



IoT Big Data Harmonised Data Model

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1 Introduction

1.1 Overview

Data interoperability has been identified 1 as a technical barrier that prohibits the realisation of the full potential value of IoT Big Data. To help address that problem, in this document data models are defined of entities or things that are commonly used in IoT Big Data applications. The definitions of the data entities have been developed through contributions from participating mobile operators and aligned with existing industry work and namespaces where possible, for example, oneM2M in Smart Home 2, OASC for Smart Cities 3 and schema.org 4 for generic entities.

These collaboratively developed harmonised data models, together with the accompanying documents “IoT Big Data Framework Architecture” [9] and “IoT Big Data NGSiv2 Profile” [10], aim to define a framework of how mobile operators can approach the delivery of IoT Big Data services.

All sections and appendixes, except “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

1.2 Scope

This document specifies harmonised data models that are approved for use by all the participants of the IoT Big Data Ecosystem Project.

The harmonised data models are expected to evolve over time, potentially new entities will be added and entity definitions changed. The harmonised entity definitions defined within this document will be published and accessible via the GSMA IoT Big Data API Directory and will be developed and maintained in a collaborative manner. Contributions are welcome from the wider IoT community to develop and update the data entities. In the short to medium term, these changes will be managed through the standard GSMA PRD process with the IoT Big Data project Technology Group being the approval authority.

1.3 Abbreviations

Term	Description
3D	Three Dimensional
CAM	Computer Aided Manufacturing
CNC	Computer Numerical Control
DTC	Diagnostic Trouble Codes
GPC	Global Product Classification
GTIN	Global Trade Item Number
IoT	Internet of Things
IoTBD	Internet of Things Big Data
JSON	JavaScript Object Notation
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
URL	Uniform Resource Locator
US EPA	United States Environmental Protection Agency

Term	Description
UTC	Universal Time Coordinated
UV	Ultra Violet
VIN	vehicle identification number

1.4 Unit Codes

Unit Code	Description
CEL ^[11]	Degree Celsius
FTU ^[11]	Formazin Turbidity Unit
GQ ^[11]	microgram per cubic metre
H29 ^[11]	microgram per litre
kg	kilogrammes
KMT ^[11]	kilometres
kW/m ²	kilo watts per square metre
M1 ^[11]	milligramper litre
mg/L	milligrams per litre
m/s	meters per second
mV	milliVolts
ppb	parts per billion
ppt	parts per thousand
ppm	parts per million
RFU ^[11]	relative fluorescence units
SMI ^[11]	Miles
S/m	Siemens per meter

1.5 References

Ref	Doc Number	Title
1.		Unlocking the Value of IoT Through Big Data. http://www.gsma.com/connectedliving/unlocking-the-value-of-iot-through-big-data/
2.	oneM2M	http://www.onem2m.org/
3.	OASC	http://oascities.org/
4.	Schema.org	http://schema.org/
5.	JSON	http://www.json.org/
6.	FIWARE NGSIv2	FIWARE-NGSIv2 Specification available at http://fiware.github.io/specifications/ngsiv2/stable/
7.	FIWARE DataModels	http://fiware-datamodels.readthedocs.io/en/latest/

Ref	Doc Number	Title
8.	Lower camel case	https://en.wikipedia.org/wiki/CamelCase
9.	GSMA PRD CLP.25	IoT Big Data Framework Architecture
10.	GSMA PRD CLP.24	IoT Big Data NGSIv2 Profile
11.	UN/CEFA CT Unit Codes	https://www.unece.org/fileadmin/DAM/cefact/recommendations/rec20/rec20_r ev3_Annex2e.pdf

2 Harmonised Data Models

2.1 Vertical Segments

The harmonised data entities contained in this document originate from and are used in the following industry verticals (or IoT Domains):

1. Agriculture
2. Automotive
3. Environment
4. Industry
5. Smart City
6. Smart Home

The data entity definitions include a list of the applicable industry verticals to assist with entity classification and discovery.

2.2 Attribute types

Attribute types used within this document broadly follow the JSON (JavaScript Object Notation) type specification 5, the NGSIv2 6 type specification and the schema.org type specification 4 as tabulated below:

Attribute Type name	Usage
List	An ordered list of values that are referenced by numerical index. Lists
Boolean	Logical value of true or false .
Date	A sequence of characters using ISO 8601 encoding to represent a Date. https://schema.org/Date
DateTime	A sequence of characters using ISO 8601 encoding to represent a timestamp (date plus time). https://schema.org/DateTime

ExtQuantitativeValue	An extended collection of key value pairs describing a point value characteristic of an entity. Specifically adding a timestamp (the date and time or the observation) to the existing Quantitative Value as defined by schema.org. (https://schema.org/QuantitativeValue)
geo:json	Defines a location specified using geo:json encoding. (https://tools.ietf.org/html/rfc7946)
Number	An integer or floating point number. (https://schema.org/Number)
Offer	An offer definition for goods or services as defined by schema.org. (https://schema.org/Offer)
Organization	An organisation definition as defined by schema.org. (https://schema.org/Organization)
Person	A person definition as defined by schema.org. (https://schema.org/Person)
Place	A place definition as defined by schema.org. (https://schema.org/Place)
PostalAddress	A Postal Address of an item as defined by schema.org. (https://schema.org/PostalAddress)
Product	A product definition as defined by schema.org. (https://schema.org/Product)
QuantitativeValue	A collection of key value pairs describing a point value characteristic of an entity or attribute as defined by schema.org. (https://schema.org/QuantitativeValue)
Reference	A sequence of characters which represents a reference to another entity.
StructuredValue	A collection of key value pairs. Values may themselves be a Text, Number, Boolean, Array, StructuredValue or DateTime as defined by schema.org. (https://schema.org/StructuredValue)
Text	A sequence of characters. (https://schema.org/Text)
Time	A sequence of characters using ISO 8601 encoding to represent a Time. (https://schema.org/Time)
URL	A sequence of characters. Defining a URL. (https://schema.org/URL)

In addition, all the entities defined in this document are valid attribute types.

2.2.1 ExtQuantitativeValue Attribute type

The ExtQuantitativeValue attribute type is defined below:

Property	Expected Type	Description
Properties from <u>ExtQuantitativeValue</u>		
<u>additionalProperty</u>	<u>PropertyValue</u>	A property-value pair representing an additional characteristics of the entity, e.g. a product feature or another characteristic for which there is no matching property in schema.org. Note: Publishers should be aware that applications designed to use specific schema.org properties (e.g. <u>http://schema.org/width</u> , <u>http://schema.org/color</u> , <u>http://schema.org/gtin13</u> , ...) will typically expect such data to be provided using those properties, rather than using the generic property/value mechanism.
<u>maxValue</u>	<u>Number</u>	The upper value of some characteristic or property.
<u>minValue</u>	<u>Number</u>	The lower value of some characteristic or property.
<u>timestamp</u> *	<u>DateTime</u>	The ISO8601 sequence of characters at which date and time the observation was made in UTC.
<u>unitCode</u>	<u>Text</u> <u>URL</u>	or The unit of measurement given using the UN/CEFACT Common Code (3 characters) or a URL. Other codes than the UN/CEFACT Common Code may be used with a prefix followed by a colon.
<u>unitText</u>	<u>Text</u>	A string or text indicating the unit of measurement. Useful if you cannot provide a standard unit code for <u>unitCode</u> .
<u>value</u>	<u>Boolean</u> <u>Number</u> <u>StructuredValue</u> <u>Text</u>	or or or The value of the quantitative value or property value node. <ul style="list-style-type: none"> For <u>QuantitativeValue</u> and <u>MonetaryAmount</u>, the recommended type for values is 'Number'. For <u>PropertyValue</u>, it can be 'Text;', 'Number', 'Boolean', or 'StructuredValue'.
<u>valueReference</u>	<u>Enumeration</u> <u>PropertyValue</u> <u>QualitativeValue</u> <u>QuantitativeValue</u> <u>StructuredValue</u>	or or or or A pointer to a secondary value that provides additional information on the original value, e.g. a reference temperature.

*the timestamp field is the only additional property to the schema.org QuantitativeValue

The ExtQuantitativeValue attribute type has an equivalent format rendered using NGSiv2 attribute value and metadata, the alternate format, equivalence and compatibility are explained in further details in Annex A

2.3 Generic Entity Data Model

This generic entity Data Model enables each instance of an entity or thing to be uniquely described using an agreed set of harmonised attributes in a uniform and consistent way. All the entities defined in this section are normative.

In this document we follow this entity definition convention:

Common mandatory attributes are always presented first and by definition are included in all entities. These are followed by entity specific mandatory attributes and finally entity specific optional attributes. Attribute naming will follow the lower camel case convention 8. Generic entity definitions are taken from the schema.org 3 vocabulary wherever possible.

<Entity Name><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity. A globally unique reference to this entity instance. It is recommended ids comply with RFC4122.	M	N
type	Text	The type of the entity. A choice of one of the entity types defined in this document.	M	N
dateCreated	DateTime	Entity creation timestamp. This will usually be allocated by the storage platform.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity. This will usually be allocated by the storage platform. A null value in this field or a value equivalent to dateCreated means the entity has not been modified since being created.	O	Y
source	URL	A sequence of characters giving the original source of the entity data as a URL. Recommended to be the fully qualified domain name of the source provider, or the URL to the source object.	R	Y
dataProvider	Text	A sequence of characters identifying the provider of the harmonised data entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits	R	Y

		representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"		
--	--	---	--	--

In addition to the generic entity attributes which are common to all entities, there are a set of entity specific attributes. In this document the entity specific attributes are listed for convenience in a separate table per entity as shown below:

<Entity Name><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
specificMan1	A valid attribute type	Some text describing a mandatory attribute which may not be null.	M	N
specificOptN	A valid attribute type	Some text describing an optional attribute which may be null.	O	Y

The combination of <Entity Name><Generic Attributes> and <Entity Name><Entity Specific Attributes> provides the definition of the complete harmonised data model of an Entity.

Note: That individual data providers may provide extensions to the harmonised data model which are specific to their implementations/ markets. Applications should therefore be written to accept additional attributes without throwing an error, and developers should consult implementation notes from data publishers to see if there are any extensions available to the harmonised data models.

2.3.1 AgriCrop

This entity contains a harmonised description of a generic crop. This entity is primarily associated with the agricultural vertical and related IoT applications.

<AgriCrop><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "AgriCrop".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	URL	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriCrop><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name of this crop.	M	N
alternateName	Text	An alternative name for this crop.	O	Y
description	Text	A description of this crop.	R	Y
refAgriSoil	List of Reference	A List containing a JSON encoded sequence of characters that reference the unique Ids of the recommended soil(s).	O	Y
refAgriFertilizer	List of Reference	A List containing a JSON encoded sequence of characters that reference the unique Ids of the	O	Y

		recommended fertiliser product(s).		
refAgriPest	List of Reference	A List containing a JSON encoded sequence of characters that reference the unique Ids of the pest(s) known to attack this crop.	O	Y
plantingFrom	List	A List containing a JSON encoded sequence of characters of the recommended planting interval date(s) for this crop. Using The ISO8601 sequence of characters for each repeating date interval: interval, description Where interval is in the form of start date/end date --MM-DD/--MM-DD Meaning repeat each year from this start date to this end date.	O	Y
harvestingInterval	List	A list containing a JSON encoded sequence of characters of the recommended harvesting interval date(s) for this crop. Using The ISO8601 sequence of characters for each repeating date interval: interval , description Where interval is in the form of start date/end date --MM-DD/--MM-DD Meaning repeat each year between the specified start date and the specified end date.	O	Y
wateringFrequency	Text	A description of the recommended watering schedule. A choice from an enumerated list. One of: daily, weekly, biweekly, monthly, onDemand, other	O	Y

2.3.1.1 AgriCrop JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/c02633ceaab7f18afd489b559d2ab0f4>

```
{
  "id": "df72dc57-1eb9-42a3-88a9-8647ecc954b4",
  "type": "AgriCrop",
  "dateCreated": {
    "value": "2016-08-22T19:20+00:00",
    "type": "DateTime"
  },
  "dateModified": {
```

```
    "value": "2016-08-22T19:20+00:00",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "value": "Wheat",
    "type": "Text"
  },
  "alternateName": {
    "value": "Triticum aestivum",
    "type": "Text"
  },
  "description": {
    "value": "Spring wheat",
    "type": "Text"
  },
  "refAgriSoil": {
    "value": [
      "00411b56-bd1b-4551-96e0-a6e7fde9c840",
      "e8a8389a-edf5-4345-8d2c-b98ac1ce8e2a"
    ],
    "type": "List"
  },
  "refAgriFertilizer": {
    "value": [
      "1b0d6cf7-320c-4a2b-b2f1-4575ea850c73",
      "380973c8-4d3b-4723-a899-0c0c5cc63e7e"
    ],
    "type": "List"
  },
  "refAgriPest": {
    "value": [
      "10b52f07-079a-4390-8237-bf6a1c049a85",
      "66bdb09b-4fe0-4932-a267-f9eda4474d2a"
    ],
    "type": "List"
  },
  "plantingFrom": {
    "value": [
      "-09-28/-10-12, Best Season",
      "-10-11/-10-18, Season OK"
    ],
  },
```

```
    "type": "List"  
  },  
  "harvestingInterval": {  
    "value": [  
      "-03-21/-04-01, Best Season",  
      "-04-02/-04-15, Season OK"  
    ],  
    "type": "List"  
  },  
  "wateringFrequency": {  
    "value": "weekly",  
    "type": "Text"  
  }  
}
```

2.3.2 AgriGreenHouse

This entity contains a harmonised description of the conditions recorded within a generic greenhouse, a type of AgriParcel. This entity is primarily associated with the agricultural vertical and related IoT applications.

<AgriGreenHouse><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " AgriGreenHouse "	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	URL	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriGreenHouse><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refAgriParcel	Reference	Reference to the Unique id of the AgriParcel to which this record relates.	M	N
refWeatherObserved	Reference	A JSON encoded sequence of characters that reference the unique id of the related weather observed record.	O	Y
relativeHumidity	ExtQuantitativeValue (Number)	The inside relative humidity expressed as a number between 0 and 1 representing the range 0% to	R	Y

		100 (%). $0 \leq \text{relativeHumidity} \leq 1$ Encoded as a ExtQuantitativeValue		
refAgriParcelRecord	List of Reference	Related AgriParcelRecords for this greenhouse.	O	Y
leafTemperature	ExtQuantitativeValue(Number)	The average greenhouse air temperature in degrees centigrade. Encoded as a ExtQuantitativeValue.	R	Y
co2	ExtQuantitativeValue(Number)	The inside CO2 concentration in mg/L. Encoded as a ExtQuantitativeValue.	O	Y
dailyLight	ExtQuantitativeValue(Number)	Daily Accumulated light measured in kW/m ² Encoded as a ExtQuantitativeValue.	O	Y
drainFlow	ExtQuantitativeValue(Number)	The observed drain flow rate in litres per second encoded as a ExtQuantitativeValue.	O	Y
refWaterQualityObserved	List of Reference	Reference to the id(s) of the WaterQualityObserved records relating to this greenhouse.	O	Y

2.3.2.1 AgriGreenHouse JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/7936c30b050b698eed3fecfe43773b7a>

```
{
  "id": "ad500806-05ea-4ab6-812a-7a315d98e88d",
  "type": "AgriGreenHouse",
  "dateCreated": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  }
}
```

```
"refAgriParcel": {
  "value": "c8b475e5-84a8-4346-ad79-cde1d2a4028b",
  "type": "Reference"
},
"refWeatherObserved": {
  "value": "c720cec5-ac6f-40b7-8e89-becb75702d0d",
  "type": "Reference"
},
"relativeHumidity": {
  "value": {
    "value": 0.40,
    "unitCode": "C62",
    "timestamp": "2016-08-22T19:20+00:00"
  },
  "type": "ExtQuantitativeValue"
},
"refAgriParcelRecord": {
  "value": [
    "8c3a525d-b42e-4048-bcdd-a119d8ddb0a5",
    "178d74c1-e6fe-4042-b955-2c164fc90b83"
  ],
  "type": "List"
},
"leafTemperature": {
  "value": {
    "value": 22,
    "unitCode": "CEL",
    "timestamp": "2016-08-22T19:20+00:00"
  },
  "type": "ExtQuantitativeValue"
},
"co2": {
  "value": {
    "value": 28,
    "unitCode": "M1",
    "timestamp": "2016-08-22T19:20+00:00"
  },
  "type": "ExtQuantitativeValue"
},
"dailyLight": {
  "value": {
    "value": 24,
    "unitCode": "N78",
    "timestamp": "2016-08-22T19:20+00:00"
  },
  "type": "ExtQuantitativeValue"
},
"drainFlow": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 33,
    "maxValue": 50,
    "minValue": 25,
```

Official Document CLP.26 - IoT Big Data Harmonised Data Model

```
    "unitCode": "G51",
    "unitText": "Litre per second",
    "timestamp": "2016-08-22T19:20+00:00"
  }
},
"refWaterQualityObserved": {
  "value": [
    "49f86e0b-bb90-4751-a1c3-d5a891920807"
  ],
  "type": "List"
}
}
```

2.3.3 AgriParcel

This entity contains a harmonised description of a generic parcel of land. This entity is primarily associated with the agricultural vertical and related IoT applications.

<AgriParcel><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "AgriParcel".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriParcel><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
location	geo:json	The geo:json encoded polygon describing this parcel.	M	N
area	Number or ExtQuantitativeValue (Number)	The area of the parcel in square meters encoded as a Number or a ExtQuantitativeValue.	M	N
description	Text	A description of the parcel.	R	Y
category	List	A choice of one or more values from an enumerated list describing the parcel category. greenhouse ,	R	Y

		irrigated, rainfed.		
refAgriCrop	Reference	A reference to the unique id of the AgriCrop associated with this Parcel.	M	N
cropStatus	Text	A choice from an enumerated list describing the crop planting status One of: seeded, justBorn, growing, maturing, readyForHarvesting.	R	Y
refAgriSoil	Reference	A reference to the unique id of the soil associated with this Parcel.	O	Y
dateLastPlanted	DateTime	The ISO8601 sequence of characters at which date and time the AgriCrop was planted in UTC.	R	Y
refDevice	List of Reference	A reference to the unique ids of the Devices used to monitor this parcel.	O	Y

2.3.3.1 AgriParcel JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/b82444f8ace1a379215b0b70a93d0bf5>

```
{
  "id": "72d9fb43-53f8-4ec8-a33c-fa931360259a",
  "type": "AgriParcel",
  "dateCreated": {
    "value": "2016-08-22T10:18:16Z ",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-22T10:18:16Z ",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "location": {
    "value": {
      "type": "Polygon",
      "coordinates": [
        [100,0],
```

```
        [101,0],
        [101,1],
        [100,1],
        [100,0]
    ]
},
"type": "geo:json"
},
"area": {
    "value": 2000,
    "type": "Number"
},
"description": {
    "value": "North greenhouse (glass)",
    "type": "Text"
},
"category": {
    "value": [
        "greenhouse"
    ],
    "type": "List"
},
"refAgriCrop": {
    "value": "af3b2a4f-3133-4747-8e00-ba5e4cf1708b",
    "type": "Reference"
},
"cropStatus": {
    "value": "seeded",
    "type": "Text"
},
"refAgriSoil": {
    "value": "791f80c4-d621-4686-9bc0-84487084b9cf",
    "type": "Reference"
},
"dateLastPlanted": {
    "value": "2016-08-09T10:18:16Z",
    "type": "DateTime"
},
"refDevice": {
    "value": [
        "276805ff-d3fb-41bf-9714-ed0ecf2ee12b",
        "59b241f5-2827-44ea-bd1f-938567d271ea"
    ],
    "type": "List"
}
}
```

2.3.4 AgriParcelOperation

This entity contains a harmonised description of a generic operations performed on a parcel of land. This entity is primarily associated with the agricultural vertical and related IoT applications.

<AgriParcelOperation><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " AgriParcelOperation ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriParcelOperation><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refAgriParcel	Reference	A reference to the unique id of the AgriParcel related to this operation.	M	N
operationType	Text	A choice from an enumerated list describing the operation performed on the parcel. One of: fertiliser, inspection, pesticide, water, other.	R	Y
description	Text	A description of the operation.	R	Y

result	Text	A description of the results of the operation. One of: ok, aborted, failed.	R	Y
startDate	DateTime	The planned start timestamp for the operation.	M	N
endDate	DateTime	The planned end timestamp for the operation. Note that this is advisory and the actual time the operation finishes may be before or after the planned endDate.	M	N
status	Text	A choice from an enumerated list describing the status. One of: planned, ongoing, finished, scheduled, cancelled.	R	Y
operator	Person	The operator performing this action encoded as a Schema.org person. https://schema.org/Person	O	Y
dateStarted	DateTime	Timestamp when the operation actually started to be performed.	R	Y
dateFinished	DateTime	Timestamp when the operation actually finished.	R	Y
refAgriProduct	Reference	A reference to the unique id of the AgriProduct used.	O	Y
quantity	ExtQuantitativeValue(Number)	The amount of water or product used encoded as a ExtQuantitativeValue.	O	Y
waterSource	Text	A choice from an enumerated list describing the water source. One of: rainfall, watering.	O	Y

2.3.4.1 AgriParcelOperation JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/6901c2e6f42ac5d21a8c5bbc7d8eb6fa>

```
{
  "id": "e1e9d3a3-074f-46f1-9375-52000d05a62b",
  "type": "AgriParcelOperation",
  "dateCreated": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
```

```
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refAgriParcel": {
    "value": "318366a9-7643-4d8e-9a11-c76a8c29d8eb",
    "type": "Reference"
  },
  "operationType": {
    "value": "fertiliser",
    "type": "Text"
  },
  "description": {
    "value": "Monthly fertiliser application",
    "type": "Text"
  },
  "result": {
    "value": "ok",
    "type": "Text"
  },
  "startDate": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "endDate": {
    "value": "2016-08-28T10:18:16Z",
    "type": "DateTime"
  },
  "status": {
    "value": "ongoing",
    "type": "Text"
  },
  "operator": {
    "value": {
      "givenName": "John Smith",
      "jobTitle": "Tractor Operator"
    },
    "type": "Person"
  },
  "dateStarted": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "dateFinished": {
    "value": "2016-08-28T10:18:16Z",
    "type": "DateTime"
  }
}
```

```
  },  
  "refAgriProduct": {  
    "value": "a8f616b8-13fb-473a-8e61-b7a80c6c93ec",  
    "type": "Reference"  
  },  
  "quantity": {  
    "value": {  
      "value": 40,  
      "unitCode": "GM"  
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "waterSource": {  
    "value": "watering",  
    "type": "Text"  
  }  
}
```

2.3.5 AgriParcelRecord

This entity contains a harmonised description of the conditions recorded on a generic parcel of land. This entity is primarily associated with the agricultural vertical and related IoT applications.

<AgriParcelRecord><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "AgriParcelRecord".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriParcelRecord><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refAgriParcel	Reference	Unique id of the AgriParcel to which this record relates.	M	N
location	geo:json	The geo:json encoded polygon of this AgriParcelRecord.	M	N
soilTemperature	ExtQuantitativeValue(Numner)	The observed soil temperature in degrees centigrade encoded as a ExtQuantitativeValue.	O	Y
temperature	ExtQuantita	The observed air temperature in	R	Y

	tiveValue(N umber)	degrees centigrade encoded as a ExtQuantitativeValue.		
soilMoistureVwc	ExtQuantita tiveValue(N umber)	Measured as Volumetric Water Content, VWC as a percentage. $0 \leq \text{soilMoistureVwc} \leq 1$ encoded as a ExtQuantitativeValue	O	Y
soilMoistureEc	ExtQuantita tiveValue(N umber)	Measured as Electrical Conductivity, EC in units of Siemens per meter (S/m) encoded as a ExtQuantitativeValue	O	Y
solarRadiation	ExtQuantita tiveValue (Number)	Measured in kW/m ² encoded as a ExtQuantitativeValue.	O	Y
relativeHumidity	ExtQuantita tiveValue(N umber)	Relative Humidity a number between 0 and 1 representing the range of 0% to 100% $0 \leq \text{relativeHumidity} \leq 1$ encoded as a ExtQuantitativeValue.	R	Y
atmosphericPressu re	ExtQuantita tiveValue(N umber)	Atmospheric Pressure in units of hecto Pascals encoded as a ExtQuantitativeValue.	O	Y
description	Text	Description of this AgriParcelRecord.	R	Y

2.3.5.1 AgriParcelRecord JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/fbd5aeff87e6b73322bea447d5b0bb94>

```
{
  "id": "8f5445e6-f49b-496e-833b-e65fc97fcab7",
  "type": "AgriParcelRecord",
  "dateCreated": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
```

```
    "type": "Text"
  },
  "refAgriParcel": {
    "value": "d3676010-d815-468c-9e01-25739c5a25ed",
    "type": "Reference"
  },
  "location": {
    "value": {
      "type": "Polygon",
      "coordinates": [
        [100, 0],
        [101, 0],
        [101, 1],
        [100, 1],
        [100, 0]
      ]
    },
    "type": "geo:json"
  },
  "soilTemperature": {
    "value": {
      "value": 27,
      "unitCode": "CEL"
    },
    "type": "ExtQuantitativeValue"
  },
  "temperature": {
    "value": {
      "value": 33,
      "unitCode": "CEL"
    },
    "type": "ExtQuantitativeValue"
  },
  "soilMoistureVwc": {
    "value": {
      "value": 0.08,
      "unitCode": "C62"
    },
    "type": "ExtQuantitativeValue"
  },
  "soilMoistureEc": {
    "value": {
      "value": 17,
      "unitCode": "D10"
    },
    "type": "ExtQuantitativeValue"
  },
  "solarRadiation": {
    "value": {
      "value": 15,
      "unitCode": "N78"
    },
    "type": "ExtQuantitativeValue"
  }
```

```
    },  
    "relativeHumidity": {  
      "value": {  
        "value": 0.15,  
        "unitCode": "C62"  
      },  
      "type": "ExtQuantitativeValue"  
    },  
    "atmosphericPressure": {  
      "value": {  
        "value": 1013.25,  
        "unitCode": "A97"  
      },  
      "type": "ExtQuantitativeValue"  
    },  
    "description": {  
      "value": "North greenhouse. Planting zone A ",  
      "type": "Text"  
    }  
  }  
}
```

2.3.6 AgriPest

This entity contains a harmonised description of a generic agricultural pest. This entity is primarily associated with the agricultural vertical and related IoT applications.

<AgriPest><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "AgriPest".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriPest><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name of this agricultural pest.	M	N
alternateName	Text	Alternative name of this agricultural pest.	O	Y
description	Text	A description of this agricultural pest.	R	Y
refAgriProduct	List of Reference	A List containing a JSON encoded sequence of characters referencing the unique ids of the recommended AgriProduct pesticide(s).	O	Y

2.3.6.1 AgriPest JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/df22eca28701a239b49cc744be8eb1ad>

```
{
  "id": "fb3f1295-500c-4aa3-b995-c909097d5c01",
  "type": "AgriPest",
  "dateCreated": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "value": "Grasshopper",
    "type": "Text"
  },
  "alternateName": {
    "value": "Chorthippus parallelus",
    "type": "Text"
  },
  "description": {
    "value": "Common European grasshopper",
    "type": "Text"
  },
  "refAgriProduct": {
    "value": [
      "7f1d962b-0d14-479b-a50a-baaef261263a"
    ],
    "type": "List"
  }
}
```

2.3.7 AgriProductType

This entity contains a harmonised description of a generic agricultural product type. This entity is primarily associated with the agricultural vertical and related IoT applications. The AgriProductType includes a hierarchical structure that allows product types to be grouped in a flexible way.

<AgriProductType><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " AgriProductType ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriProductType><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name of this AgriProductType.	M	N
description	Text	A description of this AgriProductType.	M	N
root	Boolean	A logical indicator that this product is the root of a AgriProductType hierarchy. Logical TRUE indicates it is a root.	M	N

refParentType	List of Reference	A JSON encoded sequence of characters referencing the unique ids of the AgriProductType groupings this AgriProductType is a member of.	O	Y
---------------	-------------------	--	---	---

2.3.7.1 AgriProductType JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/6f5b29763c09d621f7e154e69d18a02c>

```
{
  "id": "398aa5f4-6a81-4dea-9f85-e9869441a257",
  "type": "AgriProductType",
  "dateCreated": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-22T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "value": "Soft Fruits",
    "type": "Text"
  },
  "description": {
    "value": "Soft edible fruits",
    "type": "Text"
  },
  "root": {
    "value": false,
    "type": "Boolean"
  },
  "refParentType": {
    "value": [
      "b99c940d-7156-4280-9a2b-4a9e533cd20e"
    ],
    "type": "List"
  }
}
```

2.3.8 AgriSoil

This entity contains a harmonised description of soil. This entity is primarily associated with the agricultural vertical and related IoT applications.

<AgriSoil><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "AgriSoil".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AgriSoil><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name of this soil type.	M	N
alternateName	Text	Alternative name of this soil type.	O	Y
description	Text	A description of this soil.	R	Y
refAgriProduct	List of Reference	A List containing a JSON encoded sequence of characters referencing the unique ids of the recommended AgriProduct fertiliser (or other) product(s).	O	Y

2.3.8.1 AgriSoil JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/a3eae9503c856c835b56c8c98603cd5f>

```
{
  "id": "789363b4-c771-43d6-8505-ca582efe8fcd",
  "type": "AgriSoil",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "value": "Clay",
    "type": "Text"
  },
  "alternateName": {
    "value": "Heavy soil",
    "type": "Text"
  },
  "description": {
    "value": "Fine grained, poor draining soil. Particle size less than
0.002mm",
    "type": "Text"
  },
  "refAgriProduct": {
    "value": [
      "ea54eedf-d5a7-4e44-bddd-50e9935237c0",
      "275b4c08-5e52-4bb7-8523-74ce5d0007de"
    ],
    "type": "List"
  }
}
```

2.3.9 AirQualityObserved

This entity contains a harmonised description of the air quality observed at a particular location and time. This entity is primarily associated with the vertical segment of the environment and may also be used in smart homes, smart cities, agriculture, industry and related IoT applications.

<AirQualityObserved><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "AirQualityObserved".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<AirQualityObserved><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refPOI	Reference	A reference to the unique ids of the Point of Interest (monitoring station) that originated this observation.	O	Y
refDevice	List of Reference	A list of references to the unique ids of the devices that originated this observation.	O	Y
location	geo:json	The geo:json encoded polygon or	M	N

		point location, of this observation.		
dateObserved	DateTime	The date and time of this observation in ISO8601 UTC format.	R	Y
PM2.5	ExtQuantitativeValue	<p>value --- Measured value</p> <p>timestamp --- date and time when measurement was taken</p> <p>unitCode --- normally GQ</p> <p>unitText --- normally microgram per cubic metre</p> <p>additionalProperty airQualityLevel a choice from an enumerated list (<i>good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous</i>)</p> <p>valueReference a choice from an enumerated list determined according to the (US EPA standard, EU standard, UK standard.)</p>	O	Y
PM10	ExtQuantitativeValue	<p>value --- Measured value</p> <p>timestamp --- date and time when measurement was taken</p> <p>unitCode --- normally GQ</p> <p>unitText --- normally microgram per cubic metre</p> <p>additionalProperty airQualityLevel a choice from an enumerated list (<i>good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous</i>)</p> <p>valueReference a choice from an enumerated list determined according to the (US EPA standard, EU standard, UK standard.)</p>	O	Y
CO	ExtQuantitativeValue	<p>value --- Measured value</p> <p>timestamp --- date and time when measurement was taken</p> <p>unitCode --- normally GQ</p> <p>unitText --- normally</p>	O	Y

		<p>microgram per cubic metre</p> <p>additonalProperty</p> <p> airQualityLevel a choice from an enumerated list <i>(good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous)</i></p> <p>valueReference a choice from an enumerated list determined according to the (US EPA standard, EU standard, UK standard.)</p>		
O3	ExtQuantitativeValue	<p>value --- Measured value</p> <p>timestamp --- date and time when measurement was taken</p> <p>unitCode --- normally GQ</p> <p>unitText --- normally microgram per cubic metre</p> <p>additonalProperty</p> <p> airQualityLevel a choice from an enumerated list <i>(good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous)</i></p> <p>valueReference a choice from an enumerated list determined according to the (US EPA standard, EU standard, UK standard.)</p>	O	Y
SO2	ExtQuantitativeValue	<p>Value --- Measured value</p> <p>timestamp --- date and time when measurement was taken</p> <p>unitCode --- normally GQ</p> <p>unitText --- normally microgram per cubic metre</p> <p>additonalProperty</p> <p> airQualityLevel a choice from an enumerated list <i>(good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous)</i></p> <p>valueReference a choice from an enumerated list determined according to the (US EPA standard, EU standard, UK standard.)</p>	O	Y

NO	ExtQuantitativeValue	<p>value --- Measured value timestamp --- date and time when measurement was taken unitCode --- normally GQ unitText --- normally microgram per cubic metre additionalProperty airQualityLevel a choice from an enumerated list (<i>good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous</i>) valueReference a choice from an enumerated list determined according to the (US EPA standard, EU standard, UK standard.)</p>	O	Y
NO2	ExtQuantitativeValue	<p>value --- Measured value timestamp --- date and time when measurement was taken unitCode --- normally GQ unitText --- normally microgram per cubic metre additionalProperty airQualityLevel a choice from an enumerated list (<i>good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous</i>) valueReference a choice from an enumerated list determined according to the (US EPA standard, EU standard, UK standard.)</p>	O	Y
NOx	ExtQuantitativeValue	<p>value --- Measured value timestamp --- date and time when measurement was taken unitCode --- normally GQ unitText --- normally microgram per cubic metre additionalProperty airQualityLevel a choice from an enumerated list (<i>good, moderate, unhealthyFor SensitiveGroups, unhealthy, veryUnhealthy, hazardous</i>) valueReference a choice from an enumerated list determined according to the (US EPA standard, EU</p>	O	Y

		standard, UK standard.)		
airQualityIndex	ExtQuantitativeValue	Value Calculated Air Quality Index value. valueReference a choice from an enumerated list calculated according to the (US EPA standard, EU standard, UK standard.) ¹	O	Y

2.3.9.1 AirQualityObserved JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/d1e46adc706d986ee9e752a5b425bcc>

```
{
  "id": "c9f32b35-a185-48e2-835f-c521efc294ab",
  "type": "AirQualityObserved",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refPOI": {
    "value": [
      "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84"
    ],
    "type": "List"
  },
  "refDevice": [
    "5c9fb9dd-fc13-4fda-8f4c-f99a04f6f858"
  ],
  "location": {
```

¹ <https://cfpub.epa.gov/airnow/index.cfm?action=aqibasics.aqi>

```
"value": {
  "type": "Point",
  "coordinates": [
    -104.99404,
    39.75621
  ]
},
"type": "geo:json"
},
"dateObserved": {
  "value": "2016-08-08T10:18:16Z",
  "type": "DateTime"
},
"PM2.5": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 187,
    "unitCode": "GQ"
    "airQualityLevel": "hazardous"
  }
},
"PM10": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 50,
    "unitCode": "GQ"
    "airQualityLevel": "unhealthy"
  }
},
"CO": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 0.8,
    "unitCode": "GQ"
    "airQualityLevel": "good"
  }
},
"O3": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 300,
    "unitCode": "GQ"
    "airQualityLevel": "very unhealthy"
  }
},
"SO2": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 7,
    "unitCode": "GQ"
    "airQualityLevel": "good"
  }
},
},
```

```
"NO": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 137,
    "unitCode": "GQ"
    "airQualityLevel": "unhealthy"
  }
},
"NO2": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 63,
    "unitCode": "GQ"
    "airQualityLevel": "good"
  }
},
"NOx": {
  "type": "ExtQuantitativeValue",
  "value": {
    "value": 273,
    "unitCode": "GQ"
    "airQualityLevel": "very unhealthy"
  }
},
"airQualityIndex": {
  "type": "ExtQuantitativeValue",
  "value": {
    "airQualityLevel": "very unhealthy"
  }
}
}
```

2.3.10 Building

This entity contains a harmonised description of a building. This entity is associated with the vertical segments of smart homes, smart cities, industry and related IoT applications.

<Building><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " Building ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Building><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refBuildingType	Reference	Refers to the buildingType that this building is an instance of.	M	N
category	List	One or more categories relevant to the building with choices based on for example http://wiki.openstreetmap.org/wiki/Map_Features#Building	R	Y
containedInPlace	geo:json	The geo:json encoded polygon of the building plot in which this building sits.	R	Y

location	geo:json	The geo:json encoded polygon of this building.	M	N
address	PostalAddress	The building PostalAddress encoded as a Schema.org PostalAddress. https://schema.org/PostalAddress	R	Y
owner	List of references to Person(s) or Organization(s)	A List containing a JSON encoded sequence of characters referencing the unique Ids of the owner(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	R	Y
occupier	List of references to Person(s) or Organization(s)	A List containing a JSON encoded sequence of characters referencing the unique Ids of the occupiers(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	R	Y
refSubscriptionService	List of Reference	A List containing a JSON encoded sequence of characters of the unique Ids of the subscription service(s) related to this building.	O	Y
floorsAboveGround	Number	The number of floors above ground level in this building.	O	Y
floorsBelowGround	Number	The number of floors below ground level in this building.	O	Y
description	Text	An optional description of the entity.	R	Y
mapUrl	URL	A URL to a mapping service which shows the location of the building.	O	Y
notes	List	Free format notes relating to the building e.g. published occupants, opening hours etc.	O	Y

2.3.10.1 Building JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/69f8893b605894640e3b99f82c3f20ed>

```
{
  "id": "f95c06e3-776e-4a57-9b00-a85e3da145c1",
  "type": "Building",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
```

```
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refBuildingType": {
    "value": "8b1f2bf0-5093-4182-ad4b-224182bb3b9f",
    "type": "Reference"
  },
  "category": {
    "value": [
      "house"
    ],
    "type": "List"
  },
  "containedInPlace": {
    "value": {
      "type": "Polygon",
      "coordinates": [
        [100, 0],
        [101, 0],
        [101, 1],
        [100, 1],
        [100, 0]
      ]
    },
    "type": "geo:json"
  },
  "location": {
    "value": {
      "type": "Polygon",
      "coordinates": [
        [100, 0],
        [101, 0],
        [101, 1],
        [100, 1],
        [100, 0]
      ]
    },
    "type": "geo:json"
  },
  "address": {
    "type": "PostalAddress",
    "value": {
```

```
    "addressLocality": "London",
    "postalCode": "EC4N 8AF",
    "streetAddress": "25 Walbrook"
  }
},
"owner": {
  "value": [
    "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84",
    "1be9cd61-ef59-421f-a326-4b6c84411ad4"
  ],
  "type": "List"
},
"occupier": {
  "value": [
    "9830f692-7677-11e6-838b-4f9fb3dc5a4f"
  ],
  "type": "List"
},
"refSubscriptionService": {
  "value": [
    "b4fb8bff-1a8f-455f-8cc0-ca43c069f865onService1",
    "55c24793-3437-4157-9bda-667c9e1531fc"
  ],
  "type": "List"
},
"floorsAboveGround": {
  "value": 7,
  "type": "Number"
},
"floorsBelowGround": {
  "value": 0,
  "type": "Number"
},
"description": {
  "value": "Multi-tenant office block",
  "type": "Text"
},
"mapUrl": {
  "value":
"https://www.google.co.uk/maps/place/The+Walbrook,+Walbrook,+London+EC4N+8A
F/@51.5120758,-0.0920769",
  "type": "URL"
},
"notes": {
  "value": ["Intelligent entry barrier system", "Intelligent air
conditioning units", "Normal opening 07:00 - 20:00"],
  "type": "List"
}
}
```

2.3.11 BuildingOperation

This entity contains a harmonised description of a generic operation (related to smart buildings) applied to the referenced building. The building operation contains dynamic data reported by, or associated with a building or operations applicable to the building. This entity is associated with the vertical segments of smart homes, smart cities, industry and related IoT applications.

<BuildingOperation><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " BuildingOperation ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<BuildingOperation><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refBuilding	Reference	Refers to the unique entity Id of the building to which this building record relates.	M	N
operationType	Text	Defines the type of operation conducted/ requested. This will be one of a defined list of operation	R	Y

		types specific to the building.		
description	Text	A description of the operation.	R	Y
result	Text	A description of the results of the operation. One of ok, aborted, failed	R	Y
startDate	DateTime	The planned start timestamp for the operation.	M	N
endDate	DateTime	The planned end timestamp for the operation. Note that this is advisory and the actual time the operation finishes may be before or after the planned endDate.	M	N
status	Text	A choice from an enumerated list describing the status. One of: planned, ongoing, finished, scheduled, cancelled	R	Y
operator	Person	The operator performing this action encoded as a Schema.org person. https://schema.org/Person	O	Y
dateStarted	DateTime	Timestamp when the operation actually started to be performed.	R	Y
dateFinished	DateTime	Timestamp when the operation actually finished.	R	Y
operationSequence	Text	The sequence of operations executed/ requested for the building in a representation format relevant to the building.	O	Y
refRelatedBuilding Operation	List of Reference	A List containing a JSON encoded sequence of characters referencing the unique ids of any related building operations.	O	Y
refRelatedOperation	List of Reference	A List containing a JSON encoded sequence of characters referencing the unique ids of any related operations (device, machine or other).	O	Y

2.3.11.1 BuildingOperation JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/2c15fe4070fbbf5ed5227ccabf19b639>

```
{
  "id": "57b912ab-eb47-4cd5-bc9d-73abecelf1b3",
  "type": "BuildingOperation",
  "dateCreated": {
```

```
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refBuilding": {
    "value": "f59e2074-0032-4ccd-b0dd-f06370ffb6af",
    "type": "Reference"
  },
  "operationType": {
    "value": "Air Conditioning Switch To Low Power",
    "type": "Text"
  },
  "description": {
    "value": "Air conditioning levels reduced due to out of hours",
    "type": "Text"
  },
  "result": {
    "value": "Operation successful",
    "type": "Text"
  },
  "startDate": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "endDate": {
    "value": "2016-08-20T10:18:16Z",
    "type": "DateTime"
  },
  "status": {
    "value": "planned",
    "type": "Text"
  },
  "dateStarted": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateFinished": {
    "value": "2016-08-20T10:18:16Z",
```

```
    "type": "DateTime"
  },
  "operationSequence": {
    "value": "Fan levels reduced to minimum. Target temperature set to 24
degrees Celsius. ",
    "type": "Text"
  },
  "refRelatedBuildingOperation": {
    "value": [
      "b4fb8bff-1a8f-455f-8cc0-ca43c069f865onService1",
      "55c24793-3437-4157-9bda-667c9e1531fc"
    ],
    "type": "List"
  },
  "refRelatedOperation": {
    "value": [
      "36744245-6716-4a28-84c7-0e3d7520f143",
      "33b2b713-9223-40a5-87a0-3f80a1264a6c"
    ],
    "type": "List"
  }
}
```

2.3.12 BuildingType

This entity contains a harmonised description of a generic building type. This entity is associated with the vertical segments of smart home, smart cities, industry and related IoT applications. The building type includes a hierarchical structure that allows building types to be grouped in a flexible way.

<BuildingType><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " BuildingType ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<BuildingType><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name of this BuildingType.	M	N
description	Text	A description of this type.	R	Y
root	Boolean	A logical indicator that this is the root of a BuildingType hierarchy. TRUE indicates it is the root, FALSE indicates that it is not the root.	M	Y
refParentType	List of Reference	A List containing a JSON encoded sequence of characters referencing	O	Y

		the unique Ids of the building type groupings this BuildingType is a member of.		
--	--	---	--	--

2.3.12.1 BuildingType JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/8e82b3af9d333ca56658acff1a6f20ca>

```
{
  "id": "57b912ab-eb47-4cd5-bc9d-73abecelf1b3",
  "type": "BuildingType",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "value": "House",
    "type": "Text"
  },
  "description": {
    "value": "Standard building type definition for a domestic house",
    "type": "Text"
  },
  "root": {
    "value": false,
    "type": "Boolean"
  },
  "refParentType": {
    "value": [
      "4146335f-839f-4ff9-a575-6b4e6232b734",
      "c44fc765-51a7-4f71-bf1e-22e874c35180"
    ],
    "type": "List"
  }
}
```

2.3.13 Device

This entity contains a harmonised description of a generic device. This entity provides an essentially static description of a generic device and is therefore applicable to all IoT segments and related IoT applications.

<Device><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "Device".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Device><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refDeviceModel	Reference	Unique id of this device model selected from DeviceModel.	M	N
serialNumber	Text	The serial number assigned by the manufacturer.	M	N
supplierName	Text	The details of the supplier of this device.	R	Y
manufacturerCountry	Text	The country where this device was manufactured.	R	Y

factory	Text	The factory name/code manufacturing this device.	O	Y
dateManufactured	DateTime	The ISO8601 sequence of characters at which date and time the device was manufactured in UTC.	M	N
description	Text	An optional description of this device.	R	Y
owner	List of Reference	A List containing a JSON encoded sequence of characters referencing the unique Ids of the owner(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	O	Y
dateInstalled	DateTime	The ISO8601 sequence of characters at which date and time the device was installed in UTC.	R	N
dateFirstUsed	DateTime	The ISO8601 sequence of characters at which date and time the device was first used in UTC.	R	N
hardwareVersion	Text	The hardware version of this device.	R	N
firmwareVersion	Text	The firmware version of this device.	R	N
softwareVersion	Text	The software version of this device.	R	N
osVersion	Text	The operating system version of this device.	R	N
supportedProtocol	List	A List element per supported communication protocol.	O	N
location	geo:json	The geo:json encoded location, of this device.	O	Y
online	Boolean	The communication status of this device. A logical representation of Offline (false) or Online (true).	O	N
status	Text	The text format (current) device status code or description. Expected to be the manufacturer or device specific status code generated by the device.	R	Y
dateLastCalibration	DateTime	The date this device was last calibrated.	O	Y
batteryLevel	ExtQuantitativeValue (Number)	Battery level. It must be equal to: 1.0 When the battery charge is full. 0.0 When the battery charge empty. Null when it cannot be determined.	O	Y

		Normally encoded as an ExtQuantitativeValue.		
value	ExtQuantitativeValue (Number)	The observed or reported value of the device. For control applications the value can be updated to change the device/ actuator setting. The value is encoded as an ExtQuantitativeValue.	R	Y

2.3.13.1 Device JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/b29f6f3841d778d455e58fcad74c637d>

```
{
  "id": "ba2d4fd9-f57f-4610-a589-2d52670d14f3",
  "type": "Device",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refDeviceModel": {
    "value": "d1be2e61-d9e7-43cd-9c68-51e0861b3a49",
    "type": "Reference"
  },
  "serialNumber": {
    "value": "123456789",
    "type": "Text"
  },
  "supplierName": {
    "value": "ACME Direct, Inc.",
    "type": "Text"
  },
  "manufacturerCountry": {
    "value": "UK",
    "type": "Text"
  }
}
```

```
},
"factory": {
  "value": "56A8",
  "type": "Text"
},
"dateManufactured": {
  "value": "2016-08-21T10:18:16Z",
  "type": "DateTime"
},
"description": {
  "value": "Thermocouple",
  "type": "Text"
},
"owner": {
  "value": [
    "43c46ff2-b0f7-4e4f-838a-adee1c9cae88",
    "ebf421c9-363b-4ed4-97a0-93a6e39786ff"
  ],
  "type": "List"
},
"dateInstalled": {
  "value": "2016-08-22T10:18:16Z",
  "type": "DateTime"
},
"dateFirstUsed": {
  "value": "2016-08-22T10:18:16Z",
  "type": "DateTime"
},
"hardwareVersion": {
  "value": "1.2",
  "type": "Text"
},
"firmwareVersion": {
  "value": "2.8.56",
  "type": "Text"
},
"softwareVersion": {
  "value": "2.5.11",
  "type": "Text"
},
"osVersion": {
  "value": "8.1",
  "type": "Text"
},
"supportedProtocol": {
  "value": [
    "HTTP",
    "HTTPS",
    "FTP"
  ],
  "type": "List"
},
"location": {
```

```
"value": {
  "type": "Point",
  "coordinates": [
    -104.99404,
    39.75621
  ]
},
"type": "geo:json"
},
"online": {
  "value": true,
  "type": "Boolean"
},
"status": {
  "value": "SC1001",
  "type": "Text"
},
"dateLastCalibration": {
  "value": "2016-08-22T10:18:16Z",
  "type": "DateTime"
},
"batteryLevel": {
  "value": {
    "value": 0.7
  },
  "type": "ExtQuantitativeValue"
},
"value": {
  "value": {
    "value": 1
  },
  "type": "ExtQuantitativeValue"
}
}
```

2.3.14 DeviceModel

This entity contains a harmonised description of a generic device model and is therefore applicable to all IoT segments and related IoT applications. The Device Model includes an optional hierarchical structure that allows device types to be grouped in a flexible way.

<DeviceModel><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "DeviceModel".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<DeviceModel><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name of this DeviceModel.	M	N
doc	URL	Reference to Product Data Sheet or other manufacturer's documentation about this device model including where relevant, details of the accuracy, trueness, precision and units of measure.	R	Y
category	List	A choice from an enumerated list defining the category of this device	O	Y

		including: sensor, actuator, meter, appliance, heater, chiller, lighting, boiler, vessel, airHandlingUnit, consumer, other.		
description	Text	A description of this DeviceModel .	R	Y
manufacturerName	Text	The name of manufacturer of this DeviceModel.	R	Y
brandName	Text	A description of the brand name of this DeviceModel.	R	Y
root	Boolean	A logical indicator that this DeviceModel is the root of a DeviceModel hierarchy. TRUE indicates it is the root, FALSE indicates that it is not the root.	R	Y
refParentDeviceModel	List of Reference	A List containing a JSON encoded sequence of characters of the unique Ids of the device model groupings this device model is a member of.	O	Y

2.3.14.1 DeviceModel JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/c4765078362cfefd61909fc92b27b4ee>

```
{
  "id": "e01f13d1-fea4-4cc4-92c9-0d9fadb2c509",
  "type": "DeviceModel",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "value": "Sensor Model 501",
```

```
    "type": "Text"
  },
  "doc": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "category": {
    "value": [
      "sensor"
    ],
    "type": "List"
  },
  "description": {
    "value": "Monomatics All Weather Temperature Sensor",
    "type": "Text"
  },
  "manufacturerName": {
    "value": "ACME Manufacturing, Inc.",
    "type": "Text"
  },
  "brandName": {
    "value": "SuperWidgets",
    "type": "Text"
  },
  "root": {
    "value": false,
    "type": "Boolean"
  },
  "refParentDeviceModel": {
    "value": [
      "4146335f-839f-4ff9-a575-6b4e6232b734",
      "c44fc765-51a7-4f71-bf1e-22e874c35180"
    ],
    "type": "List"
  }
}
```

2.3.15 DeviceOperation

This entity contains a harmonised description of a generic device operation entity. The device operation entity contains dynamic data reported by a device and is therefore applicable to all IoT segments and related IoT applications.

<DeviceOperation><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " DeviceOperation ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<DeviceOperation><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refDevice	Reference	The unique entity Id of the device to which this device operation relates.	M	N
operationType	List	Choice form an enumerated list including: event, maintenance, fault, installation, upgrade, other.	R	Y
description	Text	A description of the operation.	R	Y
result	Text	A description of the results of the operation. One of	R	Y

		ok, aborted, failed		
startDate	DateTime	The planned start timestamp for the operation.	M	N
endDate	DateTime	The planned end timestamp for the operation. Note that this is advisory and the actual time the operation finishes may be before or after the planned endDate.	M	N
status	Text	A choice from an enumerated list describing the status. One of: planned, ongoing, finished, scheduled, cancelled.	R	Y
operator	Person	The operator performing this action encoded as a Schema.org person. https://schema.org/Person	O	Y
dateStarted	DateTime	Timestamp when the operation actually started to be performed.	R	Y
dateFinished	DateTime	Timestamp when the operation actually finished.	R	Y
dateReported	DateTime	The timestamp when the device event or fault was reported.	O	Y
dateAddressed	DateTime	The timestamp when the event or fault was addressed or cleared.	O	Y

2.3.15.1 DeviceOperation JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/dbaba83f8fab072c6a4765823228cc12>

```
{
  "id": "27577638-bd8a-4732-b418-fc8b949a0b0f",
  "type": "DeviceOperation",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
```

```
    "value": "1.0",
    "type": "Text"
  },
  "refDevice": {
    "value": "2033a7c7-d31b-48e7-91c2-014dc426c29e",
    "type": "Reference"
  },
  "operationType": {
    "value": [
      "fault"
    ],
    "type": "List"
  },
  "description": {
    "value": "Backup battery needs replacement",
    "type": "Text"
  },
  "result": {
    "value": "ok",
    "type": "Text"
  },
  "startDate": {
    "value": "2016-08-20T10:18:16Z",
    "type": "DateTime"
  },
  "endDate": {
    "value": "2016-08-18T14:18:16Z",
    "type": "DateTime"
  },
  "status": {
    "value": "ongoing",
    "type": "Text"
  },
  "operator": {
    "value": {
      "givenName": "John Dee"
    },
    "type": "Person"
  },
  "dateStarted": {
    "value": "2016-08-20T10:18:16Z",
    "type": "DateTime"
  },
  "dateFinished": {
    "value": "2016-08-18T10:18:16Z",
    "type": "DateTime"
  },
  "dateReported": {
    "value": "2016-08-18T10:18:16Z",
    "type": "DateTime"
  }
}
```

2.3.16 EnvironmentObserved

This entity contains a harmonised description of the environmental conditions observed at a particular location and time. This entity is primarily associated with the vertical segment of the environment and agriculture but may also be used in smart home, smart cities, industry and related IoT applications.

<EnvironmentObserved><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " EnvironmentObserved ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<EnvironmentObserved><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
location	geo:json	The geo:json encoded map location, of this observation.	M	N
refWeatherObserved	List of Reference	A List containing a JSON encoded sequence of characters that reference the unique ids of the related weather entities.	O	Y
refAirQualityObserved	List of	A List containing a JSON encoded	O	Y

ed	Reference	sequence of characters that reference the unique ids of the related AirQualityObserved entities.		
refWaterQualityObserved	List of Reference	A List containing a JSON encoded sequence of characters that reference the unique ids of the related WaterQuality entities.	O	Y

2.3.16.1 EnvironmentObserved JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/63d18a7f5845aa201c9470d84b7912f8>

```
{
  "id": "33f02632-74f4-4c96-9ba1-e26945de9481",
  "type": "EnvironmentObserved",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "location": {
    "value": {
      "type": "Point",
      "coordinates": [
        -104.99404,
        39.75621
      ]
    },
    "type": "geo:json"
  },
  "refWeatherObserved": {
    "value": [
      "fae29f4c-0691-4bab-bef8-ad1cd165cc28",
      "1c7a2711-ae38-4ea9-8f9f-627067067d53"
    ],
    "type": "List"
  }
}
```

```
},
"refAirQualityObserved": {
  "value": [
    "4b8b09c9-ce54-46de-8067-5591e02d8f29",
    "08a14933-b44d-4297-b2d2-2c3f3844012e"
  ],
  "type": "List"
},
"refWaterQualityObserved": {
  "value": [
    "68a83e68-61e6-4e3c-975c-5b301c184ca6",
    "b01518e3-2b60-4bbd-9783-3af0d660349e"
  ],
  "type": "List"
}
}
```

2.3.17 Machine

This entity contains a harmonised description of an industrial machine for example for use in CAM (Computer Aided Manufacturing). This entity provides an essentially static description of a generic automation machine. This entity is primarily associated with the industry segment in the automated manufacturing industry, including CNC (Computer Numerical Control) machines, 3D printers and all kinds of industrial robots.

<Machine><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " Machine ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Machine><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refMachineModel	Reference	Refers to the machineModel that this machine is an instance of.	M	N
serialNumber	Text	The serial number assigned by the manufacturer.	R	N
status	Text	A manufacturer specific text format machine status code or description. It is an aggregation of dynamic	R	Y

		information about the machine.		
assetIdentifier	Text	An asset identifier (e.g. asset tag number) assigned by the owner.	O	Y
manufacturerCountry	Text	The country where this machine instance was manufactured.	O	Y
factory	Text	The factory name/code manufacturing this machine.	O	Y
dateManufactured	DateTime	The ISO8601 sequence of characters at which date and time the machine was manufactured in UTC.	R	Y
dateInstalled	DateTime	The ISO8601 sequence of characters at which date and time the machine was installed in UTC.	R	Y
dateFirstUsed	DateTime	The ISO8601 sequence of characters at which date and time the machine was first used in UTC.	R	Y
online	Boolean	Identifies the communication status of the machine, online if set to TRUE.	R	Y
installationNotes	Text or URL	Notes relating to this machine installation.	O	Y
location	geo:json	The geo:json encoded location, of this machine.	M	N
refBuilding	Reference	Refers to the building instance into which this machine is installed.	O	Y
owner	List of Reference	A List containing a JSON encoded sequence of characters referencing the unique Ids of the owner(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	O	Y
refSubscriptionService	List of Reference	A List containing a JSON encoded sequence of characters of the unique Ids of any subscription service(s) associated with this machine.	O	Y
description	Text	An optional description of this machine.	R	Y
voltage	ExtQuantitativeValue	The required supply voltage, in volts	R	Y
current	ExtQuantitativeValue	The required supply current, in amps	R	Y
power	ExtQuantitativeValue	The nominal rated power consumption of the machine in kW	R	Y
speed	ExtcurrQuantitativeValue	The maximum rotational speed in rpm	R	Y

2.3.17.1 Machine JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/7b8303207db9fd5b7cf933ca360a5dd7>

```
{
  "id": "9166c528-9c98-4579-a5d3-8068aea5d6c0",
  "type": "Machine",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refMachineModel": {
    "value": "00b42701-43e1-482d-aa7a-e2956cfd69c3",
    "type": "Reference"
  },
  "serialNumber": {
    "value": "123456789",
    "type": "Text"
  },
  "status": {
    "value": "Ready/Idle : Machine operational",
    "type": "Text"
  },
  "assetIdentifier": {
    "value": "1234567",
    "type": "Text"
  },
  "manufacturerCountry": {
    "value": "UK",
    "type": "Text"
  },
  "factory": {
    "value": "ACME NorthEast Inc.",
    "type": "Text"
  },
}
```

```
"dateManufactured": {
  "value": "2016-08-21T10:18:16Z",
  "type": "DateTime"
},
"dateInstalled": {
  "value": "2016-08-22T10:18:16Z",
  "type": "DateTime"
},
"dateFirstUsed": {
  "value": "2016-08-22T10:18:16Z",
  "type": "DateTime"
},
"online": {
  "value": true,
  "type": "Boolean"
},
"installationNotes": {
  "value": "http://www.example.com/installationNotel.txt",
  "type": "URL"
},
"location": {
  "value": {
    "type": "Point",
    "coordinates": [
      -104.99404,
      39.75621
    ]
  },
  "type": "geo:json"
},
"refBuilding": {
  "value": "8683b757-649c-49e0-ac89-ad392c9a0d0c",
  "type": "Reference"
},
"owner": {
  "value": [
    "247d402f-3e0b-4e7c-a2c0-335590c27f90",
    "a7995eb7-6bec-4176-b2e8-af545e2bb3b9"
  ],
  "type": "List"
},
"refSubscriptionService": {
  "value": [
    "92158a14-f6c6-4d29-85d1-5d305cc87982",
    "3c6bac7b-9398-4529-8d89-766435b7490b"
  ],
  "type": "List"
},
"description": {
  "value": "Industrial machine to create plastic bottles",
  "type": "Text"
},
"voltage": {
```

```
    "value": {
      "value": 220,
      "unitCode": "VLT",
      "timestamp": "2016-08-08T10:18:16Z"
    },
    "type": "ExtQuantitativeValue"
  },
  "current": {
    "value": {
      "value": 20,
      "unitCode": "AMP",
      "timestamp": "2016-08-08T10:18:16Z"
    },
    "type": "ExtQuantitativeValue"
  },
  "power": {
    "value": {
      "value": 4.4,
      "unitCode": "KWT",
      "timestamp": "2016-08-08T10:18:16Z"
    },
    "type": "ExtQuantitativeValue"
  },
  "speed": {
    "value": {
      "value": 10,
      "unitCode": "RPM",
      "timestamp": "2016-08-08T10:18:16Z"
    },
    "type": "ExtQuantitativeValue"
  }
}
}
```

2.3.18 MachineModel

This entity contains a harmonised description of a generic machine model. This entity is primarily associated with the industry segment and related IoT applications. The machineModel includes a hierarchical structure that allows machine models to be grouped in a flexible way.

<MachineModel><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " MachineModel ".	M	N
dateCreated	Date	Entity creation timestamp.	M	N
dateModified	Date	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<MachineModel><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name given to this machine model.	M	N
description	Text	A description of this machine model.	R	Y
manufacturerName	Text	The name of manufacturer of this machine model.	R	Y
brandName	Text	A description of this machine model brand name.	R	Y

version	Text	The manufacturer defined version number for the machine model.	R	Y
category	List	A List of functional categories which this machineModel supports. Examples include: robot, cnc, 2dPrinter, 3dPrinter, 3dScanner, lathe, injectionMolding, laserCutter, millingMachine, grindingMachine, stampingMachine, oven, kiln, packaging, mixer, dryer, fan, saw.	O	Y
doc	URL	Reference to Product Data Sheet or other manufacturers documentation about this machine.	R	Y
root	Boolean	A logical indicator that this machineModel is the root of a machineModel hierarchy. true indicates it is the root, false indicates that it is not the root.	R	Y
refParentModel	List of Reference	A List containing a JSON encoded sequence of characters referencing the ids of other machine models which this is related to.	O	Y
processDescription	Text	A description of the industrial process carried out by this machine.	O	Y
standardOperations	List	Lists the standard set of operations supported by this machineModel.	O	Y

2.3.18.1 MachineModel JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/d292853b17e78269856715a005b7a733>

```
{
  "id": "e01f13d1-fea4-4cc4-92c9-0d9fad2c509",
  "type": "MachineModel",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  }
}
```

```
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "value": "CA1256b",
    "type": "Text"
  },
  "description": {
    "value": "Machine to screen print t-shirts",
    "type": "Text"
  },
  "manufacturerName": {
    "value": "ScreenOPrint, Inc.",
    "type": "Text"
  },
  "brandName": {
    "value": "QuickT",
    "type": "Text"
  },
  "version": {
    "value": "v1",
    "type": "Text"
  },
  "category": {
    "value": [
      "2dPrinter"
    ],
    "type": "List"
  },
  "doc": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "root": {
    "value": false,
    "type": "Boolean"
  },
  "refParentModel": {
    "value": [
      "4146335f-839f-4ff9-a575-6b4e6232b734",
      "c44fc765-51a7-4f71-bf1e-22e874c35180"
    ],
    "type": "List"
  },
  "processDescription": {
    "value": "Industrial printer used to mass print t-shirts",
    "type": "Text"
  }
```

```
},  
"standardOperations": {  
  "value": [  
    "print"  
  ],  
  "type": "List"  
}  
}
```

2.3.19 MachineOperation

This entity contains a harmonised description of a generic machine operation. This entity is primarily associated with the industry segment and related IoT applications. Each MachineOperation instance will be related to a specific Machine instance.

<MachineOperation><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " MachineOperation ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<MachineOperation><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refMachine	Reference	Refers to the specific machine instance that this machineOperation record relates to.	M	N
operationType	Text	Defines the type of operation conducted/ requested. This will be one of a defined list of operation types specific to the machine/ machineModel. Including; process,	M	N

		setup, maintenance, repair, breakdown. The list of operation types highly depends on the machine model.		
description	Text	A description of the operation conducted or applied.	R	Y
result	Text	A description of the results of the operation. One of: ok, success, suspended, aborted, failed.	R	Y
startDate	DateTime	The planned start timestamp for the operation.	R	Y
endDate	DateTime	The planned end timestamp for the operation. Note that this is advisory and the actual time the operation finishes may be before or after the planned endDate.	R	Y
status	Text	A choice from an enumerated list describing the status. One of: planned, ongoing, finished, scheduled, cancelled.	R	Y
operator	Person	The operator performing this action encoded as a Schema.org person. https://schema.org/Person	O	Y
dateStarted	DateTime	Timestamp when the operation actually started to be performed.	O	Y
dateFinished	DateTime	Timestamp when the operation actually finished.	O	Y
commandSequence	Text	The command sequence executed/ requested for the machine in a representation format relevant to the machine.	O	Y
operationOutput	Text	The text describing the output data of the operation. The schema of the output highly depends the machine model. One example of the output is for the processed goods of the machine, and the format can be: "length XX, type XX"	O	Y

2.3.19.1 MachineOperation JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/32169966d47e0e128bb37fe08937dfd3>

```
{
  "id": "27577638-bd8a-4732-b418-fc8b949a0b0f",
  "type": "MachineOperation",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refMachine": {
    "value": "2033a7c7-d31b-48e7-91c2-014dc426c29e",
    "type": "Reference"
  },
  "operationType": {
    "value": "Process",
    "type": "Text"
  },
  "description": {
    "value": "Printing of 1000 T-shirts",
    "type": "Text"
  },
  "result": {
    "value": "ok",
    "type": "Text"
  },
  "startDate": {
    "value": "2016-08-20T10:18:16Z",
    "type": "DateTime"
  },
  "endDate": {
    "value": "2016-08-18T14:18:16Z",
    "type": "DateTime"
  },
  "status": {
    "value": "finished",
    "type": "Text"
  },
  "operator": {
    "value": {
```

```
    "name": "Fred Quimby",
    "jobTitle": "Print Supervisor"
  },
  "type": "Person"
},
"dateStarted": {
  "value": "2016-08-20T10:18:16Z",
  "type": "DateTime"
},
"dateFinished": {
  "value": "2016-08-18T14:18:16Z",
  "type": "DateTime"
},
"commandSequence": {
  "value": "Select inks. Prepare print masks. Print shirts. Clean print
heads and rollers ",
  "type": "Text"
},
"operationOutput": {
  "value": "2 shirts were printed",
  "type": "Text"
}
}
```

2.3.20 MarketPriceForecast

This entity contains a harmonised description of a generic commodity, crop or product price forecast that varies over time (a spot price forecast). This entity is primarily associated with the agricultural vertical and related IoT applications.

<MarketPriceForecast><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity. A globally unique reference to this entity instance. It is recommended ids comply with RFC4122.	M	N
type	Text	Must be equal to "MarketPriceForecast" .	M	N
dateCreated	DateTime	Entity creation timestamp. This will usually be allocated by the storage platform.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity. This will usually be allocated by the storage platform. A null value in this field or a value equivalent to dateCreated means the entity has not been modified since being created.	O	Y
source	URL	A sequence of characters giving the original source of the entity data as a URL. Recommended to be the fully qualified domain name of the source provider, or the URL to the source object.	R	Y
dataProvider	Text	A sequence of characters identifying the provider of the harmonised data entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<MarketPriceForecast><EntitySpecificAttributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refEntityInstance	Reference	A reference to the unique id of the	M	N

		Entity to which this record relates.		
priceForecast	PStructured Value	The market price forecast represented using schema.org PriceSpecification attributes http://schema.org/PriceSpecification	M	N
address	PostalAddress	The market location for this forecast encoded as a Schema.org PostalAddress. https://schema.org/PostalAddress	M	N
marketScale	TStructured Value	Unique code assigned to market scale type. The content includes both a name and a value. "Wholesale":Wholesale market price "Retail":Retail market price for example (ex) {'name':'Wholesale', 'value':"02"} or {'name':'Retail', 'value':"01"}	M	N
refWeatherForecast	Reference	A reference to the unique id of the related weather forecast record.	O	Y

2.3.20.1 MarketPriceForecast JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/971cc478edf6c534b3cd33084d0f0e07>

```
{
  "id": "398aa5f4-6a81-4dea-9f85-e9869441a257",
  "type": "MarketPriceForecast",
  "dateCreated": {
    "value": "2017-06-13T23:59:15.76Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2017-06-13T23:59:15.76Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refEntityInstance": {
    "value": [
      "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84"
    ]
  }
}
```

```
    ],  
    "type": "Reference"  
  },  
  "priceForecast": {  
    "value": {  
      "price": 5,  
      "priceCurrency": "USD",  
      "validFrom": {  
        "value": "2017-08-22T10:18:16Z",  
        "type": "DateTime"  
      },  
      "validThrough": {  
        "value": "2017-08-23T10:18:16Z",  
        "type": "DateTime"  
      }  
    },  
    "type": "StructuredValue"  
  },  
  "address": {  
    "type": "PostalAddress",  
    "value": {  
      "addressCountry": "UK",  
      "addressLocality": "London"  
    }  
  },  
  "marketScale": {  
    "value" : {  
      "marketType": "Wholesale",  
      "value": "02"      "type": "text"  
    },  
    "type": "StructuredValue"  
  },  
  "priceAverage": {  
    "value": {  
      "price": 15,  
      "priceCurrency": "USD",  
      "validFrom": {  
        "value": "2012-08-23T10:18:16Z",  
        "type": "DateTime"  
      },  
      "validThrough": {  
        "value": "2017-08-23T10:18:16Z",  
        "type": "DateTime"  
      }  
    },  
    "type": "StructuredValue"  
  },  
  "refWeatherObserved": {  
    "value": [  
      "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c85"  
    ],  
    "type": "Reference"  
  }  
}
```

}

2.3.21 MarketPriceObserved

This entity contains a harmonised description of a generic commodity, crop or product price that varies over time (a spot price). This entity is primarily associated with the agricultural vertical and related IoT applications.

<MarketPriceObserved><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity. A globally unique reference to this entity instance. It is recommended ids comply with RFC4122.	M	N
type	Text	Must be equal to " MarketPriceObserved ".	M	N
dateCreated	DateTime	Entity creation timestamp. This will usually be allocated by the storage platform.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity. This will usually be allocated by the storage platform. A null value in this field or a value equivalent to dateCreated means the entity has not been modified since being created.	O	Y
source	URL	A sequence of characters giving the original source of the entity data as a URL. Recommended to be the fully qualified domain name of the source provider, or the URL to the source object.	R	Y
dataProvider	Text	A sequence of characters identifying the provider of the harmonised data entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<MarketPriceObserved><EntitySpecificAttributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/	May be Null
----------------	----------------	-------------	-------------------------	----------------

			Recommended	
refEntityInstance	Reference	A reference to the unique id of the Entity to which this record relates.	M	N
priceObserved	PStructuredValue	The market price observed represented using schema.org PriceSpecification attributes http://schema.org/PriceSpecification	M	N
address	PostalAddress	The market location encoded as a Schema.org PostalAddress. https://schema.org/PostalAddress	M	N
marketScale	TStructuredValue	Unique code assigned to market scale type. The content includes both a name and a value. "Wholesale":Wholesale market price "Retail":Retail market price for example (ex) {'name':'Wholesale', 'value':"02"} or {'name':'Retail', 'value':"01"}	M	N
priceAverage	PStructuredValue	The five year average market price observed represented using schema.org PriceSpecification attributes http://schema.org/PriceSpecification	O	Y
refWeatherObserved	Reference	A reference to the unique id of the related weather observed record.	O	Y

2.3.21.1 MarketPriceObserved JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/f4b694612a8d5c234632d1746865376c>

```
{
  "id": "398aa5f4-6a81-4dea-9f85-e9869441a257",
  "type": "MarketPriceObserved",
  "dateCreated": {
    "value": "2017-06-13T23:59:15.76Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2017-06-13T23:59:15.76Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.samplefarmproduct.com",
```

```
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refEntityInstance": {
    "value": "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84" ],
    "type": "Reference"
  },
  "priceObserved": {
    "value": {
      "price": 5,
      "priceCurrency": "USD",
      "validFrom": {
        "value": "2017-08-22T10:18:16Z",
        "type": "DateTime"
      },
      "validThrough": {
        "value": "2017-08-23T10:18:16Z",
        "type": "DateTime"
      }
    },
    "type": "StructuredValue"
  },
  "address": {
    "type": "PostalAddress",
    "value": {
      "addressCountry": "UK",
      "addressLocality": "London"
    }
  },
  "marketScale": {
    "value": {
      "name": "Wholesale",
      "value": "02" "type": "text"
    },
    "type": "StructuredValue"
  },
  "priceAverage": {
    "value": {
      "price": 15,
      "priceCurrency": "USD",
      "validFrom": {
        "value": "2012-08-23T10:18:16Z",
        "type": "DateTime"
      },
      "validThrough": {
        "value": "2017-08-23T10:18:16Z",
```

```
        "type": "DateTime"
      }
    },
    "type": "StructuredValue"
  },
  "refWeatherObserve": {
"cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c85"  ],
    "type": "Reference"
  }
}
```

2.3.22 PointOfInterest

This entity contains a harmonised geographic description of a Point of Interest. This entity is used in applications that use spatial data and is applicable to Automotive, Environment, Industry and Smart City vertical segments and related IoT applications.

<PointOfInterest><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "PointOfInterest".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<PointOfInterest><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
location	geo:json	The geo:json encoded map location (point or polygon or multi-polygon), of this point of interest.	M	N
category	List	A JSON encoded List of one or more sequence of characters referring to category codes as per the taxonomy definition at https://github.com/Factual/places/blob/master/categories/factual_taxonomy	M	Y

		y.json The respective locale specific category can be accessed via a lookup of the JSON dictionary.		
description	Text	An optional description of the entity.	R	Y
place	Place	The schema.org place definition for this Point Of Interest. See https://schema.org/Place	R	Y

2.3.22.1 PointOfInterest JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/4cd7203d66ccf2caf2123cf4519f5f74>

```
{
  "id": "44e47705-90c3-4dbc-a0ae-7810306de5e9",
  "type": "PointOfInterest",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "location": {
    "value": {
      "type": "Point",
      "coordinates": [
        -104.99404,
        39.75621
      ]
    },
    "type": "geo:json"
  },
  "category": {
    "value": [
      "36"
    ],
    "type": "List"
  }
}
```

```
  },
  "description": {
    "value": "Learn all about mobile at the GSMA Academy",
    "type": "Text"
  },
  "place": {
    "type": "Place",
    "value": {
      "name": "GSMA Academy",
      "address": {
        "type": "PostalAddress",
        "addressLocality": "London",
        "postalCode": "EC4N 8AF",
        "streetAddress": "25 Walbrook"
      },
      "telephone": "0212345678"
    }
  }
}
```

2.3.23 Product

This entity contains a harmonised description of a generic product. This entity is primarily associated with products and supply chains. It is the harmonised description of the <http://gs1.org/voc/Product>:

<Product><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "Product".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Product><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
productType	Reference	Unique id of this product type. Refers to the relevant ProductType record.	R	Y
supplierName	Text	The details of the local retailer of this product.	R	Y
category	List	A choice from an enumerated list. including: fertiliser, herbicide, pesticide, other	R	Y
gtin	Text	GS1 product code A Global Trade Item Number (GTIN)	O	Y

		<p>is the 14 digit GS1 Identification Key used to identify products. The key comprises a GS1 Company Prefix followed by an Item Reference Number and a Check Digit.</p> <p>See http://www.gs1.org/gtin for more details.</p> <p>There are four GTIN formats. A uniform 14-digit format is required for this harmonised model, add leading zeros as required:</p> <p>00000nnnnnnnn (GTIN-8) 00nnnnnnnnnnnn (GTIN-12) 0nnnnnnnnnnnnn (GTIN-13)</p>		
productName	Text	The name of this product.	R	Y
description	Text	A description of this product.	R	Y
manufacturerName	Text	The name of manufacturer of this product.	R	Y
brand	Text	A description of this brand name.	R	Y
inPackageWidth	Quantitative Value	The width of the product in the package, as measured according to the GS1 Package Measurement Rules. See http://www.gs1.org/package-measurement-rules-implementation-guide for more details.	O	Y
inPackageDepth	Quantitative Value	The depth of the product in its packaging, as measured according to the GS1 Package Measurement Rules. See http://www.gs1.org/package-measurement-rules-implementation-guide for more details.	O	Y
inPackageHeight	Quantitative Value	The height of the product in the package, as measured according to the GS1 Package Measurement Rules. See http://www.gs1.org/package-measurement-rules-implementation-guide for more details.	O	Y
netWeight	Quantitative Value	Used to identify the net weight of the product. Net Weight excludes all packaging material, including the packaging material of all lower-level GTINs. Example:11.5 kg	O	Y
grossWeight	Quantitative Value	Used to identify the gross weight of the product. The gross weight includes all packaging materials of the product. At pallet level the	O	Y

		productGrossWeight includes the weight of the pallet itself. For example, 200 GRM, value - total pounds, total grams, etc.		
countryOfOrigin	Text	Country where the product was manufactured, harvested, mined etc. Code indicating the country of origin of the product.	O	Y
gpcCategoryCode	Text	Product category code 8-digit code (GPC "Brick Value") specifying a product category according to the GS1 Global Product Classification (GPC) standard. For more information see http://www.gs1.org/gpc	O	Y
image	List of URLs	List of URLs of images of the product. Each URL links to a file containing a visual representation of the product either as catalogue images or as actual images of the specific product.	O	Y
growerURL	URL	URL of a grower of a product (particularly agricultural)	O	Y
manufacturer	Organization	Name of the product manufacturer The organization that produces the item.	O	Y

2.3.23.1 Product JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/0817901a9f8ae3440ab751513acdf88e>

```
{
  "id": "6223903a-d8c5-4e7e-af24-cc90967feb61",
  "type": "Product",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  }
}
```

```
"schemaVersion": {
  "value": "1.0",
  "type": "Text"
},
"productType": {
  "type": "Reference",
  "value": "27242396-032d-11e7-83f3-83fdf070a882"
},
"supplierName": {
  "type": "Text",
  "value": "Acme Products, Inc."
},
"category": {
  "value": [
    "Vegetables"
  ],
  "type": "List"
},
"gtin": {
  "type": "Text",
  "value": "01234567890"
},
"productName": {
  "type": "Text",
  "value": "Paprika, dried, powdered"
},
"description": {
  "type": "Text",
  "value": "Natural paprika grown in Suffolk"
},
"manufacturerName": {
  "type": "Text",
  "value": "Paprika Company"
},
"brand": {
  "type": "Text",
  "value": "All natural Suffolk spice"
},
"inPackageWidth": {
  "type": "QuantitativeValue",
  "value": {
    "unitText": "inch",
    "unitCode": "INH",
    "value": 25
  }
},
"inPackageDepth": {
  "type": "QuantitativeValue",
  "value": {
    "unitText": "inch",
    "unitCode": "INH",
    "value": 5
  }
}
```

```
},
"inPackageHeight": {
  "type": "QuantitativeValue",
  "value": {
    "unitText": "inch",
    "unitCode": "INH",
    "value": 15
  }
},
"netWeight": {
  "type": "QuantitativeValue",
  "value": {
    "unitText": "grammes",
    "unitCode": "GRM",
    "value": 2500
  }
},
"grossWeight": {
  "type": "QuantitativeValue",
  "value": {
    "unitText": "grammes",
    "unitCode": "GRM",
    "value": 3000
  }
},
"countryOfOrigin": {
  "type": "Text",
  "value": "GB"
},
"gpcCategoryCode": {
  "type": "Text",
  "value": "00786613"
},
"Image": {
  "type": "URL",
  "value": [
    "http://example.com/productImg1.jpg",
    "http://example.com/productImg2.jpg"
  ]
},
"growerURL": {
  "type": "URL",
  "value": "http://www.example.com"
},
"manufactuer": {
  "type": "Organization",
  "value": {
    "name": "Paprika Company"
  }
}
}
```

2.3.24 ProductRecord

This entity contains a harmonised description of the conditions recorded as a product (generally a physical instance of a product) moves through the supply chain. This entity is primarily associated with the retail supply vertical and related IoT applications.

<ProductRecord><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " ProductRecord ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<ProductRecord><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refProduct	Reference	Unique id of the Product to which this record relates.	M	N
location	geo:json	The geo:json encoded current location.	M	N
temperature	ExtQuantitativeValue	The observed local air temperature in degrees centigrade encoded as an ExtQuantitativeValue.	O	Y
relativeHumidity	ExtQuantitativeValue	Relative Humidity a number between 0 and 1 representing the range 0% to 100 (%)	O	Y

		$0 \leq \text{relativeHumidity} \leq 1$ encoded as a ExtQuantitativeValue.		
atmosphericPressure	ExtQuantitativeValue	Atmospheric Pressure in units of hecto Pascals encoded as a ExtQuantitativeValue.	O	Y
description	Text	Description of this ProductRecord.	R	Y
weight	ExtQuantitativeValue	Current (i.e. measured) weight of the product including packaging. This may differ from the original weight due to additional packaging or losses during shipment e.g. evaporation	O	Y
netWeight	QuantitativeValue	Weight of the Agri-Product itself in a package with GS1 code Used to identify the net weight of the product. Net Weight excludes all packaging material, including the packaging material of all lower-level GTINs. Example:11.5 kg	O	Y
volume	QuantitativeValue	The current volume of the product including packaging.	O	Y
dateObserved	DateTime	The timestamp at which this ProductRecord was generated.	R	Y
O2	QuantitativeValue	The level of gaseous Oxygen (O2) present in the atmosphere as measured around the product. (M1)	O	Y

2.3.24.1 ProductRecord JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/4c2fc701cf2bf121b360613cf27ba8d4>

```
{
  "id": "85d05a21-6907-44b3-83d8-85d8a713d003",
  "type": "ProductRecord",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
}
```

```
"schemaVersion": {
  "value": "1.0",
  "type": "Text"
},
"refProduct": {
  "type": "Reference",
  "value": "6223903a-d8c5-4e7e-af24-cc90967feb61"
},
"location": {
  "value": {
    "type": "Point",
    "coordinates": [
      -104.99404,
      39.75621
    ]
  },
  "type": "geo:json"
},
"temperature": {
  "type": "ExtQuantitativeValue",
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "unitCode": "CEL",
    "value": 3.823
  }
},
"relativeHumidity": {
  "type": "ExtQuantitativeValue",
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "unitCode": "C62",
    "value": 0.70
  }
},
"atmosphericPressure": {
  "type": "ExtQuantitativeValue",
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "unitCode": "A97",
    "value": 1006.19
  }
},
"description": {
  "type": "Text",
  "value": "Palm oil consignment arrived at port for shipment"
},
"weight": {
  "type": "ExtQuantitativeValue",
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "unitText": "grammes",
    "unitCode": "GRM",
    "value": 2550
  }
}
```

```
    }  
  },  
  "netWeight": {  
    "type": "QuantitativeValue",  
    "value": {  
      "unitText": "grammes",  
      "unitCode": "GRM",  
      "value": 2500  
    }  
  },  
  "volume": {  
    "type": "QuantitativeValue",  
    "value": {  
      "unitCode": "MTQ",  
      "value": 1.7  
    }  
  },  
  "dateObserved": {  
    "value": "2016-08-08T10:18:16Z",  
    "type": "DateTime"  
  },  
  "O2": {  
    "type": "ExtQuantitativeValue",  
    "value": {  
      "value": 300,  
      "unitCode": "GQ"  
    }  
  }  
}
```

2.3.25 ProductType

This entity contains a harmonised description of a generic product type. This entity is primarily associated with the product supply chain verticals and related IoT applications. The ProductType includes a hierarchical structure that allows product types to be grouped in a flexible way.

<ProductType><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " ProductType ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<ProductType><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
name	Text	The name of this ProductType.	M	N
description	Text	A description of this ProductType.	M	N
root	Boolean	A logical indicator that this product is the root of a ProductType hierarchy. Logical TRUE indicates it is a root.	M	N
refParentType	List of Reference	A JSON encoded sequence of characters referencing the unique ids of the ProductType groupings this ProductType is a member of.	O	Y

2.3.25.1 ProductType JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/1cc0398be95ed4287dec068f8bc6da50>

```
{
  "id": "8bd39518-041d-4a9a-8c0c-0bf15d5f07f1",
  "type": "ProductType",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "name": {
    "type": "Text",
    "value": "Refined Palm Oil"
  },
  "description": {
    "type": "Text",
    "value": "Bulk refined palm oil"
  },
  "root": {
    "type": "Boolean",
    "value": true
  },
  "refParentType": {
    "type": "List",
    "value": [
      "66edbb59-90ea-4757-aa06-5a5b95675092"
    ]
  }
}
```

2.3.26 Road

This entity contains a harmonised geographic and contextual description of a Road. Roads are made up of one or more RoadSegment entities. This entity is primarily associated with the Automotive and Smart City vertical segments and related IoT applications.

<Road><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "Road".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Road><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
country	Text	The country in which this road is in	M	N
refRoadSegment	List of Reference	A JSON encode sequence of characters referencing the unique ids of the group of roadSegments that define this road.	R	Y
roadClass	Text	The official classification of this road (relevant to the local country).	R	Y
name	Text	The official designation of this road.	R	Y
alternateName	Text	An alternative name for this road.	O	Y

2.3.26.1 Road JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/aa8dc76b8702be6e0f9509563c308861>

```
{
  "id": "19b6f4b7-a9b4-4114-8391-3133bf96aedc",
  "type": "Road",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "country": {
    "value": "United Kingdom",
    "type": "Text"
  },
  "refRoadSegment": {
    "value": [
      "2a982120-4d98-425b-a8db-1de5563db6a8",
      "43e255c7-262e-4d6d-95a1-69a53e37dcc0"
    ],
    "type": "List"
  },
  "roadClass": {
    "value": "Dual Carriageway",
    "type": "Text"
  },
  "name": {
    "value": "M1",
    "type": "Text"
  },
  "alternateName": {
    "value": "M1 Motorway",
    "type": "Text"
  }
}
```

2.3.27 RoadSegment

This entity contains a harmonised geographic and contextual description of a RoadSegment. A collection of RoadSegments are used to describe a Road. This entity is primarily associated with the Automotive and Smart City vertical segments and related IoT applications.

<RoadSegment><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "RoadSegment".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<RoadSegment><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
startPoint	geo:json	The start point of this RoadSegment.	M	N
endPoint	geo:json	The end point of this RoadSegment.	M	N
roadClass	Text	The official classification of the road that this roadSegment is a part of.	R	Y
name	Text	The official designation of the road that this roadSegment is a part of.	R	Y
location	geo:json	A geo:json line sequence (LineString)	R	Y

		containing all the points that make up this RoadSegment.		
refPointOfInterest	List of Reference	A List containing a JSON encoded sequence of characters referencing the Ids of the points of interest along this road segment.	O	Y

2.3.27.1 RoadSegment JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/127ce8f2f2b56e50d9326523fc1a221f>

```
{
  "id": "27109fe0-0c60-4302-a9eb-e7065eca876e",
  "type": "RoadSegment",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "startPoint": {
    "value": {
      "type": "Point",
      "coordinates": [
        -104.99404, 39.75621
      ]
    },
    "type": "geo:json"
  },
  "endPoint": {
    "value": {
      "type": "Point",
      "coordinates": [
        -109.99404,
        32.75621
      ]
    },
    "type": "geo:json"
  }
}
```

```
  },
  "roadClass": {
    "value": "Single Carriageway",
    "type": "Text"
  },
  "name": {
    "value": "A123",
    "type": "Text"
  },
  "location": {
    "value": {
      "type": "LineString",
      "coordinates": [
        [-104.99404, 39.75621],
        [-102.98, 32.75],
        [-103.99, 30.75],
        [-103.99, 31.75],
        [-109.99404, 32.75621]
      ]
    },
    "type": "geo:json"
  },
  "refPointOfInterest": {
    "value": [
      "4d798319-22b1-4714-b847-b81dbba3357b",
      "1909a43d-e5a1-46cb-bbd0-7cc16bc4fa33"
    ],
    "type": "List"
  }
}
```

2.3.28 Subscriber

This entity contains a harmonised description of a subscriber to a service. This entity is primarily associated with the Smart Home vertical segment and related IoT applications.

<Subscriber><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " Subscriber ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Subscriber><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
subscriptionId	Reference	A reference to the unique id of the subscription service.	M	N
startDate	DateTime	The start timestamp for this subscription as an ISO8601 sequence of characters in UTC.	R	Y
endDate	DateTime	The end timestamp for this subscription as an ISO8601 sequence of characters in UTC.	R	Y
duration	Number	The duration of the subscription in calendar months.	O	Y

category	List	The category of subscription. A selection from an enumerated list including: prepay, postpay, utility, broadband, electric, gas, heat, water, landline, mobile, tv, security, financial, energy management, other.	O	Y
averageMonthly Usage	Number or Quantitative Value	Average monthly usage of the subscription service.	O	Y
subscribed	List of Reference	A List containing a JSON encoded sequence of characters referencing the unique ids of those persons or organisations that have subscribed to this service. Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	O	Y

2.3.28.1 Subscriber JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/4bdc07091dd7fd8af7abcb58103ba513>

```
{
  "id": "c1716dea-6a4d-4171-a733-916123942f09",
  "type": "Subscriber",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
}
```

Official Document CLP.26 - IoT Big Data Harmonised Data Model

```
"subscriptionId": {
  "value": "65b1ccb0-ee32-41c1-9746-7ba83fb0f0f1",
  "type": "Reference"
},
"startDate": {
  "value": "2016-08-22T10:18:16Z",
  "type": "DateTime"
},
"endDate": {
  "value": "2017-08-22T23:59:59Z",
  "type": "DateTime"
},
"duration": {
  "value": 12,
  "type": "Number"
},
"category": {
  "value": [
    "utility"
  ],
  "type": "List"
},
"averageMonthlyUsage": {
  "value": 28,
  "type": "Number"
},
"subscribed": {
  "value": [
    "31dd0e29-45b6-476f-9756-a70f8141dcf3"
  ],
  "type": "List"
}
}
```

2.3.29 SubscriptionService

This entity contains a harmonised description of a subscription service. This entity is primarily associated with the Smart Home vertical segment and related IoT applications.

<SubscriptionService><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " SubscriptionService ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<SubscriptionService><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
description	Text	The description of this service.	M	N
offer	Offer	Encoded as Schema.org offer. https://schema.org/Offer	R	Y

2.3.29.1 SubscriptionService JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/08c9d422617b832bc1c04d164973c172>

```
{
  "id": "a1e76f95-c627-4ec4-86dc-483431d25352",
  "type": "SubscriptionService",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "description": {
    "value": "Broadband supply service",
    "type": "Text"
  },
  "offer": {
    "type": "Offer",
    "value": {
      "priceCurrency": "USD",
      "price": 50,
      "description": "100 mbps fibre broadband service"
    }
  }
}
```

2.3.30 UAV

This entity contains a harmonised description of a specific Unmanned Aerial Vehicle (UAV). This entity is primarily associated with UAV command and control and related UAV transport applications.

<UAV><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity. A globally unique reference to this entity instance. It is recommended ids comply with RFC4122.	M	N
type	Text	Must be equal to "UAV".	M	N
dateCreated	DateTime	Entity creation timestamp. This will usually be allocated by the storage platform.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity. This will usually be allocated by the storage platform. A null value in this field or a value equivalent to dateCreated means the entity has not been modified since being created.	O	Y
source	URL	A sequence of characters giving the original source of the entity data as a URL. Recommended to be the fully qualified domain name of the source provider, or the URL to the source object.	R	Y
dataProvider	Text	A sequence of characters identifying the provider of the harmonised data entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<UAV><EntitySpecificAttributes>

Attribute Name	Attribute	Description	Mandatory/ Optional/	May be
----------------	-----------	-------------	----------------------	--------

	Type		Recommended	Null
refUAVModel	Reference	A JSON encode sequence of characters referencing the Id of the UAVModel entity, which describes this UAV in more detail.	M	N
owner	List of references to Person(s) or Organization(s)	A List containing a JSON encoded sequence of characters referencing the unique Ids of the owner(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	R	Y
operator	List of references to Person(s) or Organization(s)	A List containing a JSON encoded sequence of characters referencing the unique Ids of the owner(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	R	Y
operationMode	Text	Text describing the choice from "vlos", "evlos", "bvlos", "automated" Note: descriptions align with UTM Flight message.	R	Y
location	Geo:json	The current geo:json encoded map location of the UAV	M	N
elevation	ExtQuantitativeValue	The elevation of the UAV. Specify value and units of measure	M	N
dateObserved	DateTime	The date and time of this monitoring report in ISO8601 UTC format.	M	N
flightStatus	Text	The flight status of the UAV, including stop, takeoff, flight, hover, land	M	N
workStatus	Text	The work status of the UAV, including stop, prepare, work, finish	O	Y
groundSpeed	ExtQuantitativeValue	The real-time speed of the UAV. Specify value and units of measure	O	Y
fuel	ExtQuantitativeValue	Current fuel load of the UAV. Specify value and units of measure	O	Y

2.3.30.1 UAV JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/c4797bcbb68497fdee3769df50ce12e0>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
  "type": "UAV",
  "dateCreated": {
```

```
    "value": "2017-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refUAVModel": {
    "value": "23821045-33d4-46ec-b777-98f461bf4856",
    "type": "Reference"
  },
  "owner": {
    "value": [
      "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84",
      "1be9cd61-ef59-421f-a326-4b6c84411ad4"
    ],
    "type": "List"
  },
  "operator": {
    "value": [
      "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84",
      "1be9cd61-ef59-421f-a326-4b6c84411ad4"
    ],
    "type": "List"
  },
  "operationMode": {
    "value": "vlos",
    "type": "text"
  },
  "location": {
    "value": {
      "type": "Point",
      "coordinates": [
        -103.9904,
        39.7564
      ]
    },
    "type": "geo:json"
  },
  "elevation": {
    "value": {
```

```
        "value": 1000,  
        "unitCode": "MTR",  
        "timestamp": "2016-09-20T10:15:16Z"  
    },  
    "type": "ExtQuantitativeValue"  
},  
"dateObserved": {  
    "value": "2016-08-08T10:18:16Z",  
    "type": "DateTime"  
},  
"flightStatus": {  
    "value": "takeoff",  
    "type": "text"  
},  
"workStatus": {  
    "value": "finish",  
    "type": "text"  
},  
"groundSpeed": {  
    "value": {  
        "value": 50,  
        "unitText": "MTS"  
    },  
    "type": "ExtQuantitativeValue"  
},  
"fuel": {  
    "value": {  
        "value": 50,  
        "unitCode": "GLI",  
        "timestamp": "2016-08-08T10:18:16Z"  
    },  
    "type": "ExtQuantitativeValue"  
}  
}
```

2.3.31 UAVADSB

This entity contains a harmonised description of a generic UAV Automatic Dependent Surveillance–Broadcast. This entity is primarily associated with the control and management of Unmanned Aerial Vehicles. Each UAVADSB instance will be related to a specific UAV instance.

<UAVADSB><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "UAVADSB".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

< UAVADSB><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refUAV	Reference	Refers to the specific UAV instance to which this UAVADSB record relates.	M	N
dateObserved	Date Time	The date and time of this DBS broadcast in ISO8601 UTC format.	M	N
originator	Boolean	A logical indicator of source of the message. TRUE indicates it is the UAV itself, FALSE indicates that it is a different source, a listening station software application or a different UAV.	M	N
refOriginator	Reference	Refers to the specific UAV instance or software application that reported the information.	O	Y
UAVADSBroadcast	Text	A flight message describing the current flight status encoded as a DBSB Message in a string encoded binary format. https://media.readthedocs.org/pdf/adsb-decode-guide/latest/adsb-decode-guide.pdf	M	N

2.3.31.1 UAVADSB JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/3c326f6fe66b3eeab2b1464c28563dca>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
  "type": "UAVADSB",
  "dateCreated": {
    "value": "2017-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
```

```
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refUAV": {
    "value": "23821045-33d4-46ec-b777-98f461bf4856",
    "type": "Reference"
  },
  "dateObserved": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "originator": {
    "value": true,
    "type": "Boolean"
  },
  "refOriginator": {
    "value": "23821045-33d4-46ec-b777-98f461bf4856",
    "type": "Reference"
  },
  "UAVADSBroadcast": {
    "value": "00100000001011001100001101110001110000110010110011100000",
    "type": "Text"
  }
}
```

2.3.32 UAVEvent

The UAVEvent records the incursion of a specific UAV into or near protected airspace or locations. It also records the control measure taken. This entity is primarily associated with UAV command and control and related UAV transport applications.

<UAVEvent><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
Id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "UAVEvent".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<UAVEvent><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refUAV	Reference	A JSON encode sequence of characters referencing the Id of the UAV entity, which is associated with this event.	M	N
refOriginator	Reference	Refers to the specific software application that reported the information.	M	N
location	Geo:json	The geo:json encoded map location of the UAV point where the event is triggered.	M	N
elevation	ExtQuantitativeValue	A number indicating the elevation of the UAV when the event is triggered. Specify value and units of measure	M	N
eventStart	DateTime	The start date and time of this event in ISO8601 UTC format.	M	N
eventType	Text	The type of the UAV event, a choice from: illegal flight , close to unpermitted airspace, overspeed, over height, illegal work	M	N
description	Text	The description of this event	R	Y
eventEnd	DateTime	The end date and time of this event in ISO8601 UTC format.	R	Y
eventResult	Text	The handle result of the event, a choice from: logged, notify, alarm, force land, force back, force hover	R	Y

2.3.32.1 UAVEvent JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/050f4f160371a087845e17214904f3e8>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
  "type": "UAVEvent",
  "dateCreated": {
    "value": "2017-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  }
}
```

```
},
"source": {
  "value": "http://www.example.com",
  "type": "URL"
},
"dataProvider": {
  "value": "OperatorA",
  "type": "Text"
},
"schemaVersion": {
  "value": "1.0",
  "type": "Text"
},
"refUAV": {
  "value": "23821045-33d4-46ec-b777-98f461bf4856",
  "type": "Reference"
},
"refOriginator": {
  "value": "23821045-33d4-46ec-b777-98f461bf4856",
  "type": "Reference"
},
"location": {
  "value": {
    "type": "Point",
    "coordinates": [
      -103.9904,
      39.7564
    ]
  },
  "type": "geo:json"
},
"elevation": {
  "value": {
    "value": 1000,
    "unitCode": "MTR",
    "timestamp": "2016-09-20T10:15:16Z"
  },
  "type": "ExtQuantitativeValue"
},
"eventStart": {
  "value": "2016-08-22T10:18:16Z",
  "type": "DateTime"
},
"eventType": {
  "value": "over height",
  "type": "text"
},
"description": {
  "value": "the UAV is flying over a height limit",
  "type": "text"
},
"eventEnd": {
  "value": "2016-08-22T10:19:16Z",
```

```
    "type": "DateTime"  
  },  
  "eventResult": {  
    "value": "alarm",  
    "type": "text"  
  }  
}
```

2.3.33 UAVModel

This entity contains a harmonised description of a generic Unmanned Ariel Vehicle (UAV) model and is applicable to UAV command and control and related UAV transport applications.

<UAVModel><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity. A globally unique reference to this entity instance. It is recommended ids comply with RFC4122.	M	N
type	Text	Must be equal to "UAVModel".	M	N
dateCreated	DateTime	Entity creation timestamp. This will usually be allocated by the storage platform.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity. This will usually be allocated by the storage platform. A null value in this field or a value equivalent to dateCreated means the entity has not been modified since being created.	O	Y
source	URL	A sequence of characters giving the original source of the entity data as a URL. Recommended to be the fully qualified domain name of the source provider, or the URL to the source object.	R	Y
dataProvider	Text	A sequence of characters identifying the provider of the harmonised data entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<UAVModel><EntitySpecificAttributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
model	Text	The UAV model's identifier, which may be a UAVModel name.	M	N

doc	URL	Reference to Product Data Sheet or other manufacturer's documentation about this UAVModel.	R	Y
description	Text	A description of this UAVModel.	R	Y
manufacturerName	Text	The name of manufacturer of this UAVModel.	R	Y
brandName	Text	A description of the brand name of this UAVModel.	R	Y
category	Text	The work category of the UAVModel A choice from the following list: "Aerial_photography, Plant_protection, Industry, Routing_inspection, Mailing, Transportation"	R	Y
rotorNumber	Number	The number of the rotors of the UAVModel	R	Y
fuelType	Text	The fuel type powering the UAVModel. A choice from an enumerated list describing the power source. One of: gasoline, petrol(unleaded), petrol(leaded), petrol, diesel, electric, hydrogen, lpg autogas, cng, biodiesel, ethanol, hybrid electric/petrol, hybrid electric/diesel, other	R	Y
maxFlightTime	QuantitativeValue	The maximum duration of flight of the UAVModel with full fuel and no load. Specify value and units of measure	R	Y
maxFlightAltitude	QuantitativeValue	The maximum flight altitude of the UAVModel above ground. Specify value and units of measure	R	Y
maxGroundVelocity	QuantitativeValue	The maximum ground velocity of the UAVModel. Specify value and units of measure	R	Y
minWeight	QuantitativeValue	The weight of the UAV without fuel or load. Specify value and units of measure	O	Y
minUnladenWeight	QuantitativeValue	The weight of the UAV with full fuel but no load. Specify value and units of measure	O	Y
maxLoad	QuantitativeValue	The maximum load that the UAV is permitted to transport. Specify value and units of measure.	O	Y

2.3.33.1 UAVModel JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/ef967e9b0f6837603af191f69b975ae7>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
  "type": "UAVModel",
  "dateCreated": {
    "value": "2017-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "model": {
    "value": "UASUSA Recon",
    "type": "text"
  },
  "doc": {
    "value": "http://www.uasusa.com/products-services/aircraft/the-recon.html",
    "type": "URL"
  },
  "description": {
    "value": "The Recon was constructed and designed to offer a clear payload view, with the motor and propeller system aft of the payload. It is smaller and more versatile than many drones, yet robust enough for harsh environment operations. The wingspan is 2.3 meters. An affordable, versatile, and flexible drone for a multitude of uses",
    "type": "text"
  },
  "manufactureName": {
    "value": "UASVSA",
    "type": "text"
  },
  "brandName": {
    "value": "UASVSA",
    "type": "text"
  },
  "category": {
    "value": "",
    "type": "text"
  },
}
```

```
"rotorNumber": {
  "value": 4,
  "type": "Number"
},
"fuelType": {
  "value": "gasoline",
  "type": "text"
},
"maxFlightTime": {
  "value": {
    "value": 100,
    "unitCode": "HUR"
  },
  "type": "QuantitativeValue"
},
"maxFlightAltitude": {
  "value": {
    "value": 1000,
    "unitCode": "MTR"
  },
  "type": "QuantitativeValue"
},
"maxGroundVelocity": {
  "value": {
    "value": 100,
    "unitCode": "MTS"
  },
  "type": "QuantitativeValue"
},
"minWeight": {
  "value": {
    "value": 1,
    "unitCode": "KGM"
  },
  "type": "QuantitativeValue"
},
"minUnladenWeight": {
  "value": {
    "value": 1.5,
    "unitCode": "KGM"
  },
  "type": "QuantitativeValue"
},
"maxLoad": {
  "value": {
    "value": 2,
    "unitCode": "KGM"
  },
  "type": "QuantitativeValue"
}
}
```

2.3.34 UAVStateVector

This entity contains a harmonised description of a generic UAV State Vector, which is an Interpretation and aggregation of Automatic Dependent Surveillance–Broadcast messages. This entity is primarily associated with the control and management of Unmanned Aerial Vehicles. Each UAVStateVector instance is related to a specific UAV instance.

< UAVStateVector ><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "UAVStateVector".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

< UAVStateVector ><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refUAV	Reference	Refers to the specific UAV instance to which this UAVstateVector record relates.	M	N
dateObserved	DateTime	The date and time relating to this state vector in ISO8601 UTC format.	M	N
refOriginator	Reference	Refers to the specific software application that reported the	M	N

		information.		
stateVector	List	A state vector describing the current flight status encoded as an opensky-network.org StateVector encoded as a JSON object. https://opensky-network.org/apidoc/javadoc/org/opensky/model/StateVector.html	M	N

2.3.34.1 UAVStateVector JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/0ef3d716a8303580f4fec17ca32d8af0>{

```
"id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
"type": "UAVStateVector",
"dateCreated": {
  "value": "2017-08-08T10:18:16Z",
  "type": "DateTime"
},
"dateModified": {
  "value": "2016-08-08T10:18:16Z",
  "type": "DateTime"
},
"source": {
  "value": "http://www.example.com",
  "type": "URL"
},
"dataProvider": {
  "value": "OperatorA",
  "type": "Text"
},
"schemaVersion": {
  "value": "1.0",
  "type": "Text"
},
"refUAV": {
  "value": "23821045-33d4-46ec-b777-98f461bf4856",
  "type": "Reference"
},
"dateObserved": {
  "value": "2016-08-08T10:18:16Z",
  "type": "DateTime"
},
"refOriginator": {
  "value": "13821045-33d4-46ec-b777-98f461bf4123",
  "type": "Reference"
},
"stateVector": {
  "value": [
    100,
    200,
```

```
        300,  
        400  
    ],  
    "type": "List"  
  }  
}
```

2.3.35 UAVTMS

This entity contains a harmonised description of a specific Unmanned Aerial Vehicle (UAV) Traffic Management Software Application that is designed to listen to and monitor the information transmitted by UAV's, typically this software application would be operated at a ground station. This entity is primarily associated with UAV command and control applications.

<UAVTMS><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
Id	Text	Unique id of this instance of this entity. A globally unique reference to this entity instance. It is recommended ids comply with RFC4122.	M	N
Type	Text	Must be equal to "UAVTMS" .	M	N
dateCreated	DateTime	Entity creation timestamp. This will usually be allocated by the storage platform.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity. This will usually be allocated by the storage platform. A null value in this field or a value equivalent to dateCreated means the entity has not been modified since being created.	O	Y
source	URL	A sequence of characters giving the original source of the entity data as a URL. Recommended to be the fully qualified domain name of the source provider, or the URL to the source object.	R	Y
dataProvider	Text	A sequence of characters identifying the provider of the harmonised data entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<UAVTMS><EntitySpecificAttributes>

Attribute Name	Attribute	Description	Mandatory/	May be
----------------	-----------	-------------	------------	--------

	Type		Optional/ Recommended	Null
refSoftwareAppl ication	Reference	A JSON encoded sequence of characters referencing the unique Id of the Software Application. Related to a Schema.org Software Application. https://schema.org/SoftwareApplication	M	N
operationalInsta nce	URL	A sequence of characters giving the URL of this operational instance.	M	N
owner	List of references to Person(s) or Organizati on(s)	A List containing a JSON encoded sequence of characters referencing the unique Ids of the owner(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	R	Y
operator	List of references to Person(s) or Organizati on(s)	A List containing a JSON encoded sequence of characters referencing the unique Ids of the owner(s). Related to a Schema.org person or organization. https://schema.org/Person https://schema.org/Organization	R	Y

2.3.35.1 UAVTMS JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/cfc36fd28d8b38313eccedd3bc6b00c1>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
  "type": "UAVTMS",
  "dateCreated": {
    "value": "2017-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
}
```

```
"schemaVersion": {
  "value": "1.0",
  "type": "Text"
},
"refSoftwareApplication": {
  "value": "23821045-33d4-46ec-b777-98f461bf4856",
  "type": "Reference"
},
"operationalInstallation": {
  "value": "http://www.example.com",
  "type": "URL"
},
"owner": {
  "value": [
    "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84",
    "1be9cd61-ef59-421f-a326-4b6c84411ad4"
  ],
  "type": "List"
},
"operator": {
  "value": [
    "cdfd9cb8-ae2b-47cb-a43a-b9767ffd5c84",
    "1be9cd61-ef59-421f-a326-4b6c84411ad4"
  ],
  "type": "List"
}
}
```

2.3.36 UAVUTMFlightMessage

This entity contains a harmonised description of a generic UAV UTM Flight Message, which contains a Global UTM Association protocol message. This entity is primarily associated with the control and management of Unmanned Aerial Vehicles. Each UAVUTMFlightMessage instance is related to a specific UAV instance.

< UAVUTMFlightMessage ><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "UAVUTMFlightMessage".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

< UAVUTMFlightMessage ><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refUAV	Reference	Refers to the specific UAV instance to which this UAVFlightMessage record relates.	M	N
dateObserved	DateTime	The date and time relating to this UTM flight message in ISO8601 UTC format.	M	N
originator	Boolean	A logical indicator of source of the	M	N

		message. TRUE indicates it is the UAV itself, FALSE indicates that it is a different source, a ground station software application.		
refOriginator	Reference	Refers to the specific software application that reported the information.	O	Y
flightMessage	StructuredValue	A flight message describing the current flight status encoded as a Global UTM Message encoded as a JSON object. https://bitbucket.org/global_utm/flight-declaration-protocol/	M	N

2.3.36.1 UAVUTMFlightMessage JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/03cb32dc73e933bec1ced78abc312472>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
  "type": "UAVUTMFlightMessage",
  "dateCreated": {
    "value": "2017-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refUAV": {
    "value": "23821045-33d4-46ec-b777-98f461bf4856",
    "type": "Reference"
  },
  "dateObserved": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "originator": {
    "value": true,
```

```
    "type": "Boolean"
  },
  "refOriginator": {
    "value": "23821045-33d4-46ec-b777-98f461bf4856",
    "type": "Reference"
  },
  "flightMessage": {
    "value": {
      "flightId": "5a7f3377-b991-4cc8-af2d-379d57f786d1",
      "status": "success",
      "max_safe_distance": 0,
      "advisory_color": "red"
    },
    "type": "StructuredValue"
  }
}
```

2.3.37 UAVUTMFlightMessageAgent

This entity contains a harmonised description of a generic UAV UTM Flight Message Agent that is designed to subscribe to the Global UTM Association protocol message according to a specific UAV entity. This entity supports the functionality of a service provider to confirm the validity of UTM Flight Message generated by UTM Flight Message Entity. The service provider can include their own Flight Control Policy to the original UTM Flight Message and forward this to a UAVTMS entity.

< UAVUTMFlightMessageAgent ><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "UAVUTMFlightMessageAgent".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

< UAVUTMFlightMessageAgent ><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refUAV	Reference	Refers to the specific UAV instance to which this UAVFlightMessage record relates.	M	N
dateObserved	DateTime	The date and time relating to this UTM flight message in ISO8601 UTC	M	N

		format.		
originator	Boolean	A logical indicator of source of the message. TRUE indicates it is the UAV itself, FALSE indicates that it is a different source, a ground station software application.	M	N
refOriginator	Reference	Refers to the specific software application that reported the information.	O	Y
flightMessage	Structured Value	A flight message describing the current flight status encoded as a Global UTM Message encoded as a JSON object. https://bitbucket.org/global_utm/flight-declaration-protocol/	M	N
validationResult	Boolean	A logical indicator of validation of the message. TRUE indicates it is the validation is confirmed, FALSE indicates that the validation confirmation fails.	M	N
flightControlPolicy	Text or URL	Indicates the flight control policy generated by the service provider. It could be JSON or XML format.	R	Y

2.3.37.1 UAVUTMFlightMessageAgent JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/842fda37cc62b63b55ecd24bf20eed60>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c8",
  "type": "UAVUTMFlightMessageAgent",
  "dateCreated": {
    "value": "2017-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  }
}
```

```
    },  
    "refUAV": {  
      "value": "23821045-33d4-46ec-b777-98f461bf4856",  
      "type": "Reference"  
    },  
    "dateObserved": {  
      "value": "2016-08-08T10:18:16Z",  
      "type": "DateTime"  
    },  
    "originator": {  
      "value": true,  
      "type": "Boolean"  
    },  
    "refOriginator": {  
      "value": "23821045-33d4-46ec-b777-98f461bf4856",  
      "type": "Reference"  
    },  
    "flightMessage": {  
      "value": {  
        "flightId": "5a7f3377-b991-4cc8-af2d-379d57f786d1",  
        "status": "success",  
        "max_safe_distance": 0,  
        "advisory_color": "red"  
      },  
      "type": "StructuredValue"  
    },  
    "validationResult": {  
      "value": true,  
      "type": "Boolean"  
    },  
    "flightControlPolicy": {  
      "value": "www.policy.com",  
      "type": "URL"  
    }  
  }  
}
```

2.3.38 Vehicle

This entity contains a harmonised description of a Vehicle. This entity is primarily associated with the Automotive vertical segment but might also be relevant to Industry, Smart City and Agriculture related IoT applications. Where practicable <https://schema.org/Vehicle> naming conventions have been adopted.

<Vehicle><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "Vehicle".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Vehicle><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refVehicleType	Reference	A JSON encoded sequence of characters referencing the Id of the vehicleType entity which describes this vehicle in more detail.	M	N
fuelType	Text	A choice from an enumerated list describing the power source. One of: gasoline , petrol (unleaded) , petrol (leaded) , petrol ,	O	Y

		diesel, electric, hydrogen, lpg autogas, cng, biodiesel, ethanol, hybrid electric/petrol, hybrid electric/diesel, other		
displacement	Number	A number indicating the cylinder capacity of the engine in litres	O	Y
fuelEfficiency	QuantitativeValue	The efficiency of the vehicle expressed as kilometres per litre or miles per gallon following the Schema.org definition at http://schema.org/fuelEfficiency	O	Y
vehicleModelDate	DateTime	The ISO8601 sequence of characters indicating the year of release.	O	Y
dateDiscontinued	DateTime	The ISO8601 sequence of characters indicating the year which the vehicle was discontinued.	O	Y
vehicleIdentificationNumber	Text	The VIN (vehicle identification number) of the vehicle.	O	Y
mileageFromOdometer	Number or ExtQuantitativeValue	The total distance the car has travelled according to the on-board odometer in kilometres (unitCode KMT) or miles (unitCode SMI). If Number is used the units are assumed to be kilometres. references Schema.org Vehicle/mileageFromOdometer.	O	Y

2.3.38.1 Vehicle JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/0e22f3200c12c9e725148eafca6b225c>

```
{
  "id": "1fa179a6-b507-4857-ad72-eb5513ef05c6",
  "type": "Vehicle",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
```

```
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "refVehicleType": {
    "value": "23821045-33d4-46ec-b777-98f461bf4856",
    "type": "Reference"
  },
  "fuelType": {
    "value": "diesel",
    "type": "Text"
  },
  "displacement": {
    "value": 3,
    "type": "Number"
  },
  "fuelEfficiency": {
    "value": {
      "value": 22,
      "unitText" : "mpg"
    },
    "type": "QuantitativeValue"
  },
  "vehicleModelDate": {
    "value": "2013-01-01T00:00:00Z",
    "type": "DateTime"
  },
  "dateDiscontinued": {
    "value": "2016-08-23T10:18:16Z",
    "type": "DateTime"
  },
  "vehicleIdentificationNumber": {
    "value": "2T2GK31U08C041124",
    "type": "Text"
  },
  "mileageFromOdometer": {
    "value": {
      "value": 33015,
      "unitCode": "SMI",
      "timestamp": "2016-08-08T10:18:16Z"
    },
    "type": "ExtQuantitativeValue"
  }
}
```

2.3.39 VehicleFault

This entity contains a harmonised description of a Vehicle Fault. This entity is primarily associated with the Automotive vertical segment but might also be relevant to Industry, Smart City and Agriculture related IoT applications.

<VehicleFault><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to " VehicleFault ".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<VehicleFault><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refVehicle	List of Reference	A JSON encoded sequence of characters referencing the id of the vehicle in which this fault occurred or multiple ids in the case a common fault can be identified against multiple vehicles.	M	N
dateIdentified	DateTime	An ISO8601 sequence of characters indicating the date and time the fault was detected or identified.	M	N

eventType	Text	The event type descriptor, a choice from an enumerated list including: collision, emergency, harshAccel, harshDecel, auxBatteryWarn, milWarn.	M	N
location	geo:json	The geo location where the fault was detected.	R	Y
processingType	Text	Indicates how the fault was dealt with, e.g. <i>systemHandled</i> , or not present if the issue has not been resolved.	O	Y
dateProcessed	DateTime	The ISO8601 sequence of characters indicating the data and time at which the issue was solved, or not present if the issue has not been resolved.	O	Y
dtCode	Text	DTC or Diagnostic Trouble Codes are codes generated by the vehicle's computer diagnostic system. These may be manufacturer, equipment or vehicle specific.	R	Y
faultLog	Text	Free text that records information about the initial fault incident, ongoing updates and fault resolution.	O	Y

2.3.39.1 VehicleFault JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/9a70cc18bd403c7115d0ffec8ecc2ecf>

```
{
  "id": "4939200a-5ef5-4266-8c91-1f82ad3b543b",
  "type": "VehicleFault",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
```

```
    "value": "1.0",
    "type": "Text"
  },
  "refVehicle": {
    "value": [
      "e64a2ecb-a8ae-4f51-ab66-2e9729c02d22"
    ],
    "type": "List"
  },
  "dateIdentified": {
    "value": "2016-08-20T10:18:16Z",
    "type": "DateTime"
  },
  "eventType": {
    "value": "emergency",
    "type": "Text"
  },
  "location": {
    "value": {
      "type": "Point",
      "coordinates": [
        -104.99404,
        39.75621
      ]
    },
    "type": "geo:json"
  },
  "processingType": {
    "value": "systemHandled",
    "type": "Text"
  },
  "dateProcessed": {
    "value": "2016-08-21T10:18:16Z",
    "type": "DateTime"
  },
  "dtCode": {
    "value": "EMERG-1234-a",
    "type": "Text"
  },
  "faultLog": {
    "value": "Emergency stop. Fault with engine",
    "type": "Text"
  }
}
```

2.3.40 VehicleType

This entity contains a harmonised description of a vehicleType it forms part of the description of a Vehicle. This entity is primarily associated with the Automotive vertical segment but might also be relevant to Industry, Smart City and Agriculture related IoT applications. Where practicable <https://schema.org/Vehicle> naming conventions have been adopted.

<VehicleType><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "VehicleType".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<VehicleType><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
model	Text	The vehicle model identifier.	M	N
category	Text	The vehicle category identifier.	M	N
manufacturer	Text	The manufacturer's identifier.	M	N

2.3.40.1 VehicleType JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/50133c6710743c065dc5f2f982b698fd>

```
{
  "id": "33253089-9cea-4227-889e-61950965f6f9",
  "type": "VehicleType",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "model": {
    "value": "M Class",
    "type": "Text"
  },
  "category": {
    "value": "SUV",
    "type": "Text"
  },
  "manufacturer": {
    "value": "Mercedes Benz",
    "type": "Text"
  }
}
```

2.3.41 WaterQualityObserved

This entity contains a harmonised description of the water quality at a particular location and time. This entity is primarily associated with the vertical segments of agricultural and environment and related IoT applications.

<WaterQualityObserved><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "WaterQualityObserved".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<WaterQualityObserved><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
refDevice	List of Reference	A reference to the unique entity Ids of the devices that originated this observation data.	M	N
location	geo:json	The geo:json encoded map location, that is related to this observation.	M	N
dateObserved	DateTime	The date and time of this observation in ISO8601 UTCformat.	M	N
depth	ExtQuantita	Depth where the observation was	O	Y

	ExtQuantitativeValue (Number)	taken. (<i>m</i>) encoded as a ExtQuantitativeValue.		
pressure	ExtQuantitativeValue (Number)	Hydrostatic pressure where the observation was taken. (Hector Pascals) encoded as a ExtQuantitativeValue.	O	Y
conductivity	ExtQuantitativeValue (Number)	Electrical conductivity. (<i>S/m</i>) encoded as a ExtQuantitativeValue.	O	Y
conductance	ExtQuantitativeValue (Number)	Specific conductivity / 25 °C /. (<i>S/m</i>) encoded as a ExtQuantitativeValue.	O	Y
temperature	ExtQuantitativeValue (Number)	The temperature expressed in degrees Celsius encoded as a ExtQuantitativeValue.	O	Y
tss	ExtQuantitativeValue (Number)	Total suspended solids. (<i>M1</i>) encoded as a ExtQuantitativeValue	O	Y
tds	ExtQuantitativeValue (Number)	Total dissolved solids. (<i>M1</i>) encoded as a ExtQuantitativeValue.	O	Y
turbidity	ExtQuantitativeValue (Number)	Amount of light scattered by particles in the water column. (<i>FTU</i>). encoded as a ExtQuantitativeValue.	O	Y
salinity	ExtQuantitativeValue (Number)	Derived from the conductivity measurement. (<i>parts per thousand, ppt</i>) encoded as a ExtQuantitativeValue.	O	Y
pH	ExtQuantitativeValue (Number)	pH measurement (typically a number between <i>0 and 14</i>) encoded as a ExtQuantitativeValue.	O	Y
orp	ExtQuantitativeValue (Number)	Oxidation-Reduction potential (<i>mV</i>) encoded as a ExtQuantitativeValue.	O	Y
cdom	ExtQuantitativeValue (Number)	Color dissolved organic matter (<i>RFU</i>) encoded as a ExtQuantitativeValue.	O	Y
Chla	ExtQuantitativeValue (Number)	Concentration of chlorophyll A. (<i>H29</i>)	O	Y
Cl	ExtQuantitativeValue (Number)	Concentration of chlorides. (<i>M1</i>)	O	Y
CO	ExtQuantitativeValue (Number)	The level of free non-compound carbon monoxide present. (<i>M1</i>)	O	Y
CO2	ExtQuantitativeValue (Number)	The level of free non-compound	O	Y

	ExtQuantitativeValue (Number)	carbon dioxide present. (M1)		
Hg	ExtQuantitativeValue (Number)	The level of compound mercury present. (M1)	O	Y
NH3	ExtQuantitativeValue (Number)	Concentration -n of ammonia. (M1)	O	Y
NH4	ExtQuantitativeValue (Number)	Concentration of ammonium. (M1)	O	Y
NO3	ExtQuantitativeValue (Number)	Concentration of nitrates. (M1)	O	Y
O2	ExtQuantitativeValue (Number)	The level of free non-compound oxygen present. (M1)	O	Y
PC	ExtQuantitativeValue (Number)	Concentration of pigment phycocyanin which can be measured to estimate cyanobacteria concentrations specifically. (H29)	O	Y
PE	ExtQuantitativeValue (Number)	Concentration of pigment phycoerythrin which can be measured to estimate cyanobacteria concentrations specifically.(H29)	O	Y

2.3.41.1 WaterQualityObserved JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/e23befb590592ddefa6fd817d38919f0>

```
{
  "id": "72a30ca8-888e-49a2-8d8d-a5bebc19e98b",
  "type": "WaterQualityObserved",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  }
}
```

```
"schemaVersion": {
  "value": "1.0",
  "type": "Text"
},
"refDevice": {
  "value": [
    "2033a7c7-d31b-48e7-91c2-014dc426c29e"
  ],
  "type": "List"
},
"location": {
  "value": {
    "type": "Point",
    "coordinates": [
      -104.99404,
      39.75621
    ]
  },
  "type": "geo:json"
},
"dateObserved": {
  "value": "2016-08-16T10:18:16Z",
  "type": "DateTime"
},
"depth": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 4,
    "unitCode": "MTR"
  },
  "type": "ExtQuantitativeValue"
},
"pressure": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 1020.2,
    "unitCode": "A97"
  },
  "type": "ExtQuantitativeValue"
},
"conductivity": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 10,
    "unitCode": "D10"
  },
  "type": "ExtQuantitativeValue"
},
"conductance": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 25,
    "unitCode": "SIE"
  }
}
```

```
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "temperature": {  
    "value": {  
      "timestamp": "2016-08-08T10:18:16Z",  
      "value": 15,  
      "unitCode": "CEL"  
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "tss": {  
    "value": {  
      "timestamp": "2016-08-08T10:18:16Z",  
      "value": 200,  
      "unitCode": "M1"  
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "tds": {  
    "value": {  
      "timestamp": "2016-08-08T10:18:16Z",  
      "value": 150,  
      "unitCode": "M1"  
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "turbidity": {  
    "value": {  
      "timestamp": "2016-08-08T10:18:16Z",  
      "value": 343,  
      "unitCode": "FTU"  
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "salinity": {  
    "value": {  
      "timestamp": "2016-08-08T10:18:16Z",  
      "value": 220,  
      "unitCode": "NX"  
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "pH": {  
    "value": {  
      "timestamp": "2016-08-08T10:18:16Z",  
      "value": 5  
    },  
    "type": "ExtQuantitativeValue"  
  },  
  "orp": {  
    "value": {  
      "timestamp": "2016-08-08T10:18:16Z",
```

```
    "value": 225,  
    "unitCode": "2Z"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"cdom": {  
  "value": {  
    "timestamp": "2016-08-08T10:18:16Z",  
    "value": 22,  
    "unitCode": "RFU"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"Chla": {  
  "value": {  
    "timestamp": "2016-08-08T10:18:16Z",  
    "value": 11,  
    "unitCode": "H29"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"CI": {  
  "value": {  
    "timestamp": "2016-08-08T10:18:16Z",  
    "value": 1000,  
    "unitCode": "M1"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"CO": {  
  "value": {  
    "timestamp": "2016-08-08T10:18:16Z",  
    "value": 40,  
    "unitCode": "M1"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"CO2": {  
  "value": {  
    "timestamp": "2016-08-08T10:18:16Z",  
    "value": 1,  
    "unitCode": "M1"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"Hg": {  
  "value": {  
    "timestamp": "2016-08-08T10:18:16Z",  
    "value": 0.2,  
    "unitCode": "M1"  
  },  
  "type": "ExtQuantitativeValue"  
},  
},
```

```
"NH3": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 0.03,
    "unitCode": "M1"
  },
  "type": "ExtQuantitativeValue"
},
"NH4": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 0.02,
    "unitCode": "M1"
  },
  "type": "ExtQuantitativeValue"
},
"N03": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 1,
    "unitCode": "M1"
  },
  "type": "ExtQuantitativeValue"
},
"O2": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 50,
    "unitCode": "M1"
  },
  "type": "ExtQuantitativeValue"
},
"PC": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 52,
    "unitCode": "H29"
  },
  "type": "ExtQuantitativeValue"
},
"PE": {
  "value": {
    "timestamp": "2016-08-08T10:18:16Z",
    "value": 66,
    "unitCode": "H29"
  },
  "type": "ExtQuantitativeValue"
}
}
```

2.3.42 WeatherForecast

This entity contains a harmonised description of a Weather Forecast. This entity is primarily associated with the vertical segments of the environment and agriculture but is applicable to many different applications.

<WeatherForecast><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "WeatherForecast".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<WeatherForecast><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
location	geo:json	The geo:json encoded map location (point or polygon), of this weather forecast.	M	N
dateRetrieved	DateTime	The date and time the forecast was retrieved in ISO8601 UTC format.	M	N
dateIssued	DateTime	The date and time the forecast was issued by the meteorological bureau in ISO8601 UTC format.		

weatherType	Text	The weather type. A choice from an enumerated list. One of: notAvailable, clearNight, sunnyDay, partlyCloudy, mist, fog, cloudy, overcast, lightRainShower, drizzle, lightRain, heavy RainShower, heavyRain, sleetShower, sleet, hailShower, hail, lightSnow Shower, lightSnow, heavySnowShower, heavySnow, thunderShower, thunder.	R	Y
visibility	Number or QuantitativeValue	Defines the forecast visibility nominally in metres or in an alternative measurement according to specified unitCode if QuantitativeValue is used	R	Y
name	Text	The name of the weather forecast location.	M	Y
validFrom	DateTime	The date and time the forecast is valid from expressed as an ISO8601 UTC format sequence of characters.	R	Y
validThrough	DateTime	The date and time the forecast is valid to expressed as an ISO8601 UTC format sequence of characters.	R	Y
dayMinimum	StructuredValue	Defines the minimum forecast values for defined attributes. Supports the inclusion of the nested attribute values, each of which will be a number. The units of the respective values will match the respective main attributes for temperature/ relative humidity. temperature, feelsLikeTemperature, relativeHumidity temperature -- The forecasted minimum temperature for the period in degrees Celsius. feelsLikeTemperature – The forecasted feels like temperature for the period in degrees Celsius. relativeHumidity -- The relative humidity expressed a number between $0 \leq \text{RelativeHumidity} \leq 1$ representing the range 0% to 100%	O	Y
dayMaximum	StructuredValue	Defines the maximum forecast values for defined attributes.	O	Y

		<p>Supports the inclusion of the nested attribute values, each of which will be a number. The units of the respective values will match the respective main attributes for temperature/ relative humidity.</p> <p>temperature, feelsLikeTemperature, relativeHumidity</p> <p>temperature -- The forecasted maximum temperature for the period in degrees Celsius.</p> <p>feelsLikeTemperature - The forecasted feels like temperature for the period in degrees Celsius.</p> <p>relativeHumidity -- The relative humidity expressed a number between $0 \leq \text{RelativeHumidity} \leq 1$ representing the range 0% to 100%</p>		
address	PostalAddress	<p>The weather forecast location encoded as a Schema.org PostalAddress.</p> <p>https://schema.org/PostalAddress</p>	R	Y
temperature	Number or ExtQuantitativeValue	The temperature expressed in degrees Celsius.	R	Y
windDirection	Number or ExtQuantitativeValue	The wind direction expressed in degrees compared to geographic North (measured clockwise).	O	Y
windSpeed	Number or ExtQuantitativeValue	The forecasted wind speed in meters per second.	O	Y
uvIndexMax	Number	The maximum UV index for the period, based on the World Health Organization's UV Index measure.	O	Y
relativeHumidity	Number or ExtQuantitativeValue	The relative humidity expressed a number between $0 \leq \text{RelativeHumidity} \leq 1$ representing the range 0% to 100%	O	Y
precipitationProbability	Number or ExtQuantitativeValue	The probability of precipitation, expressed as a number between $0 \leq \text{precipitationProbability} \leq 1$ representing the range 0% to 100%	O	Y
refPointOfInterest	List of Reference	A JSON encode sequence of characters referencing the unique ids of the associated group of pointOfInterests.	O	Y

2.3.42.1 WeatherForecast JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/fe74d7f9573c53bc46b5199d2ab9c847>

```
{
  "id": "7453c443-290d-44ef-a60f-d4c087010c88",
  "type": "WeatherForecast",
  "dateCreated": {
    "value": "2016-08-08 T10:18:16Z ",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "location": {
    "value": {
      "type": "Point",
      "coordinates": [
        -104.99404,
        39.75621
      ]
    },
    "type": "geo:json"
  },
  "dateRetrieved": {
    "value": "2016-08-16T10:18:16Z",
    "type": "DateTime"
  },
  "dateIssued": {
    "value": "2016-08-10T10:18:16Z",
    "type": "DateTime"
  },
  "weatherType": {
    "value": "sunnyDay",
    "type": "Text"
  },
  "visibility": {
    "value": 1500,
    "type": "Number"
  }
}
```

```
},
"name": {
  "value": "London City",
  "type": "Text"
},
"validFrom": {
  "value": "2016-08-10T10:18:16Z",
  "type": "DateTime"
},
"validThrough": {
  "value": "2016-08-29T10:18:16Z",
  "type": "Text"
},
"dayMinimum": {
  "value": {
    "temperature" : 30,
    "feelsLikeTemperature" : 32,
    "relativeHumidity" : 0.22
  },
  "type": "StructuredValue"
},
"dayMaximum": {
  "value": {
    "temperature" : 33,
    "feelsLikeTemperature" : 38,
    "relativeHumidity" : 0.52
  },
  "type": "StructuredValue"
},
"address": {
  "type": "PostalAddress",
  "value": {
    "addressLocality": "London",
    "postalCode": "EC4N 8AF",
    "streetAddress": "25 Walbrook"
  }
},
"temperature": {
  "value": 30,
  "type": "Number"
},
"windDirection": {
  "value": 122,
  "type": "Number"
},
"windSpeed": {
  "value": 3,
  "type": "Number"
},
"uVIndexMax": {
  "value": 5,
  "type": "Number"
},
},
```

```
"relativeHumidity": {  
  "value": 0.10,  
  "type": "Number"  
},  
"precipitationProbability": {  
  "value": 0.05,  
  "type": "Number"  
},  
"refPointOfInterest": {  
  "value": [  
    "d0d88168-780c-11e6-b934-2b9831af3c6f"  
  ],  
  "type": "List"  
}  
}
```

2.3.43 WeatherObserved

This entity contains a harmonised description of the weather at a particular location and time. This entity is primarily associated with the vertical segments of the environment and agriculture but is applicable to many different applications.

<WeatherObserved><Generic Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
id	Text	Unique id of this instance of this entity.	M	N
type	Text	Must be equal to "WeatherObserved".	M	N
dateCreated	DateTime	Entity creation timestamp.	M	N
dateModified	DateTime	Timestamp of the last modification of the entity.	O	Y
source	Text	A sequence of characters giving the source of the entity data as a URL.	R	Y
dataProvider	Text	A sequence of characters identifying the originator of the harmonised entity.	R	Y
schemaVersion	Text or URL	Indicates the version number of the data entity via either a URL referring to an external entity version (e.g. http://schema.org/version/2.0/) or a sequence of text characters of the form "M.N" where M is a sequence of digits representing the major version number and N is a sequence of digits representing a minor version number. If omitted implies a schema version of "1.0"	R	Y

<Weather Observed><Entity Specific Attributes>

Attribute Name	Attribute Type	Description	Mandatory/ Optional/ Recommended	May be Null
location	geo:json	The geo:json encoded map location (point or polygon), of this weather observation.	M	N
refDevice	List of Reference	Reference to the unique ids of the device(s) which captured this weather observation.	O	Y
dateObserved	DateTime	The date and time of this weather observation in ISO8601 UTCformat.	M	N

weatherType	Text	The weather type. A choice from an enumerated list. One of: notAvailable, clearNight, sunnyDay, partlyCloudy, mist, fog, cloudy, overcast, lightRainShower, drizzle, lightRain, heavyRainShower, heavyRain, sleetShower, sleet, hailShower, hail, lightSnow Shower, lightSnow, heavySnowShower, heavySnow, thunderShower, thunder	R	Y
visibility	Number or QuantitativeValue	Defines the observed visibility nominally in metres or in an alternative measurement according to specified unitCode if QuantitativeValue is used	R	Y
name	Text	The name of the weather observation location.	R	Y
address	PostalAddress	The weather observed location encoded as a Schema.org Postal Address. https://schema.org/PostalAddress	R	Y
temperature	Number or ExtQuantitativeValue	The recorded temperature expressed in degrees Celsius, encoded as a Number OR a ExtQuantitativeValue.	R	Y
refPointOfInterest	List of Reference	A JSON encode sequence of characters referencing the unique ids of the associated group of pointOfInterests.	O	Y
windDirection	Number or ExtQuantitativeValue	The wind direction expressed in degrees compared to geographic North (measured clockwise), encoded as a Number OR a ExtQuantitativeValue.	R	Y
windSpeed	Number or ExtQuantitativeValue	The observed wind speed in meters per second, encoded as a Number OR a ExtQuantitativeValue.	R	Y
relativeHumidity	Number or ExtQuantitativeValue	The relative humidity expressed a number between $0 \leq \text{RelativeHumidity} \leq 1$ representing the range 0% to 100%, encoded as a Number OR a ExtQuantitativeValue.	R	Y
dewPoint	Number Or ExtQuantitativeValue	The dew point in degrees Celsius, encoded as a Number OR a ExtQuantitativeValue.	O	Y

atmosphericPressure	Number Or ExtQuantitativeValue	The measured barometric or atmospheric pressure in units of hecto Pascals, encoded as a Number OR a ExtQuantitativeValue.	R	Y
pressureTendency	Text Or ExtQuantitativeValue	Is the pressure is rising or falling? Encoded as Text OR a ExtQuantitativeValue. A choice from an enumerated list. One of: rising, falling, steady.	R	Y

2.3.43.1 WeatherObserved JSON

The JSON code can be downloaded from:

<https://gist.github.com/GSMADeveloper/f592f7923c97cd5c6d18bc44a42b7050>

```
{
  "id": "adb144fb-e732-4944-a192-8690bd17de8c",
  "type": "WeatherObserved",
  "dateCreated": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "dateModified": {
    "value": "2016-08-08T10:18:16Z",
    "type": "DateTime"
  },
  "source": {
    "value": "http://www.example.com",
    "type": "URL"
  },
  "dataProvider": {
    "value": "OperatorA",
    "type": "Text"
  },
  "schemaVersion": {
    "value": "1.0",
    "type": "Text"
  },
  "location": {
    "value": {
      "type": "Point",
      "coordinates": [
        -104.99404,
        39.75621
      ]
    },
    "type": "geo:json"
  },
  "refDevice": {
    "value": [
```

```
        "c3e30a5a-2697-407d-908d-02a627d32730",
        "08d22ce9-ce65-46a6-8e3c-12aa3a5389de"
    ],
    "type": "List"
},
"dateObserved": {
    "value": "2016-08-16T10:18:16Z",
    "type": "DateTime"
},
"weatherType": {
    "value": "sunnyDay",
    "type": "Text"
},
"visibility": {
    "value": 500,
    "type": "Number"
},
"name": {
    "value": "London City",
    "type": "Text"
},
"address": {
    "type": "PostalAddress",
    "value": {
        "addressLocality": "London",
        "postalCode": "EC4N 8AF",
        "streetAddress": "25 Walbrook"
    }
},
"temperature": {
    "value": {
        "value": 15,
        "unitCode": "CEL"
    },
    "type": "ExtQuantitativeValue"
},
"refPointofInterest": {
    "value": [
        "b397c472-1ca8-4605-8d35-2fb27e85c0e8",
        "e7c4d076-7eec-45b2-8982-9cd4c331e491"
    ],
    "type": "List"
},
"windDirection": {
    "value": {
        "value": 122,
        "unitCode": "DD"
    },
    "type": "ExtQuantitativeValue"
},
"windSpeed": {
    "value": {
        "value": 3,
```

```
    "unitCode": "MTS"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"relativeHumidity": {  
  "value": {  
    "value": 0.20,  
    "unitCode": "C62"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"dewPoint": {  
  "value": {  
    "value": 44,  
    "unitCode": "CEL"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"atmosphericPressure": {  
  "value": {  
    "value": 1013.25,  
    "unitCode": "A97"  
  },  
  "type": "ExtQuantitativeValue"  
},  
"pressureTendency": {  
  "value": "rising",  
  "type": "Text"  
}  
}
```

Annex A ExtQuantitativeValue and NGSiv2 metadata compatibility (Informative)

The harmonized data models defined by this document make extensive use of the ExtQuantitativeValue structure. An example of the JSON formatted syntax for an attribute of type ExtQuantitativeValue is shown below:

```
"soilTemperature" : {  
  "value": {  
    "value": 27,  
    "unitCode": "CEL",  
    "timestamp": "2016-09-07T07:09:54"  
  },  
  "type" : "ExtQuantitativeValue"  
}
```

The identical example in the equivalent NGSiv2 attribute value plus metadata, format is shown below:

```
"soilTemperature": {  
  "value": 27,  
  "metadata": {  
    "timestamp": {  
      "value": "2016-09-07T07:09:54",  
      "type" : "DateTime",  
    }  
    "unitCode": {  
      "value": "CEL",  
      "type": "Text"  
    }  
  },  
  "type": "Number"  
}
```

Both implementation approaches are equivalent and comply with this harmonised data model.

Annex B Referenced Schema.org entities (Informative)

Some members of the project group have reported difficulties in accessing <https://schema.org/>. To provide additional clarity we provide a snapshot of the <https://schema.org/> entity definitions below. This information is informative only.

B.1 Schema.org entity descriptions: Offer

Property	Expected Type	Description
Properties from Offer		
acceptedPaymentMethod	LoanOrCredit or PaymentMethod	The payment method(s) accepted by seller for this offer.
addOn	Offer	An additional offer that can only be obtained in combination with the first base offer (e.g. supplements and extensions that are available for a surcharge).
advanceBookingRequirement	QuantitativeValue	The amount of time that is required between accepting the offer and the actual usage of the resource or service.
aggregateRating	AggregateRating	The overall rating, based on a collection of reviews or ratings, of the item.
areaServed	AdministrativeArea or GeoShape or Place or Text	The geographic area where a service or offered item is provided. Supersedes serviceArea .
availability	ItemAvailability	The availability of this item—for example In stock, Out of stock, Pre-order, etc.
availabilityEnds	DateTime	The end of the availability of the product or service included in the offer.
availabilityStarts	DateTime	The beginning of the availability of the product or service included in the offer.
availableAtOrFrom	Place	The place(s) from which the offer can be obtained (e.g. store locations).
availableDeliveryMethod	DeliveryMethod	The delivery method(s) available for this offer.
businessFunction	BusinessFunction	The business function (e.g. sell, lease, repair, dispose) of the offer or component of a bundle (TypeAndQuantityNode). The default is

Property	Expected Type	Description
		http://purl.org/goodrelations/v1#Sell .
category	Text Thing	or A category for the item. Greater signs or slashes can be used to informally indicate a category hierarchy.
deliveryLeadTime	QuantitativeValue	The typical delay between the receipt of the order and the goods either leaving the warehouse or being prepared for pickup, in case the delivery method is on site pickup.
eligibleCustomerType	BusinessEntityType	The type(s) of customers for which the given offer is valid.
eligibleDuration	QuantitativeValue	The duration for which the given offer is valid.
eligibleQuantity	QuantitativeValue	The interval and unit of measurement of ordering quantities for which the offer or price specification is valid. This allows e.g. specifying that a certain freight charge is valid only for a certain quantity.
eligibleRegion	GeoShape Place Text	or The ISO 3166-1 (ISO 3166-1 alpha-2) or ISO 3166-2 code, the place, or the GeoShape for the geo-political region(s) for which the offer or delivery charge specification is valid. See also ineligibleRegion .
eligibleTransactionVolume	PriceSpecification	The transaction volume, in a monetary unit, for which the offer or price specification is valid, e.g. for indicating a minimal purchasing volume, to express free shipping above a certain order volume, or to limit the acceptance of credit cards to purchases to a certain minimal amount.
gtin12	Text	The GTIN-12 code of the product, or the product to which the offer refers. The GTIN-12 is the 12-digit GS1 Identification Key composed of a U.P.C. Company Prefix, Item Reference, and Check Digit used to identify trade items. See GS1 GTIN Summary for more details.

Property	Expected Type	Description
gtin13	Text	The GTIN-13 code of the product, or the product to which the offer refers. This is equivalent to 13-digit ISBN codes and EAN UCC-13. Former 12-digit UPC codes can be converted into a GTIN-13 code by simply adding a preceding zero. See GS1 GTIN Summary for more details.
gtin14	Text	The GTIN-14 code of the product, or the product to which the offer refers. See GS1 GTIN Summary for more details.
gtin8	Text	The GTIN-8 code of the product, or the product to which the offer refers. This code is also known as EAN/UCC-8 or 8-digit EAN. See GS1 GTIN Summary for more details.
includesObject	TypeAndQuantityNode	This links to a node or nodes indicating the exact quantity of the products included in the offer.
ineligibleRegion	GeoShape Place Text	or The ISO 3166-1 (ISO 3166-1 alpha-2) or or ISO 3166-2 code, the place, or the GeoShape for the geo-political region(s) for which the offer or delivery charge specification is not valid, e.g. a region where the transaction is not allowed. See also eligibleRegion .
inventoryLevel	QuantitativeValue	The current approximate inventory level for the item or items.
itemCondition	OfferItemCondition	A predefined value from OfferItemCondition or a textual description of the condition of the product or service, or the products or services included in the offer.
itemOffered	Product Service	or The item being offered.
mpn	Text	The Manufacturer Part Number (MPN) of the product, or the product to which the offer refers.
offeredBy	Organization Person	or A pointer to the organization or person making the offer.

Property	Expected Type	Description
price	Number Text	<p>Inverse property: makesOffer.</p> <p>The offer price of a product, or of a price component when attached to PriceSpecification and its subtypes.</p> <p>Usage guidelines:</p> <ul style="list-style-type: none"> Use the priceCurrency property (with ISO 4217 codes e.g. "USD") instead of including ambiguous symbols such as '\$' in the value. Use '.' (Unicode 'FULL STOP' (U+002E)) rather than ',' to indicate a decimal point. Avoid using these symbols as a readability separator. Note that both RDFa and Microdata syntax allow the use of a "content=" attribute for publishing simple machine-readable values alongside more human-friendly formatting. Use values from 0123456789 (Unicode 'DIGIT ZERO' (U+0030) to 'DIGIT NINE' (U+0039)) rather than superficially similar Unicode symbols.
priceCurrency	Text	The currency (in 3-letter ISO 4217 format) of the price or a price component, when attached to PriceSpecification and its subtypes.
priceSpecification	PriceSpecification	One or more detailed price specifications, indicating the unit price and delivery or payment charges.
priceValidUntil	Date	The date after which the price is no longer available.
review	Review	A review of the item. Supersedes reviews .
seller	Organization Person	<p>or</p> <p>An entity which offers (sells / leases / lends / loans) the services / goods. A seller may also be a provider. Supersedes merchant, vendor.</p>
serialNumber	Text	The serial number or any alphanumeric identifier of a particular product. When

Property	Expected Type	Description
		attached to an offer, it is a shortcut for the serial number of the product included in the offer.
sku	Text	The Stock Keeping Unit (SKU), i.e. a merchant-specific identifier for a product or service, or the product to which the offer refers.
validFrom	DateTime	The date when the item becomes valid.
validThrough	DateTime	The date after when the item is not valid. For example the end of an offer, salary period, or a period of opening hours.
warranty	WarrantyPromise	The warranty promise(s) included in the offer. Supersedes warrantyPromise .

B.2 Schema.org entity descriptions: Organisation

Property	Expected Type	Description
Properties from Organization		
address	PostalAddress or Text	Physical address of the item.
aggregateRating	AggregateRating	The overall rating, based on a collection of reviews or ratings, of the item.
alumni	Person	Alumni of an organization. Inverse property: alumniOf .
areaServed	AdministrativeArea or GeoShape or Place or Text	The geographic area where a service or offered item is provided. Supersedes serviceArea .
award	Text	An award won by or for this item. Supersedes awards .
brand	Brand or Organization	The brand(s) associated with a product or service, or the brand(s) maintained by an organization or business person.
contactPoint	ContactPoint	A contact point for a person or organization. Supersedes contactPoints .
department	Organization	A relationship between an organization and a

Property	Expected Type	Description
		department of that organization, also described as an organization (allowing different urls, logos, opening hours). For example: a store with a pharmacy, or a bakery with a cafe.
dissolutionDate	Date	The date that this organization was dissolved.
duns	Text	The Dun & Bradstreet DUNS number for identifying an organization or business person.
email	Text	Email address.
employee	Person	Someone working for this organization. Supersedes employees .
event	Event	Upcoming or past event associated with this place, organization, or action. Supersedes events .
faxNumber	Text	The fax number.
founder	Person	A person who founded this organization. Supersedes founders .
foundingDate	Date	The date that this organization was founded.
foundingLocation	Place	The place where the Organization was founded.
funder	Organization or Person	A person or organization that supports (sponsors) something through some kind of financial contribution.
globalLocationNumber	Text	The Global Location Number (GLN, sometimes also referred to as International Location Number or ILN) of the respective organization, person, or place. The GLN is a 13-digit number used to identify parties and physical locations.
hasOfferCatalog	OfferCatalog	Indicates an OfferCatalog listing for this Organization, Person, or Service.
hasPOS	Place	Points-of-Sales operated by the organization or person.
isicV4	Text	The International Standard of Industrial Classification of All Economic Activities (ISIC), Revision 4 code for a particular organization, business person, or place.
legalName	Text	The official name of the organization, e.g. the

Property	Expected Type	Description
		registered company name.
leiCode	Text	An organization identifier that uniquely identifies a legal entity as defined in ISO 17442.
location	Place PostalAddress Text	or The location of for example where the event is happening, an organization is located, or where an action takes place.
logo	ImageObject URL	or An associated logo.
makesOffer	Offer	A pointer to products or services offered by the organization or person. Inverse property: offeredBy .
member	Organization Person	or A member of an Organization or a ProgramMembership. Organizations can be members of organizations; ProgramMembership is typically for individuals. Supersedes members , musicGroupMember . Inverse property: memberOf .
memberOf	Organization ProgramMembership	or An Organization (or ProgramMembership) to which this Person or Organization belongs. Inverse property: member .
naics	Text	The North American Industry Classification System (NAICS) code for a particular organization or business person.
numberOfEmployees	QuantitativeValue	The number of employees in an organization e.g. business.
owns	OwnershipInfo Product	or Products owned by the organization or person.
parentOrganization	Organization	The larger organization that this local business is a branch of, if any. Supersedes branchOf . Inverse property: subOrganization .
review	Review	A review of the item. Supersedes reviews .
seeks	Demand	A pointer to products or services sought by the organization or person (demand).
sponsor	Organization Person	or A person or organization that supports a thing through a pledge, promise, or financial contribution. e.g. a sponsor of a Medical Study or a corporate sponsor of an event.

Property	Expected Type	Description
subOrganization	Organization	A relationship between two organizations where the first includes the second, e.g., as a subsidiary. See also: the more specific 'department' property. Inverse property: parentOrganization .
taxID	Text	The Tax / Fiscal ID of the organization or person, e.g. the TIN in the US or the CIF/NIF in Spain.
telephone	Text	The telephone number.
vatID	Text	The Value-added Tax ID of the organization or person.

B.3 Schema.org entity descriptions: Person

Property	Expected Type	Description
Properties from Person		
additionalName	Text	An additional name for a Person, can be used for a middle name.
address	PostalAddress Text	or Physical address of the item.
affiliation	Organization	An organization that this person is affiliated with. For example, a school/university, a club, or a team.
alumniOf	EducationalOrganization or Organization	An organization that the person is an alumni of. Inverse property: alumni .
award	Text	An award won by or for this item. Supersedes awards .
birthDate	Date	Date of birth.
birthPlace	Place	The place where the person was born.
brand	Brand Organization	or The brand(s) associated with a product or service, or the brand(s) maintained by an organization or business person.
children	Person	A child of the person.
colleague	Person URL	or A colleague of the person. Supersedes colleagues .

Property	Expected Type	Description
contactPoint	ContactPoint	A contact point for a person or organization. Supersedes contactPoints .
deathDate	Date	Date of death.
deathPlace	Place	The place where the person died.
duns	Text	The Dun & Bradstreet DUNS number for identifying an organization or business person.
email	Text	Email address.
familyName	Text	Family name. In the U.S., the last name of a Person. This can be used along with givenName instead of the name property.
faxNumber	Text	The fax number.
follows	Person	The most generic uni-directional social relation.
funder	Organization Person	or A person or organization that supports (sponsors) something through some kind of financial contribution.
gender	GenderType Text	or Gender of the person. While http://schema.org/Male and http://schema.org/Female may be used, text strings are also acceptable for people who do not identify as a binary gender.
givenName	Text	Given name. In the U.S., the first name of a Person. This can be used along with familyName instead of the name property.
globalLocationNumber	Text	The Global Location Number (GLN, sometimes also referred to as International Location Number or ILN) of the respective organization, person, or place. The GLN is a 13-digit number used to identify parties and physical locations.
hasOfferCatalog	OfferCatalog	Indicates an OfferCatalog listing for this Organization, Person, or Service.
hasPOS	Place	Points-of-Sales operated by the organization or person.
height	Distance	or The height of the item.

Property	Expected Type	Description
	QuantitativeValue	
homeLocation	ContactPoint Place	or A contact location for a person's residence.
honorificPrefix	Text	An honorific prefix preceding a Person's name such as Dr/Mrs/Mr.
honorificSuffix	Text	An honorific suffix preceding a Person's name such as M.D. /PhD/MSCSW.
isicV4	Text	The International Standard of Industrial Classification of All Economic Activities (ISIC), Revision 4 code for a particular organization, business person, or place.
jobTitle	Text	The job title of the person (for example, Financial Manager).
knows	Person	The most generic bi-directional social/work relation.
makesOffer	Offer	A pointer to products or services offered by the organization or person. Inverse property: offeredBy .
memberOf	Organization ProgramMembership	or An Organization (or ProgramMembership) to which this Person or Organization belongs. Inverse property: member .
naics	Text	The North American Industry Classification System (NAICS) code for a particular organization or business person.
nationality	Country	Nationality of the person.
netWorth	MonetaryAmount PriceSpecification	or The total financial value of the person as calculated by subtracting assets from liabilities.
owns	OwnershipInfo Product	or Products owned by the organization or person.
parent	Person	A parent of this person. Supersedes parents .
performerIn	Event	Event that this person is a performer or participant in.

Property	Expected Type	Description
relatedTo	Person	The most generic familial relation.
seeks	Demand	A pointer to products or services sought by the organization or person (demand).
sibling	Person	A sibling of the person. Supersedes siblings .
sponsor	Organization or Person	A person or organization that supports a thing through a pledge, promise, or financial contribution. e.g. a sponsor of a Medical Study or a corporate sponsor of an event.
spouse	Person	The person's spouse.
taxID	Text	The Tax / Fiscal ID of the organization or person, e.g. the TIN in the US or the CIF/NIF in Spain.
telephone	Text	The telephone number.
vatID	Text	The Value-added Tax ID of the organization or person.
weight	QuantitativeValue	The weight of the product or person.
workLocation	ContactPoint or Place	A contact location for a person's place of work.
worksFor	Organization	Organizations that the person works for.

B.4 Schema.org entity descriptions: PostalAddress

Property	Expected Type	Description
Properties from PostalAddress		
addressCountry	Country or Text	The country. For example, USA. You can also provide the two-letter ISO 3166-1 alpha-2 country code .
addressLocality	Text	The locality. For example, Mountain View.
addressRegion	Text	The region. For example, CA.
postOfficeBoxNumber	Text	The post office box number for PO box addresses.
postalCode	Text	The postal code. For example, 94043.

Property	Expected Type	Description
streetAddress	Text	The street address. For example, 1600 Amphitheatre Pkwy.

B.5 Schema.org entity descriptions: Product

Property	Expected Type	Description
Properties from Product		
additionalProperty	PropertyValue	<p>A property–value pair representing an additional characteristics of the entity, e.g. a product feature or another characteristic for which there is no matching property in schema.org.</p> <p>Note: Publishers should be aware that applications designed to use specific schema.org properties (e.g. http://schema.org/width, http://schema.org/color, http://schema.org/gtin13, ...) will typically expect such data to be provided using those properties, rather than using the generic property/value mechanism.</p>
aggregateRating	AggregateRating	The overall rating, based on a collection of reviews or ratings, of the item.
audience	Audience	An intended audience, i.e. a group for whom something was created. Supersedes serviceAudience .
award	Text	An award won by or for this item. Supersedes awards .
brand	Brand or Organization	The brand(s) associated with a product or service, or the brand(s) maintained by an organization or business person.
category	Text or Thing	A category for the item. Greater signs or slashes can be used to informally indicate a category hierarchy.
color	Text	The color of the product.
depth	Distance or QuantitativeValue	The depth of the item.
gtin12	Text	The GTIN-12 code of the product, or the

Property	Expected Type	Description
		product to which the offer refers. The GTIN-12 is the 12-digit GS1 Identification Key composed of a U.P.C. Company Prefix, Item Reference, and Check Digit used to identify trade items. See GS1 GTIN Summary for more details.
gtin13	Text	The GTIN-13 code of the product, or the product to which the offer refers. This is equivalent to 13-digit ISBN codes and EAN UCC-13. Former 12-digit UPC codes can be converted into a GTIN-13 code by simply adding a preceding zero. See GS1 GTIN Summary for more details.
gtin14	Text	The GTIN-14 code of the product, or the product to which the offer refers. See GS1 GTIN Summary for more details.
gtin8	Text	The GTIN-8 code of the product, or the product to which the offer refers. This code is also known as EAN/UCC-8 or 8-digit EAN. See GS1 GTIN Summary for more details.
height	Distance or QuantitativeValue	The height of the item.
isAccessoryOrSparePartFor	Product	A pointer to another product (or multiple products) for which this product is an accessory or spare part.
isConsumableFor	Product	A pointer to another product (or multiple products) for which this product is a consumable.
isRelatedTo	Product or Service	A pointer to another, somehow related product (or multiple products).
isSimilarTo	Product or Service	A pointer to another, functionally similar product (or multiple products).
itemCondition	OfferItemCondition	A predefined value from OfferItemCondition or a textual description of the condition of the product or service, or the products or services included in the offer.
logo	ImageObject or URL	An associated logo.

Property	Expected Type	Description
manufacturer	Organization	The manufacturer of the product.
model	ProductModel or Text	The model of the product. Use with the URL of a ProductModel or a textual representation of the model identifier. The URL of the ProductModel can be from an external source. It is recommended to additionally provide strong product identifiers via the gtin8/gtin13/gtin14 and mpn properties.
mpn	Text	The Manufacturer Part Number (MPN) of the product, or the product to which the offer refers.
offers	Offer	An offer to provide this item—for example, an offer to sell a product, rent the DVD of a movie, perform a service, or give away tickets to an event.
productID	Text	The product identifier, such as ISBN. For example: meta itemprop="productID" content="isbn:123-456-789".
productionDate	Date	The date of production of the item, e.g. vehicle.
purchaseDate	Date	The date the item e.g. vehicle was purchased by the current owner.
releaseDate	Date	The release date of a product or product model. This can be used to distinguish the exact variant of a product.
review	Review	A review of the item. Supersedes reviews .
sku	Text	The Stock Keeping Unit (SKU), i.e. a merchant-specific identifier for a product or service, or the product to which the offer refers.
weight	QuantitativeValue	The weight of the product or person.
width	Distance or QuantitativeValue	The width of the item.

B.6 Schema.org entity descriptions: PriceSpecification

Property	Expected Type	Description
Properties from PriceSpecification		
eligibleQuantity	QuantitativeValue	The interval and unit of measurement of ordering quantities for which the offer or price specification is valid. This allows e.g. specifying that a certain freight charge is valid only for a certain quantity.
eligibleTransactionVolume	PriceSpecification	The transaction volume, in a monetary unit, for which the offer or price specification is valid, e.g. for indicating a minimal purchasing volume, to express free shipping above a certain order volume, or to limit the acceptance of credit cards to purchases to a certain minimal amount.
maxPrice	Number	The highest price if the price is a range.
minPrice	Number	The lowest price if the price is a range.
price	Number or Text	<p>The offer price of a product, or of a price component when attached to PriceSpecification and its subtypes.</p> <p>Usage guidelines:</p> <ul style="list-style-type: none"> Use the priceCurrency property (with ISO 4217 codes e.g. "USD") instead of including ambiguous symbols such as '\$' in the value. Use '.' (Unicode 'FULL STOP' (U+002E)) rather than ',' to indicate a decimal

Property	Expected Type	Description
		<p>point. Avoid using these symbols as a readability separator.</p> <ul style="list-style-type: none"> Note that both RDFa and Microdata syntax allow the use of a "content=" attribute for publishing simple machine-readable values alongside more human-friendly formatting. Use values from 0123456789 (Unicode 'DIGIT ZERO' (U+0030) to 'DIGIT NINE' (U+0039)) rather than superficially similar Unicode symbols.
priceCurrency	Text	The currency (in 3-letter ISO 4217 format) of the price or a price component, when attached to PriceSpecification and its subtypes.
validFrom	DateTime	The date when the item becomes valid.
validThrough	DateTime	The date after when the item is not valid. For example the end of an offer, salary period, or a period of opening hours.
valueAddedTaxIncluded	Boolean	Specifies whether the applicable value-added tax (VAT) is included in the price specification or not.
Properties from Thing		
additionalType	URL	An additional type for the item, typically used for adding more specific types from external vocabularies in microdata syntax. This is a

Property	Expected Type	Description
		relationship between something and a class that the thing is in. In RDFa syntax, it is better to use the native RDFa syntax – the 'typeof' attribute – for multiple types. Schema.org tools may have only weaker understanding of extra types, in particular those defined externally.
<u>alternateName</u>	<u>Text</u>	An alias for the item.
<u>description</u>	<u>Text</u>	A description of the item.
<u>disambiguatingDescription</u>	<u>Text</u>	A sub property of description. A short description of the item used to disambiguate from other, similar items. Information from other properties (in particular, name) may be necessary for the description to be useful for disambiguation.
<u>identifier</u>	<u>PropertyValue</u> or <u>Text</u> or <u>URL</u>	The identifier property represents any kind of identifier for any kind of <u>Thing</u> , such as ISBNs, GTIN codes, UUIDs etc. Schema.org provides dedicated properties for representing many of these, either as textual strings or as URL (URI) links. See <u>background notes</u> for more details.
<u>image</u>	<u>ImageObject</u> or <u>URL</u>	An image of the item. This can be a <u>URL</u> or a fully described <u>ImageObject</u> .
<u>mainEntityOfPage</u>	<u>CreativeWork</u> or <u>URL</u>	Indicates a page (or other CreativeWork) for which this thing is the main entity being described. See <u>background notes</u> for details.

Property	Expected Type	Description
		Inverse property: mainEntity .
name	Text	The name of the item.
potentialAction	Action	Indicates a potential Action, which describes an idealized action in which this thing would play an 'object' role.
sameAs	URL	URL of a reference Web page that unambiguously indicates the item's identity. E.g. the URL of the item's Wikipedia page, Wikidata entry, or official website.
url	URL	URL of the item.

B.7 Schema.org entity descriptions: QuantitativeValue

Property	Expected Type	Description
Properties from QuantitativeValue		
additionalProperty	PropertyValue	A property-value pair representing an additional characteristics of the entity, e.g. a product feature or another characteristic for which there is no matching property in schema.org. Note: Publishers should be aware that applications designed to use specific schema.org properties (e.g. http://schema.org/width , http://schema.org/color , http://schema.org/gtin13 , ...) will typically expect such data to be provided using those properties, rather than using the generic property/value mechanism.
maxValue	Number	The upper value of some characteristic or property.
minValue	Number	The lower value of some characteristic or property.
unitCode	Text URL	or The unit of measurement given using the UN/CEFACT Common Code (3 characters) or a URL. Other codes than the UN/CEFACT Common Code may be used with a prefix followed by a colon.

Property	Expected Type	Description
unitText	Text	A string or text indicating the unit of measurement. Useful if you cannot provide a standard unit code for unitCode .
value	Boolean or Number or StructuredValue or Text	The value of the quantitative value or property value node. <ul style="list-style-type: none"> For QuantitativeValue and MonetaryAmount, the recommended type for values is 'Number'. For PropertyValue, it can be 'Text;', 'Number', 'Boolean', or 'StructuredValue'.
valueReference	Enumeration or PropertyValue or QualitativeValue or QuantitativeValue or StructuredValue	A pointer to a secondary value that provides additional information on the original value, e.g. a reference temperature.

B.8 Schema.org entity descriptions: SoftwareApplication

Property	Expected Type	Description
Properties from SoftwareApplication		
applicationCategory	Text or URL	Type of software application, e.g. 'Game, Multimedia'.
applicationSubCategory	Text or URL	Subcategory of the application, e.g. 'Arcade Game'.
applicationSuite	Text	The name of the application suite to which the application belongs (e.g. Excel belongs to Office).
availableOnDevice	Text	Device required to run the application. Used in cases where a specific make/model is required to run the application. Supersedes device .
countriesNotSupported	Text	Countries for which the application is not supported. You can also provide the two-letter ISO 3166-1 alpha-2 country code.
countriesSupported	Text	Countries for which the application is supported. You can also provide the two-letter ISO 3166-1 alpha-2 country code.

Property	Expected Type	Description
<u>downloadUrl</u>	<u>URL</u>	If the file can be downloaded, URL to download the binary.
<u>featureList</u>	<u>Text</u> <u>URL</u>	or Features or modules provided by this application (and possibly required by other applications).
<u>fileSize</u>	<u>Text</u>	Size of the application / package (e.g. 18MB). In the absence of a unit (MB, KB etc.), KB will be assumed.
<u>installUrl</u>	<u>URL</u>	URL at which the app may be installed, if different from the URL of the item.
<u>memoryRequirements</u>	<u>Text</u> <u>URL</u>	or Minimum memory requirements.
<u>operatingSystem</u>	<u>Text</u>	Operating systems supported (Windows 7, OSX 10.6, Android 1.6).
<u>permissions</u>	<u>Text</u>	Permission(s) required to run the app (for example, a mobile app may require full internet access or may run only on wifi).
<u>processorRequirements</u>	<u>Text</u>	Processor architecture required to run the application (e.g. IA64).
<u>releaseNotes</u>	<u>Text</u> <u>URL</u>	or Description of what changed in this version.
<u>screenshot</u>	<u>ImageObject</u> <u>URL</u>	or A link to a screenshot image of the app.
<u>softwareAddOn</u>	<u>SoftwareApplication</u>	Additional content for a software application.
<u>softwareHelp</u>	<u>CreativeWork</u>	Software application help.
<u>softwareRequirements</u>	<u>Text</u> <u>URL</u>	or Component dependency requirements for application. This includes runtime environments and shared libraries that are not included in the application distribution package, but required to run the application (Examples: DirectX, Java or .NET runtime). Supersedes <u>requirements</u> .
<u>softwareVersion</u>	<u>Text</u>	Version of the software instance.
<u>storageRequirements</u>	<u>Text</u> <u>URL</u>	or Storage requirements (free space required).

Property	Expected Type	Description
<u>supportingData</u>	<u>DataFeed</u>	Supporting data for a SoftwareApplication.
Properties from <u>CreativeWork</u>		
<u>about</u>	<u>Thing</u>	The subject matter of the content. Inverse property: <u>subjectOf</u> .
<u>accessMode</u>	<u>Text</u>	The human sensory perceptual system or cognitive faculty through which a person may process or perceive information. Expected values include: auditory, tactile, textual, visual, colorDependent, chartOnVisual, chemOnVisual, diagramOnVisual, mathOnVisual, musicOnVisual, textOnVisual.
<u>accessModeSufficient</u>	<u>Text</u>	A list of single or combined accessModes that are sufficient to understand all the intellectual content of a resource. Expected values include: auditory, tactile, textual, visual.
<u>accessibilityAPI</u>	<u>Text</u>	Indicates that the resource is compatible with the referenced accessibility API (<u>WebSchemas wiki lists possible values</u>).
<u>accessibilityControl</u>	<u>Text</u>	Identifies input methods that are sufficient to fully control the described resource (<u>WebSchemas wiki lists possible values</u>).
<u>accessibilityFeature</u>	<u>Text</u>	Content features of the resource, such as accessible media, alternatives and supported enhancements for accessibility (<u>WebSchemas wiki lists possible values</u>).
<u>accessibilityHazard</u>	<u>Text</u>	A characteristic of the described resource that is physiologically dangerous to some users. Related to WCAG 2.0 guideline 2.3 (<u>WebSchemas wiki lists possible values</u>).
<u>accessibilitySummary</u>	<u>Text</u>	A human-readable summary of specific accessibility features or deficiencies, consistent with the other accessibility metadata but expressing subtleties such as "short descriptions are present but long descriptions will be needed for non-visual users" or "short descriptions are present and no long descriptions are

Property	Expected Type	Description
		needed."
<u>accountablePerson</u>	<u>Person</u>	Specifies the Person that is legally accountable for the CreativeWork.
<u>aggregateRating</u>	<u>AggregateRating</u>	The overall rating, based on a collection of reviews or ratings, of the item.
<u>alternativeHeadline</u>	<u>Text</u>	A secondary title of the CreativeWork.
<u>associatedMedia</u>	<u>MediaObject</u>	A media object that encodes this CreativeWork. This property is a synonym for encoding.
<u>audience</u>	<u>Audience</u>	An intended audience, i.e. a group for whom something was created. Supersedes <u>serviceAudience</u> .
<u>audio</u>	<u>AudioObject</u>	An embedded audio object.
<u>author</u>	<u>Organization</u> <u>Person</u>	or The author of this content or rating. Please note that author is special in that HTML 5 provides a special mechanism for indicating authorship via the rel tag. That is equivalent to this and may be used interchangeably.
<u>award</u>	<u>Text</u>	An award won by or for this item. Supersedes <u>awards</u> .
<u>character</u>	<u>Person</u>	Fictional person connected with a creative work.
<u>citation</u>	<u>CreativeWork</u> <u>Text</u>	or A citation or reference to another creative work, such as another publication, web page, scholarly article, etc.
<u>comment</u>	<u>Comment</u>	Comments, typically from users.
<u>commentCount</u>	<u>Integer</u>	The number of comments this CreativeWork (e.g. Article, Question or Answer) has received. This is most applicable to works published in Web sites with commenting system; additional comments may exist elsewhere.
<u>contentLocation</u>	<u>Place</u>	The location depicted or described in the content. For example, the location in a photograph or painting.
<u>contentRating</u>	<u>Text</u>	Official rating of a piece of content—for example, 'MPAA PG-13'.

Property	Expected Type	Description
<u>contentReferenceTime</u>	<u>DateTime</u>	The specific time described by a creative work, for works (e.g. articles, video objects etc.) that emphasise a particular moment within an Event.
<u>contributor</u>	<u>Organization</u> <u>Person</u>	or A secondary contributor to the CreativeWork or Event.
<u>copyrightHolder</u>	<u>Organization</u> <u>Person</u>	or The party holding the legal copyright to the CreativeWork.
<u>copyrightYear</u>	<u>Number</u>	The year during which the claimed copyright for the CreativeWork was first asserted.
<u>creator</u>	<u>Organization</u> <u>Person</u>	or The creator/author of this CreativeWork. This is the same as the Author property for CreativeWork.
<u>dateCreated</u>	<u>Date</u> <u>DateTime</u>	or The date on which the CreativeWork was created or the item was added to a DataFeed.
<u>dateModified</u>	<u>Date</u> <u>DateTime</u>	or The date on which the CreativeWork was most recently modified or when the item's entry was modified within a DataFeed.
<u>datePublished</u>	<u>Date</u>	Date of first broadcast/publication.
<u>discussionUrl</u>	<u>URL</u>	A link to the page containing the comments of the CreativeWork.
<u>editor</u>	<u>Person</u>	Specifies the Person who edited the CreativeWork.
<u>educationalAlignment</u>	<u>AlignmentObject</u>	An alignment to an established educational framework.
<u>educationalUse</u>	<u>Text</u>	The purpose of a work in the context of education; for example, 'assignment', 'group work'.
<u>encoding</u>	<u>MediaObject</u>	A media object that encodes this CreativeWork. This property is a synonym for <u>associatedMedia</u> . Supersedes <u>encodings</u> .
<u>exampleOfWork</u>	<u>CreativeWork</u>	A creative work that this work is an example/instance/realization/derivation of. Inverse property: <u>workExample</u> .

Property	Expected Type	Description
<u>expires</u>	<u>Date</u>	Date the content expires and is no longer useful or available. For example a <u>VideoObject</u> or <u>NewsArticle</u> whose availability or relevance is time-limited, or a <u>ClaimReview</u> fact check whose publisher wants to indicate that it may no longer be relevant (or helpful to highlight) after some date.
<u>fileFormat</u>	<u>Text</u> <u>URL</u>	or Media type, typically MIME format (see <u>IANA site</u>) of the content e.g. application/zip of a SoftwareApplication binary. In cases where a CreativeWork has several media type representations, 'encoding' can be used to indicate each MediaObject alongside particular fileFormat information. Unregistered or niche file formats can be indicated instead via the most appropriate URL, e.g. defining Web page or a Wikipedia entry.
<u>funder</u>	<u>Organization</u> <u>Person</u>	or A person or organization that supports (sponsors) something through some kind of financial contribution.
<u>genre</u>	<u>Text</u> <u>URL</u>	or Genre of the creative work, broadcast channel or group.
<u>hasPart</u>	<u>CreativeWork</u>	Indicates a CreativeWork that is (in some sense) a part of this CreativeWork. Inverse property: <u>isPartOf</u> .
<u>headline</u>	<u>Text</u>	Headline of the article.
<u>inLanguage</u>	<u>Language</u> <u>Text</u>	or The language of the content or performance or used in an action. Please use one of the language codes from the <u>IETF BCP 47 standard</u> . See also <u>availableLanguage</u> . Supersedes <u>language</u> .
<u>interactionStatistic</u>	<u>InteractionCounter</u>	The number of interactions for the CreativeWork using the WebSite or SoftwareApplication. The most specific child type of InteractionCounter should be used. Supersedes <u>interactionCount</u> .
<u>interactivityType</u>	<u>Text</u>	The predominant mode of learning supported by the learning resource.

Property	Expected Type	Description
		Acceptable values are 'active', 'expositive', or 'mixed'.
<u>isAccessibleForFree</u>	<u>Boolean</u>	A flag to signal that the item, event, or place is accessible for free. Supersedes <u>free</u> .
<u>isBasedOn</u>	<u>CreativeWork</u> <u>Product</u> <u>URL</u>	or A resource that was used in the creation of this resource. This term can be repeated for multiple sources. For example, http://example.com/great-multiplication-intro.html . Supersedes <u>isBasedOnUrl</u> .
<u>isFamilyFriendly</u>	<u>Boolean</u>	Indicates whether this content is family friendly.
<u>isPartOf</u>	<u>CreativeWork</u>	Indicates a CreativeWork that this CreativeWork is (in some sense) part of. Inverse property: <u>hasPart</u> .
<u>keywords</u>	<u>Text</u>	Keywords or tags used to describe this content. Multiple entries in a keywords list are typically delimited by commas.
<u>learningResourceType</u>	<u>Text</u>	The predominant type or kind characterizing the learning resource. For example, 'presentation', 'handout'.
<u>license</u>	<u>CreativeWork</u> <u>URL</u>	or A license document that applies to this content, typically indicated by URL.
<u>locationCreated</u>	<u>Place</u>	The location where the CreativeWork was created, which may not be the same as the location depicted in the CreativeWork.
<u>mainEntity</u>	<u>Thing</u>	Indicates the primary entity described in some page or other CreativeWork. Inverse property: <u>mainEntityOfPage</u> .
<u>material</u>	<u>Product</u> <u>Text</u> <u>URL</u>	or A material that something is made from, or e.g. leather, wool, cotton, paper.
<u>mentions</u>	<u>Thing</u>	Indicates that the CreativeWork contains a reference to, but is not necessarily about a concept.
<u>offers</u>	<u>Offer</u>	An offer to provide this item—for example, an offer to sell a product, rent the DVD of a movie, perform a service, or

Property	Expected Type	Description
		give away tickets to an event.
<u>position</u>	<u>Integer</u> <u>Text</u>	or The position of an item in a series or sequence of items.
<u>producer</u>	<u>Organization</u> <u>Person</u>	or The person or organization who produced the work (e.g. music album, movie, tv/radio series etc.).
<u>provider</u>	<u>Organization</u> <u>Person</u>	or The service provider, service operator, or service performer; the goods producer. Another party (a seller) may offer those services or goods on behalf of the provider. A provider may also serve as the seller. Supersedes <u>carrier</u> .
<u>publication</u>	<u>PublicationEvent</u>	A publication event associated with the item.
<u>publisher</u>	<u>Organization</u> <u>Person</u>	or The publisher of the creative work.
<u>publisherImprint</u>	<u>Organization</u>	The publishing division which published the comic.
<u>publishingPrinciples</u>	<u>CreativeWork</u> <u>URL</u>	or The publishingPrinciples property indicates (typically via <u>URL</u>) a document describing the editorial principles of an <u>Organization</u> (or individual e.g. a <u>Person</u> writing a blog) that relate to their activities as a publisher, e.g. ethics or diversity policies. When applied to a <u>CreativeWork</u> (e.g. <u>NewsArticle</u>) the principles are those of the party primarily responsible for the creation of the <u>CreativeWork</u> . While such policies are most typically expressed in natural language, sometimes related information (e.g. indicating a <u>funder</u>) can be expressed using schema.org terminology.
<u>recordedAt</u>	<u>Event</u>	The Event where the CreativeWork was recorded. The CreativeWork may capture all or part of the event. Inverse property: <u>recordedIn</u> .
<u>releasedEvent</u>	<u>PublicationEvent</u>	The place and time the release was issued, expressed as a PublicationEvent.

Property	Expected Type	Description
<u>review</u>	<u>Review</u>	A review of the item. Supersedes <u>reviews</u> .
<u>schemaVersion</u>	<u>Text</u> <u>URL</u>	or Indicates (by URL or string) a particular version of a schema used in some CreativeWork. For example, a document could declare a schemaVersion using an URL such as http://schema.org/version/2.0/ if precise indication of schema version was required by some application.
<u>sourceOrganization</u>	<u>Organization</u>	The Organization on whose behalf the creator was working.
<u>spatialCoverage</u>	<u>Place</u>	The spatialCoverage of a CreativeWork indicates the place(s) which are the focus of the content. It is a subproperty of contentLocation intended primarily for more technical and detailed materials. For example with a Dataset, it indicates areas that the dataset describes: a dataset of New York weather would have spatialCoverage which was the place: the state of New York. Supersedes <u>spatial</u> .
<u>sponsor</u>	<u>Organization</u> <u>Person</u>	or A person or organization that supports a thing through a pledge, promise, or financial contribution. e.g. a sponsor of a Medical Study or a corporate sponsor of an event.
<u>temporalCoverage</u>	<u>DateTime</u> <u>Text</u> <u>URL</u>	or The temporalCoverage of a CreativeWork indicates the period that the content applies to, i.e. that it describes, either as a DateTime or as a textual string indicating a time period in <u>ISO 8601 time interval format</u> . In the case of a Dataset it will typically indicate the relevant time period in a precise notation (e.g. for a 2011 census dataset, the year 2011 would be written "2011/2012"). Other forms of content e.g. ScholarlyArticle, Book, TVSeries or TVEpisode may indicate their temporalCoverage in broader terms – textually or via well-known URL. Written works such as books may sometimes have precise temporal coverage too, e.g. a work set in 1939 – 1945 can be

Property	Expected Type	Description
		indicated in ISO 8601 interval format via "1939/1945". Supersedes datasetTimeInterval , temporal .
text	Text	The textual content of this CreativeWork.
thumbnailUrl	URL	A thumbnail image relevant to the Thing.
timeRequired	Duration	Approximate or typical time it takes to work with or through this learning resource for the typical intended target audience, e.g. 'P30M', 'P1H25M'.
translationOfWork	CreativeWork	The work that this work has been translated from. e.g. 物种起源 is a translationOf "On the Origin of Species" Inverse property: workTranslation .
translator	Organization Person	or Organization or person who adapts a creative work to different languages, regional differences and technical requirements of a target market, or that translates during some event.
typicalAgeRange	Text	The typical expected age range, e.g. '7-9', '11-1'.
version	Number Text	or The version of the CreativeWork embodied by a specified resource.
video	VideoObject	An embedded video object.
workExample	CreativeWork	Example/instance/realization/derivation of the concept of this creative work. eg. The paperback edition, first edition, or eBook. Inverse property: exampleOfWork .
workTranslation	CreativeWork	A work that is a translation of the content of this work. e.g. 西遊記 has an English workTranslation "Journey to the West", a German workTranslation "Monkeys Pilgerfahrt" and a Vietnamese translation Tây du ký bình khảo. Inverse property: translationOfWork .
Properties from Thing		
additionalType	URL	An additional type for the item, typically used for adding more specific types from

Property	Expected Type	Description
		external vocabularies in microdata syntax. This is a relationship between something and a class that the thing is in. In RDFa syntax, it is better to use the native RDFa syntax – the 'typeof' attribute – for multiple types. Schema.org tools may have only weaker understanding of extra types, in particular those defined externally.
<u>alternateName</u>	<u>Text</u>	An alias for the item.
<u>description</u>	<u>Text</u>	A description of the item.
<u>disambiguatingDescription</u>	<u>Text</u>	A sub property of description. A short description of the item used to disambiguate from other, similar items. Information from other properties (in particular, name) may be necessary for the description to be useful for disambiguation.
<u>identifier</u>	<u>PropertyValue</u> <u>Text</u> <u>URL</u>	or or The identifier property represents any kind of identifier for any kind of <u>Thing</u> , such as ISBNs, GTIN codes, UUIDs etc. Schema.org provides dedicated properties for representing many of these, either as textual strings or as URL (URI) links. See <u>background notes</u> for more details.
<u>image</u>	<u>ImageObject</u> <u>URL</u>	or An image of the item. This can be a <u>URL</u> or a fully described <u>ImageObject</u> .
<u>mainEntityOfPage</u>	<u>CreativeWork</u> <u>URL</u>	or Indicates a page (or other <u>CreativeWork</u>) for which this thing is the main entity being described. See <u>background notes</u> for details. Inverse property: <u>mainEntity</u> .
<u>name</u>	<u>Text</u>	The name of the item.
<u>potentialAction</u>	<u>Action</u>	Indicates a potential <u>Action</u> , which describes an idealized action in which this thing would play an 'object' role.
<u>sameAs</u>	<u>URL</u>	URL of a reference Web page that unambiguously indicates the item's identity. E.g. the URL of the item's Wikipedia page, Wikidata entry, or official website.

Property	Expected Type	Description
<u>subjectOf</u>	<u>CreativeWork</u> or <u>Event</u>	A CreativeWork or Event about this Thing.. Inverse property: <u>about</u> .
<u>url</u>	<u>URL</u>	URL of the item.

Canonical URL: <http://schema.org/SoftwareApplication>

B.9 Schema.org entity descriptions: Vehicle

Property	Expected Type	Description
Properties from Vehicle		
cargoVolume	QuantitativeValue	<p>The available volume for cargo or luggage. For automobiles, this is usually the trunk volume.</p> <p>Typical unit code(s): LTR for liters, FTQ for cubic foot/feet</p> <p>Note: You can use minValue and maxValue to indicate ranges.</p>
dateVehicleFirstRegistered	Date	<p>The date of the first registration of the vehicle with the respective public authorities.</p>
driveWheelConfiguration	DriveWheelConfigurationValue or Text	<p>The drive wheel configuration, i.e. which roadwheels will receive torque from the vehicle's engine via the drivetrain.</p>
fuelConsumption	QuantitativeValue	<p>The amount of fuel consumed for traveling a particular distance or temporal duration with the given vehicle (e.g. litres per 100 km).</p> <ul style="list-style-type: none"> Note 1: There are unfortunately no standard unit codes for liters per 100 km. Use unitText to indicate the unit of measurement, e.g. L/100 km. Note 2: There are two ways of indicating the fuel consumption, fuelConsumption (e.g. 8 liters per 100 km) and fuelEfficiency (e.g. 30 miles per gallon). They are reciprocal. Note 3: Often, the absolute value is useful only when related to driving speed ("at 80 km/h") or usage pattern ("city traffic"). You can use valueReference to link the value for the fuel consumption to another value.

Property	Expected Type	Description
fuelEfficiency	QuantitativeValue	<p>The distance traveled per unit of fuel used; most commonly miles per gallon (mpg) or kilometers per liter (km/L).</p> <ul style="list-style-type: none"> Note 1: There are unfortunately no standard unit codes for miles per gallon or kilometers per liter. Use unitText to indicate the unit of measurement, e.g. mpg or km/L. Note 2: There are two ways of indicating the fuel consumption, fuelConsumption(e.g. 8 liters per 100 km) and fuelEfficiency (e.g. 30 miles per gallon). They are reciprocal. Note 3: Often, the absolute value is useful only when related to driving speed ("at 80 km/h") or usage pattern ("city traffic"). You can use valueReference to link the value for the fuel economy to another value.
fuelType	QualitativeValue Text URL	<p>or or The type of fuel suitable for the engine or engines of the vehicle. If the vehicle has only one engine, this property can be attached directly to the vehicle.</p>
knownVehicleDamages	Text	<p>A textual description of known damages, both repaired and unrepaired.</p>
mileageFromOdometer	QuantitativeValue	<p>The total distance travelled by the particular vehicle since its initial production, as read from its odometer. Typical unit code(s): KMT for kilometers, SMI for statute miles</p>
numberOfAirbags	Number Text	<p>or The number or type of airbags in the vehicle.</p>
numberOfAxles	Number QuantitativeValue	<p>or The number of axles. Typical unit code(s): C62</p>
numberOfDoors	Number QuantitativeValue	<p>or The number of doors. Typical unit code(s): C62</p>
numberOfForwardGears	Number QuantitativeValue	<p>or The total number of forward gears available for the transmission system of the vehicle. Typical unit code(s): C62</p>

Property	Expected Type	Description
numberOfPreviousOwners	Number or QuantitativeValue	The number of owners of the vehicle, including the current one. Typical unit code(s): C62
productionDate	Date	The date of production of the item, e.g. vehicle.
purchaseDate	Date	The date the item e.g. vehicle was purchased by the current owner.
steeringPosition	SteeringPositionValue	The position of the steering wheel or similar device (mostly for cars).
vehicleConfiguration	Text	A short text indicating the configuration of the vehicle, e.g. '5dr hatchback ST 2.5 MT 225 hp' or 'limited edition'.
vehicleEngine	EngineSpecification	Information about the engine or engines of the vehicle.
vehicleIdentificationNumber	Text	The Vehicle Identification Number (VIN) is a unique serial number used by the automotive industry to identify individual motor vehicles.
vehicleInteriorColor	Text	The color or color combination of the interior of the vehicle.
vehicleInteriorType	Text	The type or material of the interior of the vehicle (e.g. synthetic fabric, leather, wood, etc.). While most interior types are characterized by the material used, an interior type can also be based on vehicle usage or target audience.
vehicleModelDate	Date	The release date of a vehicle model (often used to differentiate versions of the same make and model).
vehicleSeatingCapacity	Number or QuantitativeValue	The number of passengers that can be seated in the vehicle, both in terms of the physical space available, and in terms of limitations set by law. Typical unit code(s): C62 for persons.

Property	Expected Type	Description
vehicleSpecialUsage	Text	Indicates whether the vehicle has been used for special purposes, like commercial rental, driving school, or as a taxi. The legislation in many countries requires this information to be revealed when offering a car for sale.
vehicleTransmission	QualitativeValue or Text or URL	The type of component used for transmitting the power from a rotating power source to the wheels or other relevant component(s) ("gearbox" for cars).

Annex C Referenced entities (Informative)

To provide additional clarity we provide a snapshot of the referenced UAV entity definitions below. This information is informative only.

C.1 Automatic Dependent Surveillance–Broadcast Message entity descriptions:

Automatic Dependent Surveillance–Broadcast (ADS-B) is a satellite based surveillance system. Aircraft position, velocity, together with identification are transmitted automatically through Mode-S Extended (1090 MHz) transponders.

The majority of modern aircrafts are broadcasting ADS-B messages constantly (1 second period). The ADSB Message is a binary message with the following protocol specification.

An ADS-B message is 112 bits long, and consists of 5 main parts:

DF	CA	ICAO	TC&DATA	PI
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This table defines the key components and bit structure of an ADS-B message:

nBits	Bits	Abbreviation	Name
5	1 – 5	DF	Downlink Format
3	6 – 8	CA	Capability Additional identifier
24	9 – 32	ICAO	ICAO aircraft address
4	33 - 37	TC	Data Type Code
52	38 - 88	DATA	Data pertaining to the message type
24	89 – 112	PI	Parity/Interrogator ID

Further information may be found here:

<https://media.readthedocs.org/pdf/adsb-decode-guide/latest/adsb-decode-guide.pdf>

https://global.ihs.com/doc_detail.cfm?item_s_key=00536618&item_key_date=871131&rid=GS

<https://www.faa.gov/nextgen/programs/adsb/>

C.2 State Vector entity descriptions:

The Open Sky State Vector Message is interpreted, reformatted data that may be extracted from the OpenSky platform using an API defined here:

<https://opensky-network.org/apidoc/index.html#state-vectors>

Each OpenSky State vector has the following properties

Property	Type	Description
time	integer	The time which the state vectors in this response are associated with. All vectors represent the state of a vehicle with the interval [time-1,time][time-1,time] .
states	array	The state vectors.

The states property is a two-dimensional array. Each row represents a state vector and contains the following fields:

Index	Property	Type	Description
0	icao24	String	Unique ICAO 24-bit address of the transponder in hex string representation.
1	callsign	String	Callsign of the vehicle (8 chars). Can be null if no callsign has been received.
2	origin_country	String	Country name inferred from the ICAO 24-bit address.
3	time_position	Float	Unix timestamp (seconds) for the last position update. Can be null if no position report was received by OpenSky within the past 15s.
4	time_velocity	Float	Unix timestamp (seconds) for the last velocity update. Can be null if no velocity report was received by OpenSky within the past 15s.
5	longitude	Float	WGS-84 longitude in decimal degrees. Can be null.
6	latitude	Float	WGS-84 latitude in decimal degrees. Can be null.
7	altitude	Float	Barometric or geometric altitude in meters. Can be null.
8	on_ground	boolean	Boolean value which indicates if the position was retrieved from a surface position report.

Index	Property	Type	Description
9	velocity	Float	Velocity over ground in m/s. Can be null.
10	heading	Float	Heading in decimal degrees clockwise from north (i.e. north=0°). Can be null.
11	vertical_rate	Float	Vertical rate in m/s. A positive value indicates that the airplane is climbing, a negative value indicates that it descends. Can be null.
12	sensors	int[]	IDs of the receivers which contributed to this state vector. Is null if no filtering for sensor was used in the request.

Further information is available here:

<https://opensky-network.org/apidoc/index.html#state-vectors>

C.3 flightMessage descriptions:

The UTM Flight Message is part of an event-based notification system promoted by the Global UTM association (<https://gutma.org/>) where the Originating Party notifies Interested Parties of a flight or changes to a previously announced flight.

The flightMessage is the primary entity exchanged between Originating and Interested Parties. Each UTM Flight Message has the following properties

C.3.1 UTM Flight Message description:

Name	Description	Type
flightId	Identifier provided by the Originating Party that uniquely identifies this declaration from other declarations provided by the same Originating Party.	string
sequenceNumber	A number that represents the version of this message data. When a record is modified, the sequence number must be numerically greater than the previous update.	number (uint64)
flightDeclaration	A flightDeclaration object describing this proposed flight. To delete a flight, this field should be null.	flightDeclaration
version	The version of this protocol that the message has been implemented from.	string - currently "0.2.0"

C.3.2 flightDeclaration

Name	Description	Type
parts	One or more part that make up this flight	array
purpose	A human readable description of the reason the flight is being conducted. This field can be omitted if the end user chooses not to share the purpose of their flight. (See <i>notes</i>)	string
expectTelemetry	A flag indicting whether it is expected that telemetry will be available during the flight.	boolean
originatingParty	The name of the party that the flight was originally declared with.	string
contactUrl	The URL to be use to initiate contact with the user. This can be used to make nuisance report about this flight or for law enforcement to start the process of identifying a drone operator. It is expected that the flightId will be used as part of this Url as the Url must be standalone and not require any other information.	string
operationMode	The mode that the drone is being operated in.	operationMode { "vlos", "evlos", "bvlos", "automated" }

Name	Description	Type
idents	Any idents that are associated with this flight	array [optional]
actualTakeOffTime	The time the flight took off. This value can be null or omitted if the take-off time is not known	datetime [optional]
actualLandingTime	The time the flight completed. This value can be null or omitted if the landing time is not known	datetime [optional]

C.3.3 flightPart

A flight consists of one or more parts. Each part has a start and end time as well as a geography and maximum altitude.

Name	Description	Type
id	An identifier that uniquely identifies this part within this flight.	string
geography	A Polygon or LineString describing the planned operating area or route.	geometry
startTime	The time that the flight is expected to start.	datetime
endTime	The time that the flight is expected to be completed by. This must always be greater than startTime.	datetime
maxAltitude	The maximum altitude that the drone will achieve during the <i>flightPart</i> .	altitude

C.3.4 altitude

Altitude is specified in Metres above the specified datum. The altitude type combines both values.

Name	Description	Type
metres	The height above the specified datum in metres	number
datum	The datum that describes what the altitude measurement is relative to	altitudeDatum { "agl", "amsl", "sps", "wgs84" }

Datum	Description
agl	Above Ground Level
amsl	Above Mean Sea Level. This value is included for completeness. As this datum is not valid for any of the messages in this specification, the issue of defining the tidal datum for Mean Sea Level has not been included.
sps	Altitude where a barometric altimeter would be set to the Standard Pleasure Setting. This is effectively of the Flight Level multiplied by 100 and converted to metres.
wgs84	Distance above the WGS 84 datum.

C.3.5 operationMode

operationMode	Description
vlos	The drone is being flown by a human pilot within visual line of sight
evlos	The drone is being flown by a human pilot with extended visual line of sight – typically enabled by the use of observers.
bvlos	The drone is being flown by a human pilot beyond visual line of sight
automated	The drone does not have a human pilot

Further information is available here:

https://bitbucket.org/global_utm/flight-declaration-protocol/

Annex D Document Management

D.1 Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
0.10	8 Sept 2016	New PRD - first draft	PSMC	Allan Bartlett / GSMA
1.0	11 Oct 2016	Approved first version	PSMC	Allan Bartlett / GSMA
2.0	21 June 2017	<p>Updated PRD with the following improved definitions:</p> <ol style="list-style-type: none"> 1. Mandatory Null Values removed (Generic issue) changed to three possible combinations (section 2.3): <ol style="list-style-type: none"> I. "Mandatory / May not be Null" – attribute must always be specified and with a non Null value; II. "Recommended / May be Null" – attribute should always be specified but may have a Null value or may default to a defined value if omitted; III. "Optional / May be Null" – attribute may be specified but may have a Null value or may default to a defined value if omitted. 2. 'EnvironmentObserved' entity 2.3.16 has 'Measurand' attribute removed due to ambiguous usage. 3. 'Machine' entity 2.3.17 has 'factory' attribute added. 4. 'Product' entity 2.3.21 allowed only one supplierName to be listed (Specific to 'Product' entity) so changed to supplier or the URL to the supplier of the product or to a list of suppliers for the product. The URL can point to either a web page for one or more suppliers or a JSON based list of suppliers structured using the Schema.org defined 'Organisation'URL 5. 'ProductRecord' entity 2.3.22 (Specific issue to 'ProductRecord') enhanced e.g. O2 attribute 6. 'Vehicle' entity 2.3.28 references multiple 'VehicleType's (Specific to 'Vehicle' entity) so changed the definition of the 'refVehicleType' attribute to a single value rather than a list of values. 7. 'Vehicle' entity 2.3.28 updated with 'fuelEconomy' attribute adopted to use the Schema.org definition of 'fuelEfficiency' which is based on 'QuantitativeValue'. 8. 'WaterQualityObserved' 2.3.31 - removed 'measurand' (Generic issue with 'measurand'). Measurand removed from this and all other entity definitions. 9. 'WeatherForecast' 2.3.32 attribute 'visibility' lacked agreement on definition 	Project Approval	Allan Bartlett / GSMA

		<p>(Specific issue to 'WeatherForecast') so revised to type 'ExtQuantitativeValue' and normally recorded in metres (though with the option to use 'statute miles' provided the relevant unitCode is used within 'ExtQuantitativeValue')</p> <p>10. 'WeatherForecast' 2.3.32 validity period was not queryable using NGSiv2 (Generic issue for validity periods) so revised the 'validity' attribute to separate 'validFrom' and 'validTo' attributes.</p> <p>11. 'WeatherForecast' 2.3.32 'dayMinimum' & 'dayMaximum' attributes was not queryable using NGSiv2 (Generic issue relating to 'Array of text') so have been revised.</p> <p>GSMA logo updated on page 1 Typo on page 11 of Whcere corrected to Where</p>		
3.0	24 Oct 2017	<p>Updated entities: 2.3.17 machine 2.3.19 machineOperation New entities: 2.3.20 MarketPriceForecast 2.3.21 MarketPriceObserved Annex B6 schema.org/PriceSpecification</p>	Project Approval	Allan Bartlett / GSMA
4.0	22 Dec 2017	<p>Updated entities: 2.3.9 AirQualityObserved New entities 2.3.30 UAV 2.3.31 UAVADSB 2.3.32 UAVEvent 2.3.33 UAVModel 2.3.34 UAVStateVector 2.3.35 UAVTMS 2.3.36 UAVUTMFlightMessage 2.3.37 UAVUTMFlightMessageAgent Annex B7 schema.org/SoftwareApplication Annex C UAV entity definitions</p>	Project Approval	Allan Bartlett / GSMA

Other Information

Type	Description
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Your comments or suggestions & questions are always welcome.