



Context Information Management (CIM); NGSI-LD API

STANDARDS PREVIEW
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sst/b2156-8a9e-4406-8e66-a4fe539d58b5/etsi-gs-cim-009-v1.2.2-2020-02>

Disclaimer

The present document has been produced and approved by the cross-cutting Context Information Management (CIM) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG. It does not necessarily represent the views of the entire ETSI membership.

Reference

RGS/CIM-0009v122

Keywords

API, architecture, GAP, information model,
interoperability, smart city, WoT

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2020.

All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

3GPP™ and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

oneM2M™ logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

GSM® and the GSM logo are trademarks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	12
Foreword.....	12
Modal verbs terminology.....	12
Executive summary	12
Introduction	13
1 Scope	14
2 References	14
2.1 Normative references	14
2.2 Informative references.....	16
3 Definition of terms, symbols and abbreviations.....	17
3.1 Terms.....	17
3.2 Symbols.....	18
3.3 Abbreviations	19
4 Context Information Management Framework.....	19
4.1 Introduction	19
4.2 NGSI-LD Information Model.....	20
4.2.1 Introduction.....	20
4.2.2 NGSI-LD Meta Model.....	20
4.2.3 Cross Domain Ontology	21
4.2.4 NGSI-LD domain-specific models and instantiation.....	22
4.2.5 UML representation.....	23
4.3 NGSI-LD Architectural considerations	23
4.3.1 Introduction.....	23
4.3.2 Centralized architecture	24
4.3.3 Distributed architecture	24
4.3.4 Federated architecture	25
4.4 Core NGSI-LD @context.....	26
4.5 NGSI-LD Data Representation.....	27
4.5.1 NGSI-LD Entity Representation.....	27
4.5.2 NGSI-LD Property Representation.....	28
4.5.3 NGSI-LD Relationship Representation	28
4.5.4 Simplified Representation.....	29
4.5.5 Multi-Attribute Support	29
4.5.6 Temporal Representation of an Entity	29
4.5.7 Temporal Representation of a Property	29
4.5.8 Temporal Representation of a Relationship.....	30
4.5.9 Simplified Temporal Representation of an Entity	30
4.6 Data Representation Restrictions	30
4.6.1 Supported text encodings.....	30
4.6.2 Supported names.....	31
4.6.3 Supported data types for Values	31
4.6.4 Supported Entity Content.....	32
4.7 Geospatial Properties.....	32
4.7.1 GeoJSON Geometries.....	32
4.7.2 Representation of GeoJSON Geometries in JSON-LD	33
4.8 Temporal properties	33
4.9 NGSI-LD Query Language	34
4.10 NGSI-LD Geo-query language.....	37
4.11 NGSI-LD Temporal Query language	39
4.12 NGSI-LD Query pagination	40
5 API Operation Definition	40
5.1 Introduction	40

5.2	Data types	41
5.2.1	Introduction	41
5.2.2	Common members	41
5.2.3	@context	41
5.2.4	Entity	41
5.2.5	Property	42
5.2.6	Relationship	42
5.2.7	GeoProperty	43
5.2.8	EntityInfo	43
5.2.9	CsourceRegistration	43
5.2.10	RegistrationInfo	45
5.2.11	TimeInterval	45
5.2.12	Subscription	45
5.2.13	GeoQuery	47
5.2.14	NotificationParams	47
5.2.14.1	NotificationParams data type definition	47
5.2.14.2	Additional members	48
5.2.15	Endpoint	48
5.2.16	BatchOperationResult	48
5.2.17	BatchEntityError	49
5.2.18	UpdateResult	49
5.2.19	NotUpdatedDetails	49
5.2.20	EntityTemporal	49
5.2.21	TemporalQuery	49
5.3	Notification data types	50
5.3.1	Notification	50
5.3.2	CsourceNotification	50
5.3.3	TriggerReasonEnumeration	51
5.4	NGSI-LD Fragments	51
5.5	Common behaviours	52
5.5.1	Introduction	52
5.5.2	Error types	52
5.5.3	Error response payload body	52
5.5.4	JSON-LD validation	53
5.5.5	Default @context assignment	53
5.5.6	Operation execution	53
5.5.7	Term to URI expansion or compaction	53
5.5.8	JSON-LD Merge Patch Behaviour	54
5.5.9	Pagination Behaviour	54
5.6	Context Information Provision	55
5.6.1	Create Entity	55
5.6.1.1	Description	55
5.6.1.2	Use case diagram	55
5.6.1.3	Input data	55
5.6.1.4	Behaviour	55
5.6.1.5	Output data	56
5.6.2	Update Entity Attributes	56
5.6.2.1	Description	56
5.6.2.2	Use case diagram	56
5.6.2.3	Input data	56
5.6.2.4	Behaviour	56
5.6.2.5	Output data	57
5.6.3	Append Entity Attributes	57
5.6.3.1	Description	57
5.6.3.2	Use case diagram	57
5.6.3.3	Input data	57
5.6.3.4	Behaviour	57
5.6.3.5	Output data	58
5.6.4	Partial Attribute update	58
5.6.4.1	Description	58
5.6.4.2	Use case diagram	58
5.6.4.3	Input data	59

5.6.4.4	Behaviour	59
5.6.4.5	Output data	59
5.6.5	Delete Entity Attribute	59
5.6.5.1	Description	59
5.6.5.2	Use case diagram	60
5.6.5.3	Input data	60
5.6.5.4	Behaviour	60
5.6.5.5	Output data	61
5.6.6	Delete Entity	61
5.6.6.1	Description	61
5.6.6.2	Use case diagram	61
5.6.6.3	Input data	61
5.6.6.4	Behaviour	61
5.6.6.5	Output data	61
5.6.7	Batch Entity Creation	61
5.6.7.1	Description	61
5.6.7.2	Use case diagram	62
5.6.7.3	Input data	62
5.6.7.4	Behaviour	62
5.6.7.5	Output data	62
5.6.8	Batch Entity Creation or Update (Upsert)	63
5.6.8.1	Description	63
5.6.8.2	Use case diagram	63
5.6.8.3	Input data	63
5.6.8.4	Behaviour	63
5.6.8.5	Output data	64
5.6.9	Batch Entity Update	64
5.6.9.1	Description	64
5.6.9.2	Use case diagram	64
5.6.9.3	Input data	64
5.6.9.4	Behaviour	64
5.6.9.5	Output data	65
5.6.10	Batch Entity Delete	65
5.6.10.1	Description	65
5.6.10.2	Use case diagram	65
5.6.10.3	Input data	65
5.6.10.4	Behaviour	66
5.6.10.5	Output data	66
5.6.11	Create or Update Temporal Representation of an Entity	66
5.6.11.1	Description	66
5.6.11.2	Use case diagram	66
5.6.11.3	Input data	67
5.6.11.4	Behaviour	67
5.6.11.5	Output data	67
5.6.12	Add Attributes to Temporal Representation of an Entity	67
5.6.12.1	Description	67
5.6.12.2	Use case diagram	67
5.6.12.3	Input data	67
5.6.12.4	Behaviour	68
5.6.12.5	Output data	68
5.6.13	Delete Attribute from Temporal Representation of an Entity	68
5.6.13.1	Description	68
5.6.13.2	Use case diagram	68
5.6.13.3	Input data	68
5.6.13.4	Behaviour	69
5.6.13.5	Output data	69
5.6.14	Modify Attribute instance in Temporal Representation of an Entity	69
5.6.14.1	Description	69
5.6.14.2	Use case diagram	69
5.6.14.3	Input data	70
5.6.14.4	Behaviour	70
5.6.14.5	Output data	71

5.6.15	Delete Attribute instance from Temporal Representation of an Entity	71
5.6.15.1	Description	71
5.6.15.2	Use case diagram	71
5.6.15.3	Input data	71
5.6.15.4	Behaviour	71
5.6.15.5	Output data	72
5.6.16	Delete Temporal Representation of an Entity	72
5.6.16.1	Description	72
5.6.16.2	Use case diagram	72
5.6.16.3	Input data	72
5.6.16.4	Behaviour	72
5.6.16.5	Output data	73
5.7	Context Information Consumption	73
5.7.1	Retrieve Entity	73
5.7.1.1	Description	73
5.7.1.2	Use case diagram	73
5.7.1.3	Input data	73
5.7.1.4	Behaviour	73
5.7.1.5	Output data	74
5.7.2	Query Entities	74
5.7.2.1	Description	74
5.7.2.2	Use case diagram	74
5.7.2.3	Input data	74
5.7.2.4	Behaviour	75
5.7.2.5	Output data	75
5.7.3	Retrieve temporal evolution of an Entity	75
5.7.3.1	Description	75
5.7.3.2	Use case diagram	75
5.7.3.3	Input data	76
5.7.3.4	Behaviour	76
5.7.3.5	Output data	76
5.7.4	Query temporal evolution of Entities	77
5.7.4.1	Description	77
5.7.4.2	Use case diagram	77
5.7.4.3	Input data	77
5.7.4.4	Behaviour	78
5.7.4.5	Output Data	79
5.8	Context Information Subscription	79
5.8.1	Create Subscription	79
5.8.1.1	Description	79
5.8.1.2	Use case diagram	79
5.8.1.3	Input data	79
5.8.1.4	Behaviour	80
5.8.1.5	Output data	80
5.8.2	Update Subscription	80
5.8.2.1	Description	80
5.8.2.2	Use case diagram	80
5.8.2.3	Input data	81
5.8.2.4	Behaviour	81
5.8.2.5	Output data	82
5.8.3	Retrieve Subscription	82
5.8.3.1	Description	82
5.8.3.2	Use case diagram	82
5.8.3.3	Input data	82
5.8.3.4	Behaviour	82
5.8.3.5	Output data	82
5.8.4	Query Subscriptions	83
5.8.4.1	Description	83
5.8.4.2	Use case diagram	83
5.8.4.3	Input data	83
5.8.4.4	Behaviour	83
5.8.4.5	Output data	83

5.8.5	Delete Subscription.....	83
5.8.5.1	Description.....	83
5.8.5.2	Use case diagram	83
5.8.5.3	Input data	84
5.8.5.4	Behaviour	84
5.8.5.5	Output data.....	84
5.8.6	Notification behaviour	84
5.9	Context Source Registration.....	85
5.9.1	Introduction.....	85
5.9.2	Register Context Source	85
5.9.2.1	Description	85
5.9.2.2	Use case diagram	85
5.9.2.3	Input data	86
5.9.2.4	Behaviour.....	86
5.9.2.5	Output data.....	86
5.9.3	Update Context Source Registration.....	86
5.9.3.1	Description	86
5.9.3.2	Use case diagram	87
5.9.3.3	Input data	87
5.9.3.4	Behaviour.....	87
5.9.3.5	Output data.....	87
5.9.4	Delete Context Source Registration.....	88
5.9.4.1	Description	88
5.9.4.2	Use case diagram	88
5.9.4.3	Input data	88
5.9.4.4	Behaviour.....	88
5.9.4.5	Output data.....	88
5.10	Context Source Discovery.....	88
5.10.1	Retrieve Context Source Registration.....	88
5.10.1.1	Description	88
5.10.1.2	Use case diagram	89
5.10.1.3	Input data	89
5.10.1.4	Behaviour.....	89
5.10.1.5	Output data.....	89
5.10.2	Query context source registrations.....	89
5.10.2.1	Description	89
5.10.2.2	Use case diagram	90
5.10.2.3	Input data	90
5.10.2.4	Behaviour.....	90
5.10.2.5	Output data.....	91
5.11	Context Source Registration Subscription.....	91
5.11.1	Introduction.....	91
5.11.2	Create Context Source Registration Subscription.....	92
5.11.2.1	Description	92
5.11.2.2	Use case diagram	92
5.11.2.3	Input data	92
5.11.2.4	Behaviour.....	92
5.11.2.5	Output data.....	93
5.11.3	Update Context Source Registration Subscription.....	93
5.11.3.1	Description	93
5.11.3.2	Use case diagram	93
5.11.3.3	Input data	94
5.11.3.4	Behaviour.....	94
5.11.3.5	Output data.....	94
5.11.4	Retrieve Context Source Registration Subscription.....	94
5.11.4.1	Description	94
5.11.4.2	Use case diagram	94
5.11.4.3	Input data	94
5.11.4.4	Behaviour.....	95
5.11.4.5	Output data.....	95
5.11.5	Query Context Source Registration Subscriptions.....	95
5.11.5.1	Description.....	95

5.11.5.2	Use case diagram	95
5.11.5.3	Input data	95
5.11.5.4	Behaviour	95
5.11.5.5	Output data	96
5.11.6	Delete Context Source Registration Subscriptions	96
5.11.6.1	Description	96
5.11.6.2	Use case diagram	96
5.11.6.3	Input data	96
5.11.6.4	Behaviour	96
5.11.6.5	Output data	96
5.11.7	Notification behaviour	97
5.12	Matching Context Source Registrations	97
6	API HTTP binding	98
6.1	Introduction	98
6.2	Global definitions and resource structure	98
6.3	Common behaviours	102
6.3.1	Introduction	102
6.3.2	Error types	102
6.3.3	Reporting errors	102
6.3.4	HTTP request preconditions	102
6.3.5	JSON-LD @context resolution	103
6.3.6	HTTP response common requirements	104
6.3.7	Simplified representation of entities	104
6.3.8	Notification behaviour	104
6.3.9	Csource Notification behaviour	104
6.3.10	Pagination behaviour	104
6.3.11	Including system-generated attributes	105
6.3.12	Simplified temporal representation of entities	105
6.4	Resource: entities/	105
6.4.1	Description	105
6.4.2	Resource definition	106
6.4.3	Resource methods	106
6.4.3.1	POST	106
6.4.3.2	GET	106
6.5	Resource: entities/{entityId}	108
6.5.1	Description	108
6.5.2	Resource definition	108
6.5.3	Resource methods	108
6.5.3.1	GET	108
6.5.3.2	DELETE	109
6.6	Resource: entities/{entityId}/attrs/	109
6.6.1	Description	109
6.6.2	Resource definition	110
6.6.3	Resource methods	110
6.6.3.1	POST	110
6.6.3.2	PATCH	111
6.7	Resource: entities/{entityId}/attrs/{attrId}	111
6.7.1	Description	111
6.7.2	Resource definition	111
6.7.3	Resource methods	112
6.7.3.1	PATCH	112
6.7.3.2	DELETE	112
6.8	Resource: csourceRegistrations/	113
6.8.1	Description	113
6.8.2	Resource definition	113
6.8.3	Resource methods	113
6.8.3.1	POST	113
6.8.3.2	GET	114
6.9	Resource: csourceRegistrations/{registrationId}	116
6.9.1	Description	116
6.9.2	Resource definition	116

6.9.3	Resource methods.....	116
6.9.3.1	GET.....	116
6.9.3.2	PATCH	117
6.9.3.3	DELETE	118
6.10	Resource: subscriptions/.....	118
6.10.1	Description.....	118
6.10.2	Resource definition.....	118
6.10.3	Resource methods.....	118
6.10.3.1	POST.....	118
6.10.3.2	GET.....	119
6.11	Resource: subscriptions/{subscriptionId}	120
6.11.1	Description.....	120
6.11.2	Resource definition.....	120
6.11.3	Resource methods.....	120
6.11.3.1	GET.....	120
6.11.3.2	PATCH	121
6.11.3.3	DELETE	122
6.12	Resource: csourceSubscriptions/.....	122
6.12.1	Description.....	122
6.12.2	Resource definition.....	123
6.12.3	Resource methods.....	123
6.12.3.1	POST.....	123
6.12.3.2	GET.....	123
6.13	Resource: csourceSubscriptions/{subscriptionId}.....	124
6.13.1	Description.....	124
6.13.2	Resource definition.....	124
6.13.3	Resource methods.....	125
6.13.3.1	GET.....	125
6.13.3.2	PATCH	125
6.13.3.3	DELETE	126
6.14	Resource: entityOperations/create.....	126
6.14.1	Description.....	126
6.14.2	Resource definition.....	127
6.14.3	Resource methods.....	127
6.14.3.1	POST.....	127
6.15	Resource: entityOperations/insert.....	127
6.15.1	Description.....	127
6.15.2	Resource definition.....	127
6.15.3	Resource methods.....	128
6.15.3.1	POST.....	128
6.16	Resource: entityOperations/update.....	128
6.16.1	Description.....	128
6.16.2	Resource definition.....	128
6.16.3	Resource methods.....	129
6.16.3.1	POST.....	129
6.17	Resource: entityOperations/delete.....	129
6.17.1	Description.....	129
6.17.2	Resource definition.....	129
6.17.3	Resource methods.....	130
6.17.3.1	POST.....	130
6.18	Resource: temporal/entities/.....	130
6.18.1	Description.....	130
6.18.2	Resource definition.....	130
6.18.3	Resource methods.....	130
6.18.3.1	POST.....	130
6.18.3.2	GET.....	131
6.19	Resource: temporal/entities/{entityId}	133
6.19.1	Description.....	133
6.19.2	Resource definition.....	133
6.19.3	Resource methods.....	133
6.19.3.1	GET.....	133
6.19.3.2	DELETE	134

6.20	Resource: temporal/entities/{entityId}/attrs/	135
6.20.1	Description.....	135
6.20.2	Resource definition	135
6.20.3	Resource methods	135
6.20.3.1	POST.....	135
6.21	Resource: temporal/entities/{entityId}/attrs/{attrId}.....	136
6.21.1	Description.....	136
6.21.2	Resource definition	136
6.21.3	Resource methods	136
6.21.3.1	DELETE	136
6.22	Resource: temporal/entities/{entityId}/attrs/{attrId}/ {instanceId}	137
6.22.1	Description.....	137
6.22.2	Resource definition	137
6.22.3	Resource methods	138
6.22.3.1	PATCH	138
6.22.3.2	DELETE	138
Annex A (normative):	NGSI-LD identifier considerations	140
A.1	Introduction	140
A.2	Entity identifiers	140
A.3	NGSI-LD namespace	140
Annex B (normative):	Core NGSI-LD @context definition.....	141
Annex C (informative):	Examples of using the API.....	144
C.1	Introduction	144
C.2	Entity Representation	144
C.2.1	Property Graph	144
C.2.2	Vehicle Entity.....	145
C.2.3	Parking Entity.....	146
C.2.4	@context	147
C.3	Context Source Registration.....	147
C.4	Context Subscription	148
C.5	HTTP REST API Examples	149
C.5.1	Introduction	149
C.5.2	Create Entity of Type Vehicle	149
C.5.2.1	HTTP Request	149
C.5.2.2	HTTP Response	149
C.5.3	Query Entities.....	149
C.5.3.1	Introduction.....	149
C.5.3.2	HTTP Request	149
C.5.3.3	HTTP Response	150
C.5.4	Query Entities (Pagination)	150
C.5.4.1	Introduction.....	150
C.5.4.2	HTTP Request	150
C.5.4.3	HTTP Response	150
C.5.5	Temporal Query	151
C.5.5.1	Introduction.....	151
C.5.5.2	HTTP Request	151
C.5.5.3	HTTP Response	151
C.5.6	Temporal Query (Simplified Representation)	151
C.5.6.1	Introduction.....	151
C.5.6.2	HTTP Request	152
C.5.6.3	HTTP Response	152
C.6	Date Representation	152
C.7	@context utilization clarifications	153

C.8	Link header utilization clarifications.....	155
C.9	@context processing clarifications.....	156
Annex D (informative):	Transformation Algorithms.....	158
D.1	Introduction	158
D.2	Algorithm for transforming an NGSI-LD Entity into a JSON-LD document (ALG1).....	158
D.3	Algorithm for transforming an NGSI-LD Property into JSON-LD (ALG1.1)	159
D.4	Algorithm for transforming an NGSI-LD Relationship into JSON-LD (ALG1.2).....	160
Annex E (informative):	RDF-compatible specification of NGSI-LD meta-model.....	161
Annex F (informative):	Conventions and syntax guidelines.....	162
Annex G (informative):	Change history	163
History		164

iTeh STANDARD PREVIEW
 (standards.iteh.ai)
 Full standard:
<https://standards.iteh.ai/catalog/standards/sist/fb299156-8a9e-4406-8e66-a4fe539d58b5/etsi-gs-cim-009-v1.2.2-2020-02>

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) cross-cutting Context Information Management (CIM).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Executive summary

The present document formally describes the Context Information Management API (NGSI-LD) Specification. The Context Information Management API allows users to provide, consume and subscribe to context information in multiple scenarios and involving multiple stakeholders. It enables close to real-time access to information coming from many different sources (not only IoT data sources).

Introduction

The present document defines the Context Information Management API Specification. The Context Information Management API allows users to provide, consume and subscribe to context information in multiple scenarios and involving multiple stakeholders. The ongoing status of the NGSI-LD API can be found in [i.17].

The ETSI ISG CIM has decided to give the name "NGSI-LD" to the Context Information Management API. The rationale is to reinforce the fact that the present document leverages on the former OMA NGSI 9 and 10 interfaces [i.3] and FIWARE NGSIv2 [i.9] to incorporate the latest advances from Linked Data.

The present document provides additions and corrections to the ETSI GS CIM 004 [i.16] preliminary API specification, based on feedback about ETSI GS CIM 004 [i.16] received from other SDOs as well as developers in the linked-data, internet-of-things, and mobile-apps and smart-applications communities, as well as from end users and stakeholders. In particular, open issues and proposed features in annexes of the referred ETSI GS CIM 004 [i.16] document have been addressed or added respectively.

Most of the NGSI-LD API and the ETSI ISG CIM information model work referenced here was created with the support of the following European Union Horizon 2020 research projects: No. 732851 (FI-NEXT), No. 723156 (WISE-IoT), No. 732240 (SynchroniCity), No. 731993 (AutoPilot), No. 814918 (Fed4IoT), No. 779852 (IoT-Crawler), and No. 731884 (IoF2020).

ETSI STANDARD PREVIEW
(standards.iteh.ai)
Full standard:
<https://standards.iteh.ai/catalog/standards/sist/fb299156-8a9e-4406-8e66-a4fe539d58b5/etsi-gs-cim-009-v1.2.2-2020-02>