | J | J | A | S | O | N | D |
| M0 |  | X |  |  |  |  |  |  |  |  |  |  |
| T0 |  |  |  |  |  |  |  |  |  |  |  |  |
| T1 (D1, D2) |  | E |  |  | S |  | F |  |  |  |  | P |
| T2 (D3) |  |  |  |  | E |  | S |  |  | F |  | P |
| T3 (D4) |  | E |  |  | S |  | F |  |  |  |  | P |
| T4 (D5) |  |  |  |  |  |  | E |  | S |  | F | P |
| MA |  | X |  |  |  |  |  |  |  |  |  |  |
| MB |  |  |  |  | X |  |  |  |  |  |  |  |
| MC |  |  |  |  |  |  | X |  |  |  |  |  |
| MD |  |  |  |  |  |  |  |  |  | X |  |  |
| ME |  |  |  |  |  |  |  |  |  |  |  | X |

E: Early draft accepted by ISG CIM

S: Stable draft accepted by ISG CIM

F: Final draft approved by ISG CIM

P : Publication (of GS or GR) by ETSI

# Expertise required

It is expected that all STF participants have a basic knowledge of NGSI-LD specification, including both property graph and web service API.

Up to 4 participants will be selected to ensure the following mix of competences:

|  |  |
| --- | --- |
| **Priority** | **Qualifications and competences** |
| High | Data privacy and security in distributed architectures |
| High | Updated knowledge of the oneM2M specification, including the oneM2M base ontology and Interworking proxy definitions |
| High | Knowledge of the SmartM2M SAREF ontologies with experience on actual applications |
| High | GIS frameworks and specifications |
| High | LOD frameworks and specifications |
| High | Graph databases and property graph models |
| Medium | Smart city and community reference architectures |

Part IV: STF performance evaluation criteria

# Performance Indicators

|  |  |
| --- | --- |
| **Select relevant Performance indicators applicable for these ToR (X)** | |
| Contribution from ETSI Members to STF work | |
| Direct financial contribution (co-funding) |  |
| Support to the STF work (e.g., provision of test–beds, organization of workshops, events) | X |
| Steering Group meetings (number of meetings / participants / duration) | Minimum 2 |
| Number of delegates directly involved in the review of the deliverables | 3 |
| Contributions/comments received from other Reference Bodies | X |
|  |  |
| **Contribution from the STF to ETSI work** | |
| Contributions to Reference Body meetings (number of documents / meetings / participants) | 1 per month minimum |
| Contributions to other Reference Bodies | X |
| Presentations in workshops, conferences, stakeholder meetings | Minimum 3 |
|  |  |
| **Liaison with other stakeholders** | |
| Stakeholder participation in the project (category, business area) |  |
| Cooperation with other standardization bodies | X |
| Potential interest of new members to join ETSI | X (exploring new areas) |
| Liaison to identify requirements and raise awareness on ETSI deliverables | X (producing guidelines) |
| Comments received on drafts (e.g. on WEB site, mailing lists, etc.) |  |
|  |  |
| **Quality of deliverables** | |
| Approval of deliverables according to schedule | X |
| Respect of time scale, with reference to start/end dates in the approved ToR | X |
| Comments from Quality review by Reference Body | X |
| Comments from Quality review by ETSI Secretariat | X |

During the activity, the STF Leader shall collect the relevant information, as necessary to measure the performance indicators. The result will be presented in the Final Report.

# Document history

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Date | Author | Status | Comments |
| 0.0 | 2021-08-24 |  |  |  |
| 1.1 | 2021-09-03 | PG |  | Technical Officer Review for Board Consultation |
| 1.2 | 2021-09-08 | ETSI Secretariat |  | Update before Board submission |

1. India Urban Data Exchange (IUDX) - https://smartcities.gov.in/India\_Urban\_Data\_Exchange [↑](#footnote-ref-2)
2. Smart city national innovation and growth engine project - https://www.smartcities.kr/project/project.do#en\_intercep [↑](#footnote-ref-3)
3. https://www.w3.org/standards/semanticweb/ [↑](#footnote-ref-4)
4. https://linkeddatafragments.org/specification/triple-pattern-fragments/ [↑](#footnote-ref-5)
5. https://www.ogc.org/standards/ [↑](#footnote-ref-6)
6. https://ogcapi.ogc.org/ [↑](#footnote-ref-7)
7. https://cinea.ec.europa.eu/connecting-europe-facility/energy-infrastructure-connecting-europe-facility\_en [↑](#footnote-ref-8)
8. https://living-in.eu/ [↑](#footnote-ref-9)
9. https://inspire.ec.europa.eu/documents/inspire-generic-conceptual-model [↑](#footnote-ref-10)
10. https://agrovoc.fao.org/browse/agrovoc/en/ [↑](#footnote-ref-11)
11. <https://www.ogc.org/standards/sensorthings> [↑](#footnote-ref-12)
12. https://www.w3.org/TR/vocab-ssn/ [↑](#footnote-ref-13)
13. https://smartdatamodels.org/ [↑](#footnote-ref-14)
14. <https://living-in.eu/declaration#footnote8_k8ugfj1> [↑](#footnote-ref-15)
15. https://portal.etsi.org/webapp/WorkProgram/Report\_WorkItem.asp?WKI\_ID=57808 [↑](#footnote-ref-16)