

D2.8 EGTN Transport Data and Knowledge Models final version

Document Summary Information

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Glossary of terms and abbreviations used

Abbreviation / Term	Description
JSON	JavaScript Object Notation
KG	Knowledge Graph
GTIN	Global Trade Identification Number
SGTIN	Serialized Global Trade Identification Number
	Lot Global Trade Identification Number
SOML	Semantic Object Modelling Language
	Transport and Logistics
EGTN	Eu-Global T&L network
EPCIS	Electronic Product Code Information Services
WWIS	World Weather Information Service
API	Application Programming Interface
SOML	Semantic Object Modelling Interface

1 Executive Summary

2 Introduction

2.1 Mapping PLANET Outputs

Table 1: Adherence to PLANET's GA Deliverable & Tasks Descriptions

PLANET GA Component Title	PLANET GA Component Outline	Respective Document Chapter(s)	Justification
DELIVERABLE			
D2.8 EGTN Transport Data and Knowledge Models final version	Final version of the strategic, meso and micro transport models	Section 6	Section 6 covers the final state of the complete transport data model that fully describes the content of the Knowledge Graph. This includes both the contents from D2.7 and the extensions developed and described in D2.8
D2.8 EGTN Transport Data and Knowledge Models final version	China-Poland train route model representation extension to model	Section 3	Section 3 covers the various aspects of modelling related to the China-Poland route. This includes the route descriptions, technical details of the vehicles, weather data stations, carbon emissions data, typical transit times and so on.
D2.8 EGTN Transport Data and Knowledge Models final version	Fully-integrated EPCIS 2.0 system with sample data	Section 4	Section 4 covers the work on a detailed example of using the newly released EPCIS 2.0 standard for IoT devices. It was directly used to inform partners in LL1 and LL3 how to handle the data-transmission aspect of their sensor deployment.
D2.8 EGTN Transport Data and Knowledge Models final version		Section 5	Section 5 continues on from the previous section and discusses the additional data modelling work based on raw sensor events. This ties into trip tracking, delivery time estimates, carbon emissions predictions and so on.
TASKS			
ST2.2.3 EGTN Transport Data and Knowledge Models as a Service	Incorporation of global standards and major ontologies in the modelling	Chapter 4	Chapter 4 describes the implementation of the newly released EPCIS 2.0 standard for IoT device data sharing, the development of sample outputs and the coordination with partners on deploying services using it.
ST2.2.3 EGTN Transport Data and Knowledge Models as a Service	Strategic, meso and micro transport models that correspond to key transport routes and corridors	Chapter 3	Chapter 3 details the extension of the route model with additional data including connection to weather stations from the weather dataset, per country modelling of

			sample train composition and the application to carbon footprint calculations
ST2.2.3 EGTN Transport Data and Knowledge Models as a Service	Single data-sharing intelligence space in the Cloud	Chapter 5 & 6	<p>Chapter 5 follows up from Chapter 4 to describe how the collected IoT data can be leveraged to infer unique insights into the transport and logistics process.</p> <p>Chapter 6 presents the complete final version of the unified data model.</p>

2.2 Deliverable Overview and Report Structure

2.3 Business Value and Reusability

2.4 Data Workflow Within and Beyond the EGTN Connectivity Framework

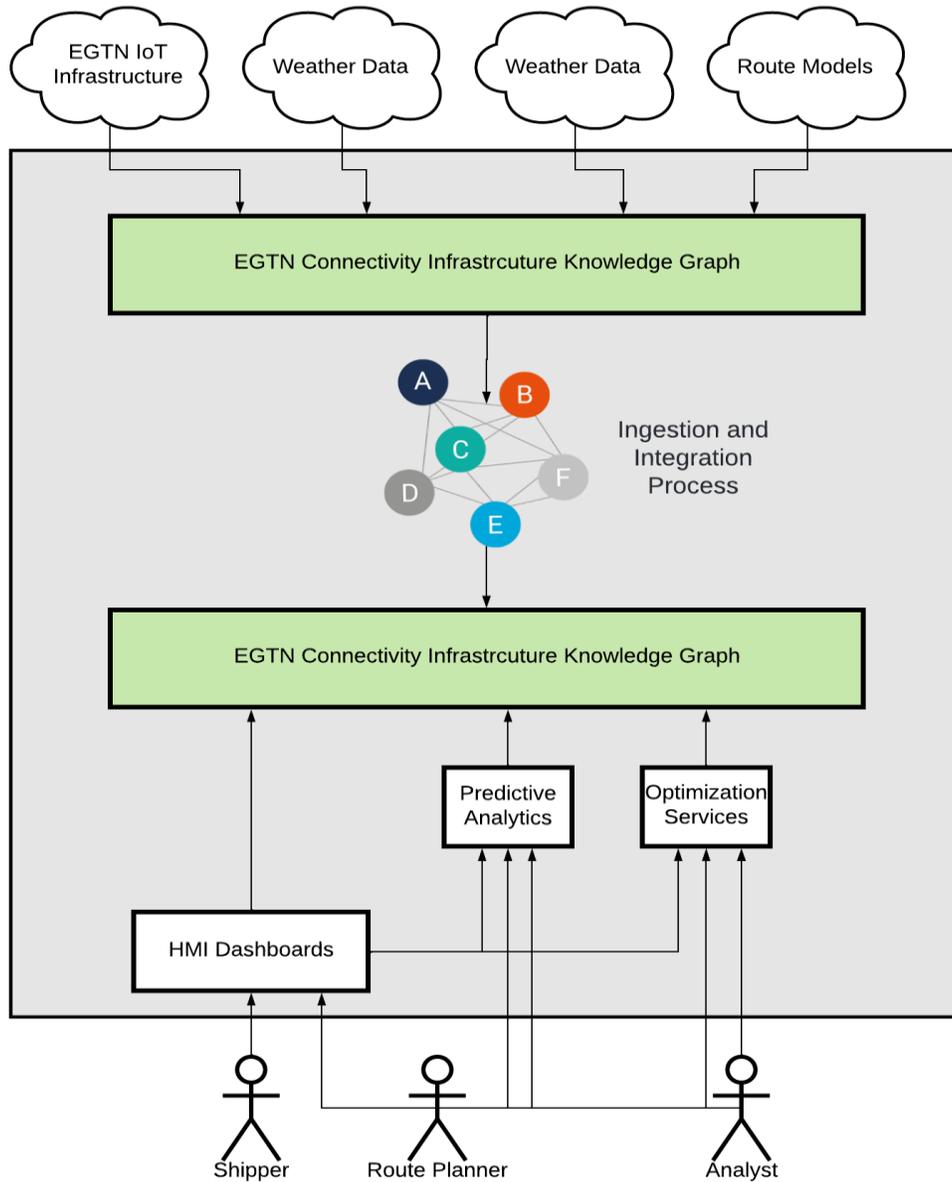


Figure 1: Connectivity Data Flow

3 Route model extended

3.1 Connection to weather stations

3.2 Train composition simulations

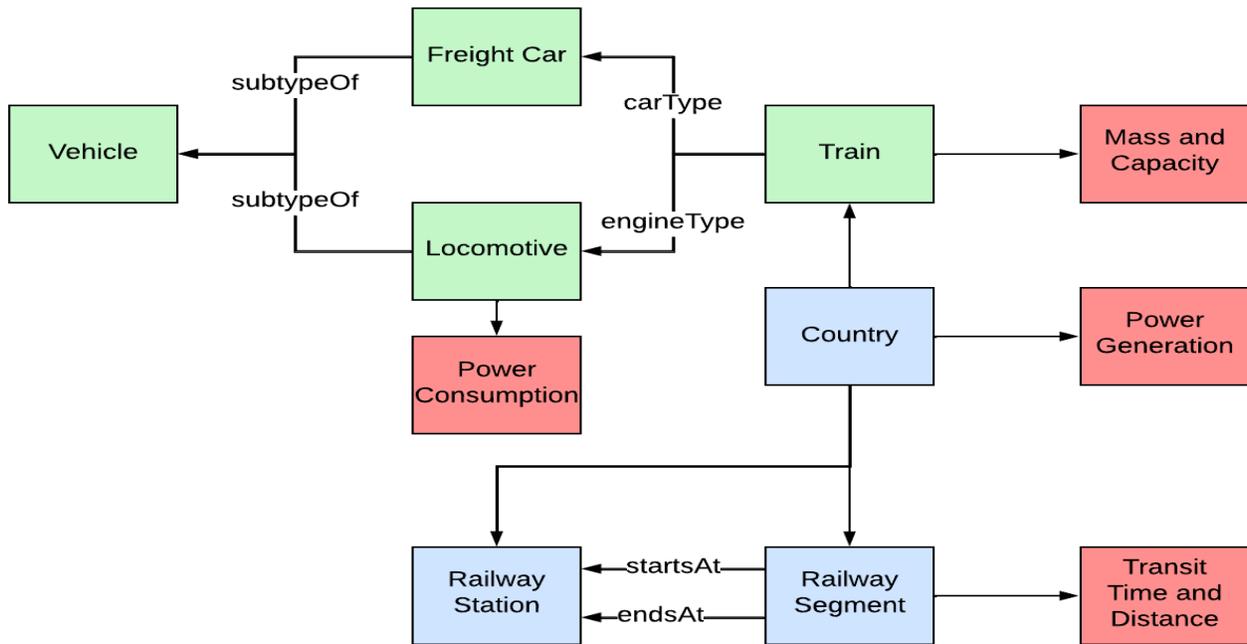


Figure 2: Extended Route Model

3.3 Carbon footprint estimate

4 Fully-integrated EPCIS 2.0 system

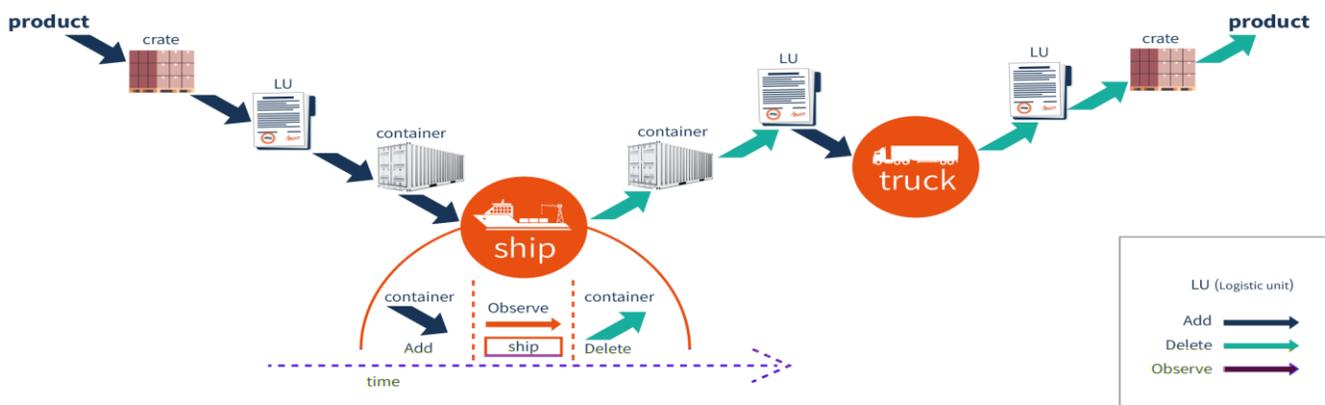


Figure 3: EPCIS 2.0 Events example

4.1 Companies, products and certificates

4.2 Products, crates and containers

4.3 Integrated IoT sensor tracking

5 IoT Device Event Inference

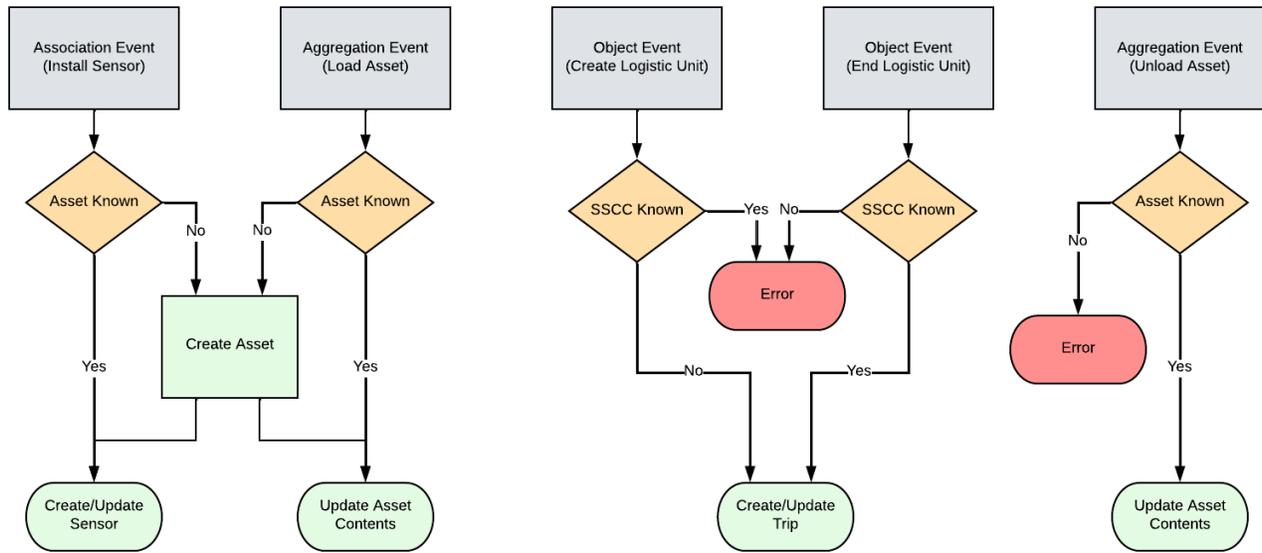


Figure 4: IoT Device Events Inference

5.1 Logistic Unit and Trip data

5.2 Sensor Installation

5.3 Asset Loading and Unloading

6 Finalised data model

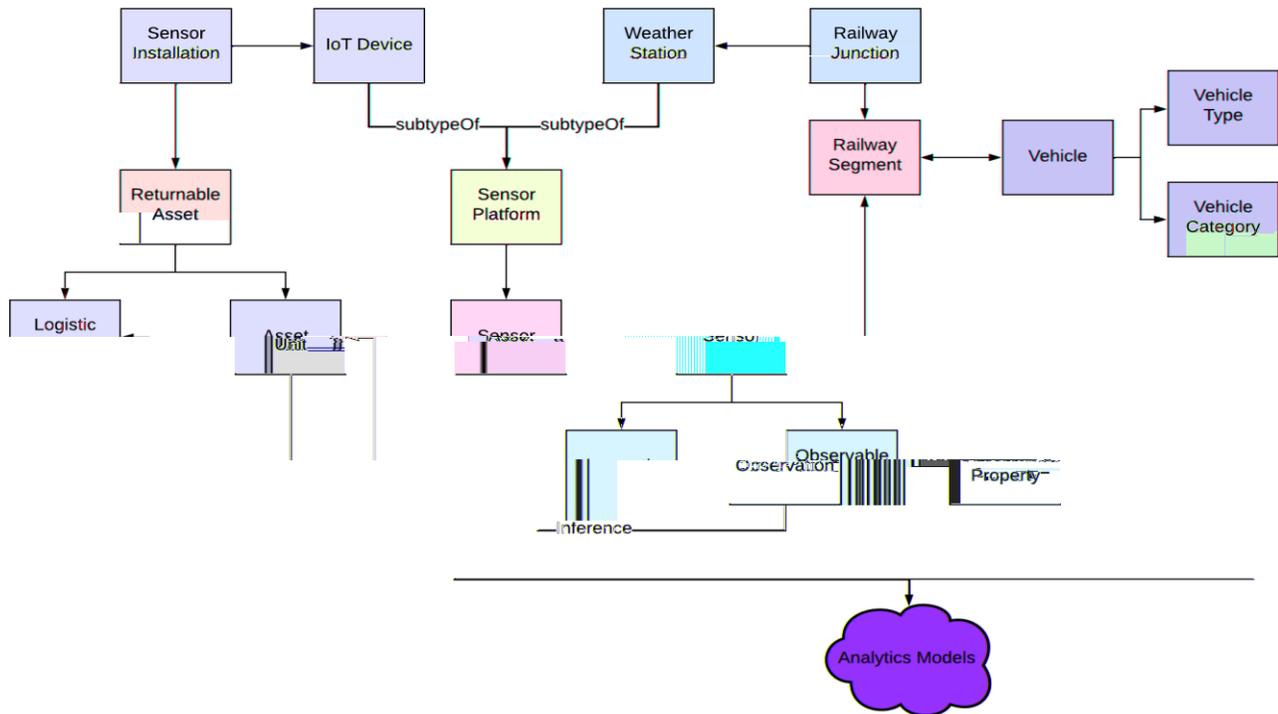


Figure 5: Simplified presentation of final data model

7 Conclusions

Annex I: EPCIS 2.0 Data Example

```

{
  "@context": [
    "https://gs1.github.io/EPCIS/epcis-context.jsonld",
    { "gs1": "https://gs1.org/voc/" },
    { "cbv": "https://ns.gs1.org/cbv/" },
    { "ngs": "https://ngs-sensors.it/" }
  ],
  "type": "EPCISDocument",
  "schemaVersion": "2.0",
  "creationDate": "2022-07-29T14:00:00.000000",
  "epcisBody": {
    "eventList": [
      {
        "@id": "ni:///sha-256;00?ver=CBV2.0",
        "@type": "epcis:AssociationEvent",
        "epcis:action": "ADD",
        "epcis:bizLocation": { "@id": "https://id.gs1.org/414/095200001237" },
        "epcis:readPoint": { "@id": "https://id.gs1.org/414/095200001237/254/235" },
        "epcis:bizStep": { "@id": "cbv:BizStep-assembling" },
        "epcis:disposition": { "@id": "cbv:Disp-in_progress" },
        "epcis:parentID": { "@id": "https://id.gs1.org/8003/009520000000150000123" },
        "epcis:childEPCs": { "@id": "ngs:D5:D1:B8:17:F8:18" },
        "epcis:eventTime": {
          "@value": "2022-05-01T00:00:00.000+00:00",
          "@type": "xsd:dateTimeStamp"
        },
        "epcis:recordTime": {
          "@value": "2022-05-01T00:00:00.000+00:00",
          "@type": "xsd:dateTimeStamp"
        },
        "epcis:eventTimeZoneOffset": "+00:00"
      }
    ]
  }
}

```

Figure 6: Sensor Installation Event

```

{
  "@context": [
    "https://gs1.github.io/EPCIS/epcis-context.jsonld",
    { "gs1": "https://gs1.org/voc/" },
    { "cbv": "https://ns.gs1.org/cbv/" },
    { "ngs": "https://ngs-sensors.it/" }
  ],
  "type": "EPCISDocument",
  "schemaVersion": "2.0",
  "creationDate": "2022-07-29T14:00:00.000000",
  "epcisBody": {
    "eventList": [
      {
        "@id": "ni:///sha-256;01?ver=CBV2.0",
        "@type": "epcis:AggregationEvent",
        "epcis:action": "ADD",
        "epcis:bizLocation": { "@id": "https://id.gs1.org/414/095200001237" },
        "epcis:readPoint": { "@id": "https://id.gs1.org/414/095200001237/254/235" }
      },
      "epcis:bizStep": { "@id": "cbv:BizStep-assembling" },
      "epcis:disposition": { "@id": "cbv:Disp-in_progress" },
      "epcis:parentID": { "@id":
        "https://id.gs1.org/8003/009520000000150000123" },
        "epcis:childEPCs": { "@id": "https://id.gs1.org/01/0952012345678" },
        "epcis:eventTime": {
          "@value": "2022-07-15T08:00:00.000000",
          "@type": "xsd:dateTimeStamp"
        },
        "epcis:recordTime": {
          "@value": "2022-07-15T08:00:00.000000",
          "@type": "xsd:dateTimeStamp"
        },
        "epcis:eventTimeZoneOffset": "+08:00"
      }
    ]
  }
}

```

Figure 7: Aggregation Event ADD

```

{
  "@context": [
    "https://gs1.github.io/EPCIS/epcis-context.jsonld",
    { "gs1": "https://gs1.org/voc/" },
    { "cbv": "https://ns.gs1.org/cbv/" },
    { "ngs": "https://ngs-sensors.it/" }
  ],
  "type": "EPCISDocument",
  "schemaVersion": "2.0",
  "creationDate": "2022-07-29T14:00:00.000000",
  "epcisBody": {
    "eventList": [
      {
        "@id": "ni:///sha-256;05?ver=CBV2.0",
        "@type": "epcis:AggregationEvent",
        "epcis:action": "DELETE",
        "epcis:bizLocation": { "@id": "https://id.gs1.org/414/095200001237" },
        "epcis:readPoint": { "@id": "https://id.gs1.org/414/095200001237/254/235" }
      },
      "epcis:bizStep": { "@id": "cbv: BizStep-assembling" },
      "epcis:disposition": { "@id": "cbv: Disp-in_progress" },
      "epcis:parentID": { "@id":
"https://id.gs1.org/8003/009520000000150000123" },
      "epcis:childEPCs": { "@id": "https://id.gs1.org/01/0952012345678" },
      "epcis:eventTime": {
        "@value": "2022-07-29T12:30:00.000000",
        "@type": "xsd:dateTimeStamp"
      },
      "epcis:recordTime": {
        "@value": "2022-07-29T12:30:00.000000",
        "@type": "xsd:dateTimeStamp"
      },
      "epcis:eventTimeZoneOffset": "+02:00"
    }
  }
}

```

Figure 8: Aggregation Event DELETE

```

{
  "@context": [
    "https://gs1.github.io/EPCIS/epcis-context.jsonld",
    { "gs1": "https://gs1.org/voc/" },
    { "cbv": "https://ns.gs1.org/cbv/" },
    { "ngs": "https://ngs-sensors.it/" }
  ],
  "type": "EPCISDocument",
  "schemaVersion": "2.0",
  "creationDate": "2022-07-29T14:00:00.000000",
  "epcisBody": {
    "eventList": [
      {
        "@id": "ni:///sha-256;02?ver=CBV2.0",
        "@type": "epcis:ObjectEvent",
        "epcis:action": "ADD",
        "epcis:bizLocation": { "@id": "https://id.gs1.org/414/095200001237" },
        "epcis:readPoint": { "@id":
"https://id.gs1.org/414/095200001237/254/235" },
        "epcis:bizStep": { "@id": "cbv: BizStep-assembling" },
        "epcis:disposition": { "@id": "cbv: Disp-in_progress" },
        "epcis:parentID": { "@id": "https://id.gs1.org/sscc/106141412345678908"
      },
      "epcis:childEPCs": { "@id":
"https://id.gs1.org/8003/009520000000150000123" },
      "epcis:eventTime": {
        "@value": "2022-07-15T08:01:00.000000",
        "@type": "xsd:dateTimeStamp"
      },
      "epcis:recordTime": {
        "@value": "2022-07-15T08:01:00.000000",
        "@type": "xsd:dateTimeStamp"
      },
      "epcis:eventTimeZoneOffset": "+08:00"
    }
  ]
}

```

Figure 9: Object Event ADD

```

{
"@context": [
  "https://gs1.github.io/EPCIS/epcis-context.jsonld",
  { "gs1": "https://gs1.org/voc/" },
  { "cbv": "https://ns.gs1.org/cbv/" },
  { "ngs": "https://ngs-sensors.it/" }
],
"type": "EPCISDocument",
"schemaVersion": "2.0",
"creationDate": "2022-07-29T14:00:00.000000",
"epcisBody": {
  "eventList": [
    {
      "@id": "ni:///sha-256;04?ver=CBV2.0",
      "@type": "epcis:ObjectEvent",
      "epcis:action": "DELETE",
      "epcis:bizLocation": { "@id": "https://id.gs1.org/414/095200001237" },
      "epcis:readPoint": { "@id":
"https://id.gs1.org/414/095200001237/254/235" },
      "epcis:bizStep": { "@id": "cbv: BizStep-assembling" },
      "epcis:disposition": { "@id": "cbv: Disp-in_progress" },
      "epcis:parentID": { "@id":
"https://id.gs1.org/sscc/106141412345678908" },
      "epcis:childEPCs": { "@id":
"https://id.gs1.org/8003/009520000000150000123" },
      "epcis:eventTime": {
        "@value": "2022-07-29T12:00:00.000000",
        "@type": "xsd:dateTimeStamp"
      },
      "epcis:recordTime": {
        "@value": "2022-07-29T12:00:00.000000",
        "@type": "xsd:dateTimeStamp"
      },
      "epcis:eventTimeZoneOffset": "+02:00"
    }
  ]
}

```

Figure 10: Object Event DELETE

```

{
  "@context": [
    "https://gs1.github.io/EPCIS/epcis-context.jsonld",
    { "gs1": "https://gs1.org/voc/" },
    { "cbv": "https://ns.gs1.org/cbv/" },
    { "ngs": "https://ngs-sensors.it/" }
  ],
  "type": "EPCISDocument",
  "schemaVersion": "2.0",
  "creationDate": "2022-07-29T14:00:00.000000",
  "epcisBody": {
    "eventList": [
      {
        "@id": "ni:///sha-256;03?ver=CBV2.0",
        "@type": "epcis:ObjectEvent",
        "epcis:action": "OBSERVE",
        "epcis:bizStep": "cbv: BizStep-sensor_reporting",
        "epcis:eventTime": "2022-07-22T19:11:16+00:00",
        "epcis:eventTimeZoneOffset": "00:00",
        "epcis:readPoint": { "id": "geo:51.2069,71.2940" },
        "sensorElementList": [
          {
            "sensorMetadata": { "time": "2022-07-22T19:11:16", "deviceId":
"ngs:D5:D1:B8:17:F8:18" },
            "sensorReport": [
              {
                "type": "gs1:Temperature", "value": 18.31, "uom": "CEL"
              },
              {
                "type": "gs1:RelativeHumidity", "value": 51.2069, "uom": "P1",
                "exception": "gs1:ALARM_CONDITION"
              }
            ]
          }
        ]
      }
    ]
  }
}

```

Figure 11: Object Event OBSERVE