ETSI GR CIM 024 V1.1.1 (2024-02)

Context Information Management (CIM); NGSI-LD Architecture Deployment Scenarios

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Foreword

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

Modal verbs terminology

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

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Executive summary

The present document is intended to provide developers with supplement descriptions based on Next Generation Service Interface Linked Data (NGSI-LD) architectural considerations that are discussed in the NGSI-LD Application Programming Interface (API) specification. The aim is to give detailed statements for how to configure NGSI-LD systems and use the distributed operations of NGSI-LD API in various deployment scenarios using central, distributed, and federated architecture configurations.

Introduction

While ETSI GS CIM 009 [i.1] provides the distributed architectural concepts with distributed operations. However, it could be difficult to implement the specifications without further informative deliverables. The present document is intended to help readers how to configure NGSI-LD systems using a centralized, distributed, or federated architectures.

Each deployment scenario consists of the following:

- Service scenario
- System configuration with components (e.g. national disaster warning platform)
- NGSI-LD entity modelling (e.g. EarthquakeEvent)
- Request message of each distributed operation

1 Scope

The present document provides detailed statements for how to configure NGSI-LD system and use the distributed operations of NGSI-LD API in the centralized, distributed, and federated architectures. Those architectural considerations are described in ETSI GS CIM 009 [i.1].

The present document includes the following topics:

- NGSI-LD deployment scenarios and usage of NGSI-LD API operations using the centralized architecture.
- NGSI-LD deployment scenarios and usage of distributed operations of NGSI-LD API using the distributed architecture.
- NGSI-LD deployment scenarios and usage of distributed operations of NGSI-LD API using the federated architecture.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI GS CIM 009 (V1.7.1): "Context Information Management (CIM); NGSI-LD API".

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API	Application Programming Interface
CSR	Context Source Registration
ID	IDentifier

NGSI-LD Next Generation Service Interfaces Linked Data
URI Uniform Resource Identifier

4 Overview

The present document supplements the architectural considerations of NGSI-LD API specification (see clause 4.3 in ETSI GS CIM 009 [i.1]). For this purpose, the present document provides deployment scenarios with NGSI-LD system configuration and examples.

Table 4-1 shows the relationship between the present document and NGSI-LD API specification.

Table 4-1: Relationship between the present document and NGSI-LD API specification

Deployment scenario	The present document	The NGSI-LD API specification ETSI GS CIM 009 [i.1]
Centralized architecture	Clause 5	Clause 4.3.2
Distributed architecture using exclusive mode	Clause 6	Clause 4.3.3 and 4.3.6
Distributed architecture using inclusive mode	Clause 6	Clause 4.3.3 and 4.3.6
Distributed architecture using redirect mode	Clause 6	Clause 4.3.3 and 4.3.6
Distributed architecture using auxiliary mode	Clause 6	Clause 4.3.3 and 4.3.6
Federated architecture	Clause 7	Clause 4.3.4 and 4.3.6

5 Deployment scenario #1 - centralized architecture

5.1 Introduction

The clause 5 describes an NGSI-LD API-based simple data production and consumption using the centralized architecture (see clause 4.3.2 in ETSI GS CIM 009 [i.1]).

5.2 NGSI-LD system configuration

Figure 5.2-1 shows an NGSI-LD system for simple data production and consumption using the centralized architecture.

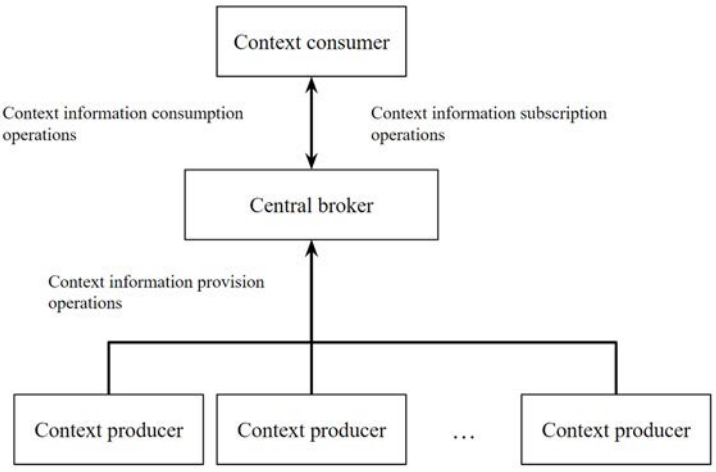

Figure 5.2-1: NGSI-LD system for simple data production and consumption using the centralized architecture

The definition of the central broker, context producer, and context consumer is specified in clause 3.1 of ETSI GS CIM 009 [i.1].

Context information provision operations are specified in clause 5.6 of ETSI GS CIM 009 [i.1].

Context information consumption operations are specified in clause 5.7 of ETSI GS CIM 009 [i.1].

Context information subscription operations are specified in clause 5.8 of ETSI GS CIM 009 [i.1].

5.3 Deployment scenario example - smart parking

5.3.1 Overview

A building has a number of parking spaces. For each parking space, a vehicle detection sensor is installed and connected to a smart parking server. Every time the vehicle detection sensor detects a vehicle in its parking space, it sends a detection event to the smart parking server.

Now, a building customer drives to the building and looks for available parking spaces using the smart parking application.

5.3.2 Service component mapping

Figure 5.3.2-1 shows a service component mapping to the NGSI-LD system.

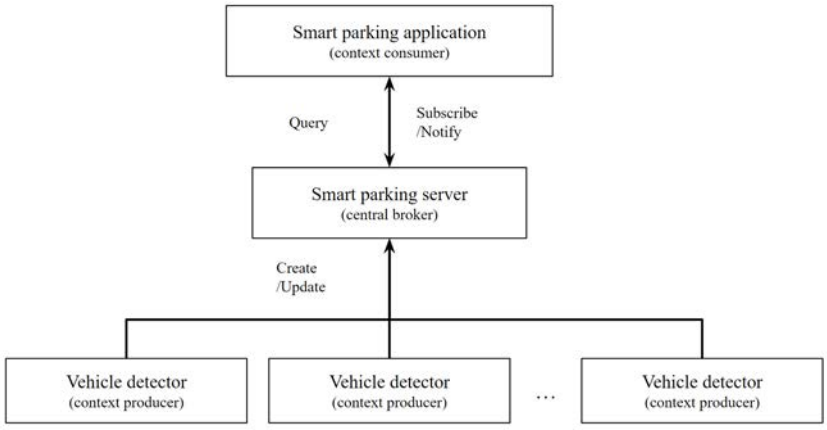

Figure 5.3.2-1: Service component mapping to the NGSI-LD system

Table 5.3.2-1 shows an example data model of the entity *VehicleDetector*. Each vehicle detector has its entity ID and their context information is persisted in the smart parking server.

Table 5.3.2-1: Example data model of entity *VehicleDetector*

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity identifier (ID) of vehicle detector
type	String	The value is equal to "http://example.org/ngsi-ld/VehicleDetector"	1	Entity type
name	String		1	Property for indicating a parking space
isDetected	Boolean		1	Property for indicating a vehicle is detected or not: • false: not detected • true: detected
location	GeoJSON		0..1	Property for location of the installation point for the vehicle detection sensor

5.3.3 Scenarios

5.3.3.1 Parking space availability retrieval

Figure 5.3.3.1-1 shows communication flows to get available parking spaces.

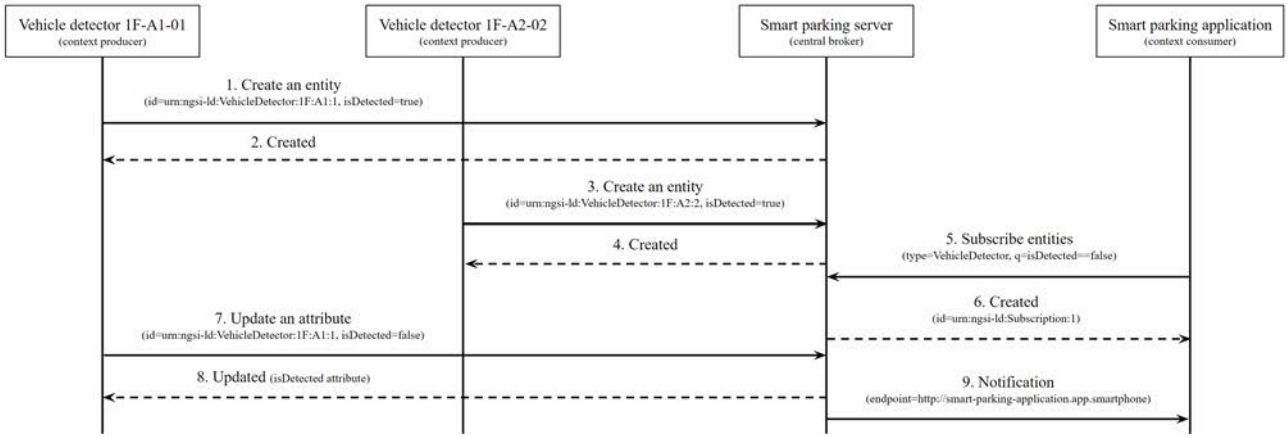

Figure 5.3.3.1-1: Communication flows to get available parking spaces

Each step is described as follows:

1) Vehicle detector 1F-A1-01 provisions its context information to the smart parking server.

   - The entity creation request (see clause 5.6.1 in ETSI GS CIM 009 [i.1]) includes the entity resource (see clause 5.2.4 in ETSI GS CIM 009 [i.1]):

```
{
  "id": "urn:ngsi-ld:VehicleDetector:1F:A1:1",
  "type": "VehicleDetector",
  "name": {
    "type": "Property",
    "value": "1F-A1-01"
  },
  "isDetected": {
    "type": "Property",
    "value": true,
    "observedAt": "2023-01-01T12:00:00Z"
  },
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Point",
      "coordinates": [127.16019783463986, 37.40378558266181]
    }
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/vehicle-detector.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) Smart parking server sends back the successful response.

3) Vehicle detector 1F-A2-02 provisions its context information to smart parking server.

   - The entity creation request (see clause 5.6.1 in ETSI GS CIM 009 [i.1]) includes the entity resource (see clause 5.2.4 in ETSI GS CIM 009 [i.1]):

```
{
  "id": "urn:ngsi-ld:VehicleDetector:1F:A2:2",
  "type": "VehicleDetector",
  "name": {
    "type": "Property",
    "value": "1F-A2-02"
  },
```

```
  "isDetected": {
    "type": "Property",
    "value": true,
    "observedAt": "2023-01-01T12:00:00Z"
  },
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Point",
      "coordinates": [127.16019783463986, 37.40378558266181]
    }
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/vehicle-detector.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

4) Smart parking server sends back the successful response.

5) Smart parking application subscribes for available parking spaces.

   - The subscription creation request (see clause 5.8.1 in ETSI GS CIM 009 [i.1]) includes the subscription resource (see clause 5.2.12 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "Subscription",
  "entities": [
    {
      "type": "VehicleDetector"
    }
  ],
  "watchedAttributes": ["name", "isDetected"],
  "q": "isDetected==false",
  "notification": {
    "attributes": ["name", "isDetected"],
    "endpoint": "http://smart-parking-application.app.smartphone"
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/vehicle-detector.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

6) Smart parking server creates subscription resource and responds with the successful response.

7) Vehicle detector 1F-A1-01 detects a vacancy for its parking space and updates vacancy information to smart parking server.

   - The partial attribute update request (see clause 5.6.4 in ETSI GS CIM 009 [i.1]) for the entity "urn:ngsi-ld:VehicleDetector:1F:A1:1" is as follows:

```
{
  "isDetected": false
}
```

8) Smart parking server updates the attributes for the entity resource and responds with the successful response.

9) Smart parking server checks if there is one or more subscription(s) match with the event in step 8, , then the server notifies to notification endpoint of the subscription.

   - There is one subscription that is created in the step 5, according to the notification behaviour (see clause 5.8.6 in ETSI GS CIM 009 [i.1]), smart parking server notifies to smart parking application with the following notification resource (see clause 5.3.1 in ETSI GS CIM 009 [i.1]):

```
{
  "id": "urn:ngsi-ld:Notification:1",
  "type": "Notification",
  "subscriptionId": "urn:ngsi-ld:Subscription:1",
  "notifiedAt": "2023-01-01T14:00:00Z",
  "data": [
    {
      "id": "urn:ngsi-ld:VehicleDetector:1F:A1:1",
      "type": "VehicleDetector",
```

```
      "name": {
        "type": "Property",
        "value": "1F-A1-01"
      },
      "isDetected": {
        "type": "Property",
        "value": false,
        "observedAt": "2023-01-01T14:00:00Z"
      },
      "@context": [
        "http://example.org/ngsi-ld/latest/vehicle-detector.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
      ]
    }
  ],
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```


6 Deployment scenario #2 - distributed architecture

6.1 Introduction

The clause 6 describes an NGSI-LD API-based interactions using the distributed architecture (see clause 4.3.3 in ETSI GS CIM 009 [i.1]).

6.2 NGSI-LD system configuration

Figure 6.2-1 shows an NGSI-LD system using the distributed architecture.

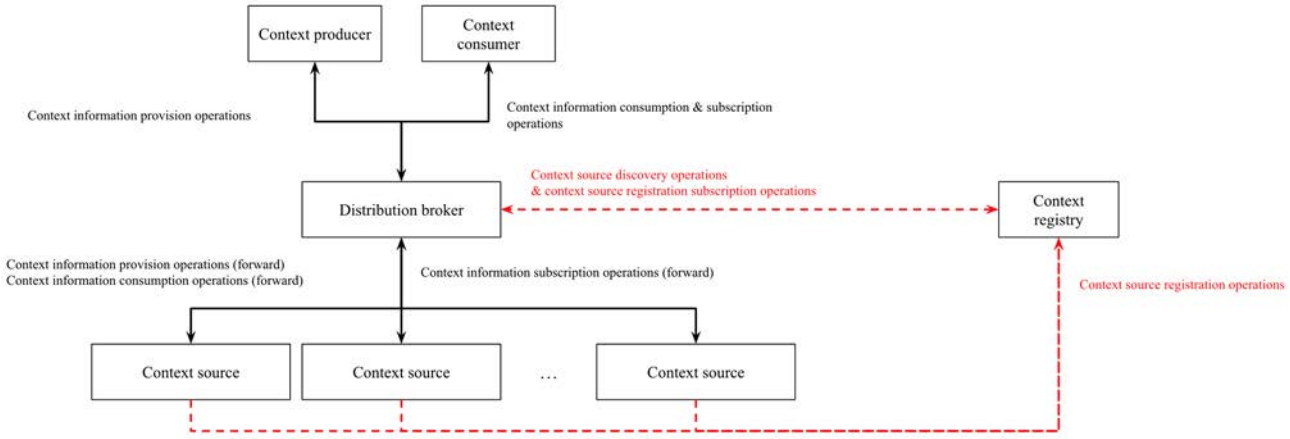

Figure 6.2-1: NGSI-LD system using the distributed architecture

The definition of the distribution broker, context producer, context consumer, context source, and context registry are specified in clause 3.1 of ETSI GS CIM 009 [i.1].

Context information provision operations are specified in clause 5.6 of ETSI GS CIM 009 [i.1].

Context information consumption operations are specified in clause 5.7 of ETSI GS CIM 009 [i.1].

Context information subscription operations are specified in clause 5.8 of ETSI GS CIM 009 [i.1].

Context source registration operations are specified in clause 5.9 of ETSI GS CIM 009 [i.1].

Context source discovery operations are specified in clause 5.10 of ETSI GS CIM 009 [i.1].

Context source registration subscription operations are specified in clause 5.11 of ETSI GS CIM 009 [i.1].

NOTE: In order to show interactions among context registry and others, the present document assumes that the context broker and context registry are running independently. The functionality of the context broker and context registry can be integrated. How to integrate context broker and context registry is outside the scope of the present document.

6.3 Deployment scenario example #1 - street light control using exclusive mode

6.3.1 Overview

A smart city management office in a metropolitan city has a smart city management platform that controls city infrastructures. In the city, a number of street lights are installed and connected to street light management platforms, managed by each vendor. The smart city management platform is interworking with street light management platforms of different vendors. Information of each street light management platform is contained in smart city management registry.

Now, a smart city management officer wants to turn on street lights within a specific area of the city using a smart city management application. The management application controls the status of street lights via the smart city management platform.

6.3.2 Service component mapping

Figure 6.3.2-1 shows a service component mapping to the NGSI-LD system configuration.

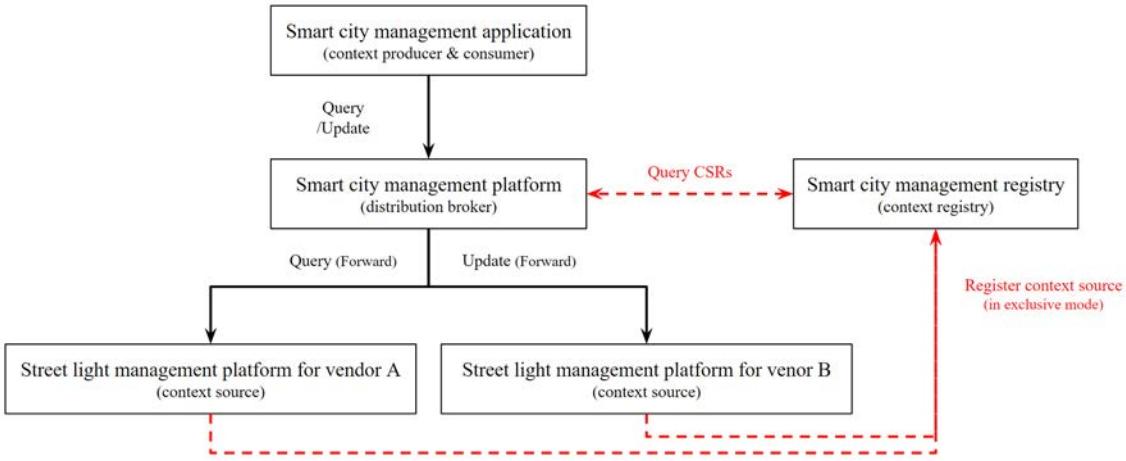

Figure 6.3.2-1: Service component mapping to the NGSI-LD system configuration

Table 6.3.2-1 shows an example data model of the entity *StreetLight*. How to manage *StreetLight* entities themselves in the street light management platform is beyond the scope of the present document. Each street light is mapped with the *StreetLight* entity and their context information is persisted in the street light management platform of a specific vendor.

Table 6.3.2-1: Example data model of entity *StreetLight*

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity ID of street light
type	String	It is equal to "http://example.org/ngsi-ld/StreetLight"	1	Entity type
status	Boolean		1	Property for on/off status of light: • false: the light is turned off • true: the light is turned on
vendorName	String		1	Property for the vendor name of street light
location	GeoJSON		0..1	Property for the installed location of light in a city

An instance of the entity *StreetLight* is described as follows:

```
{
  "id": "urn:ngsi-ld:StreetLight:VendorA:NewYork:Broadway:1",
  "type": "StreetLight",
  "status": {
    "type": "Property",
    "value": false,
    "observedAt": "2023-01-01T12:00:00Z"
  },
  "vendorName": {
    "type": "Property",
    "value": "A"
  },
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Point",
      "coordinates": [-73.990897, 40.734593]
    }
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/street-light.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

6.3.3 Scenarios

6.3.3.1 Street light management platform registration

Figure 6.3.3.1-1 shows communication flows to register street light management platforms.

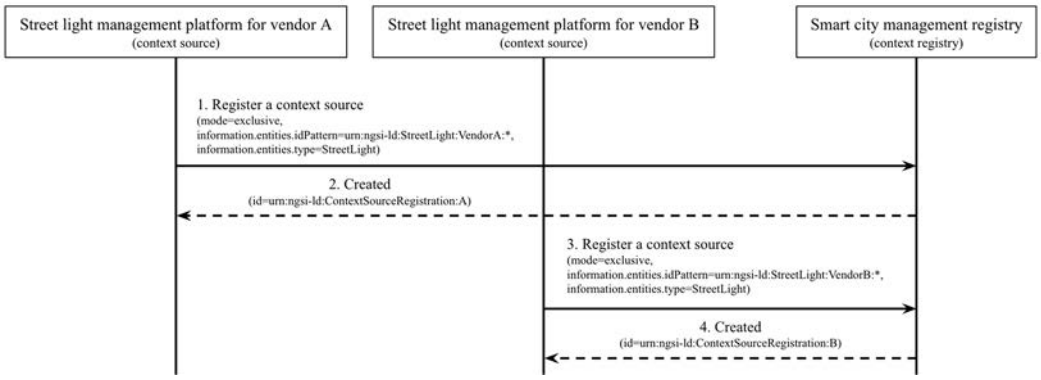

Figure 6.3.3.1-1: Communication flows to register street light management platforms

Each step is described as follows:

1) Street light management platform for vendor A registers to smart city management registry, as a context source:

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the following CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "idPattern": "urn:ngsi-ld:StreetLight:VendorA:*",
          "type": "StreetLight"
        }
      ],
      "propertyNames": ["status", "vendorName"]
    }
  ],
  "mode": "exclusive",
```

```
  "endpoint": "http://street-light-management-platform.a",
  "@context": [
    "http://example.org/ngsi-ld/latest/street-light.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) Smart city management registry creates CsourceRegistration resource and then responds with the registration ID:

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:A".

3) Street light management platform for vendor B registers to smart city management registry, as a context source:

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "idPattern": "urn:ngsi-ld:StreetLight:VendorB:*",
          "type": "StreetLight"
        }
      ],
      "propertyNames": ["status", "vendorName"]
    }
  ],
  "mode": "exclusive",
  "endpoint": "http://street-light-management-platform.b",
  "@context": [
    "http://example.org/ngsi-ld/latest/street-light.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

4) Smart city management registry creates CsourceRegistration resource and then responds with the registration ID:

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:B".

6.3.3.2 Street light information retrieval

NOTE: This scenario assumes that the NGSI-LD system already performed the procedures in clause 6.3.3.1. Thus, smart city management registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:A" and "urn:ngsi-ld:ContextSourceRegistration:B".

Figure 6.3.3.2-1 shows communication flows to retrieve street light information.

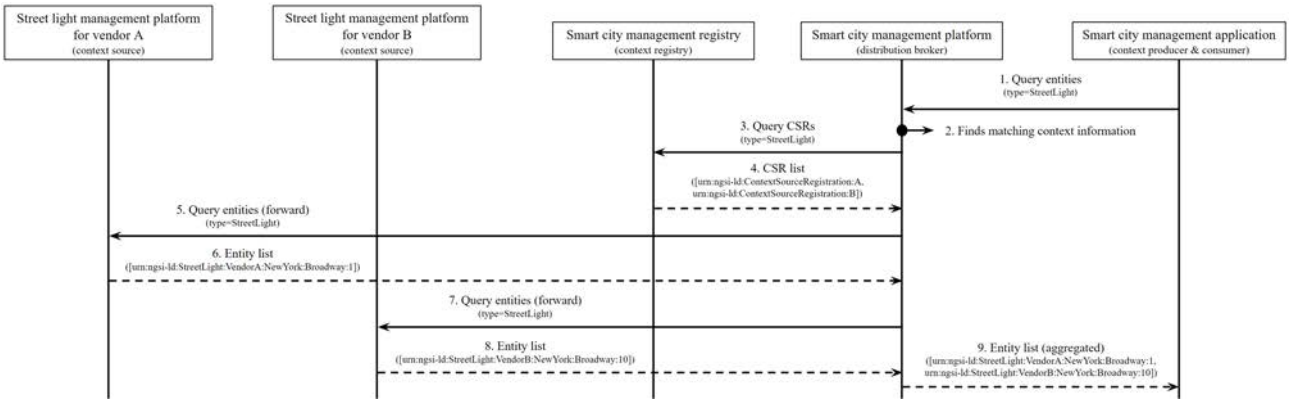

Figure 6.3.3.2-1: Communication flows to retrieve street light information

Each step is described as follows:

1) Smart city management application requests street light information to smart city management platform:

   - The request is querying entities (see clause 5.7.2 in ETSI GS CIM 009 [i.1]) with entity type *StreetLight*.

2) Smart city management platform finds matching context information locally, but there is no match.

3) Smart city management platform finds CSR information of the entity type *StreetLight* from smart city management registry:

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *StreetLight*.

4) Smart city management registry responds with a matching CSR list:

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:A",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "idPattern": "urn:ngsi-ld:StreetLight:VendorA:*",
            "type": "StreetLight"
          }
        ],
        "propertyNames": ["status", "vendorName"]
      }
    ],
    "mode": "exclusive",
    "endpoint": "http://street-light-management-platform.a",
    "@context": [
      "http://example.org/ngsi-ld/latest/street-light.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  },
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:B",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "idPattern": "urn:ngsi-ld:StreetLight:VendorB:*",
            "type": "StreetLight"
          }
        ],
        "propertyNames": ["status", "vendorName"]
      }
    ],
    "mode": "exclusive",
    "endpoint": "http://street-light-management-platform.b",
    "@context": [
      "http://example.org/ngsi-ld/latest/street-light.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

   - From this step, the smart city management platform knows the request need to be forwarded to smart light management platform for vendor A and vendor B.

5) Smart city management platform forwards the request to street light management platform for vendor A.

6) Street light management platform for vendor A responds with a matching entity list:

   - The matching entity list contains all entity information that is persisted in the street light management platform for vendor A.Smart city management platform forwards the request to street light management platform for vendor B.

7) Street light management platform for vendor B responds with a matching entity list:

   - The matching entity list contains all entity information that is persisted in the street light management platform for vendor B.

8) Smart city management platform aggregates responses from each street light management platform and responds to smart city management application with an aggregated entity list:

   - The aggregated entity list contains the following entities:


```
[
  {
    "id": "urn:ngsi-ld:StreetLight:VendorA:NewYork:Broadway:1",
    "type": "StreetLight",
    "status": {
      "type": "Property",
      "value": false,
      "observedAt": "2023-01-01T12:00:00Z"
    },
    "vendorName": {
      "type": "Property",
      "value": "A"
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/street-light.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  },
  {
    "id": "urn:ngsi-ld:StreetLight:VendorB:NewYork:Broadway:10",
    "type": "StreetLight",
    "status": {
      "type": "Property",
      "value": false,
      "observedAt": "2023-01-01T12:00:00Z"
    },
    "vendorName": {
      "type": "Property",
      "value": "B"
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/street-light.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```


6.3.3.3 Street light status control

NOTE 1: This scenario assumes that the NGSI-LD system already performed the procedures in clause 6.3.3.1. Thus, smart city management registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:A" and "urn:ngsi-ld:ContextSourceRegistration:B".

NOTE 2: This scenario also assumes that smart city management application knows two *StreetLight* entities "urn:ngsi-ld:StreetLight:VendorA:NewYork:Broadway:1" and "urn:ngsi-ld:StreetLight:VendorB:NewYork:Broadway:10".

NOTE 3: How to control actual street lights in street light management platform is outside the scope of the present document.

Figure 6.3.3.3-1 shows communication flows to turn on street lights.

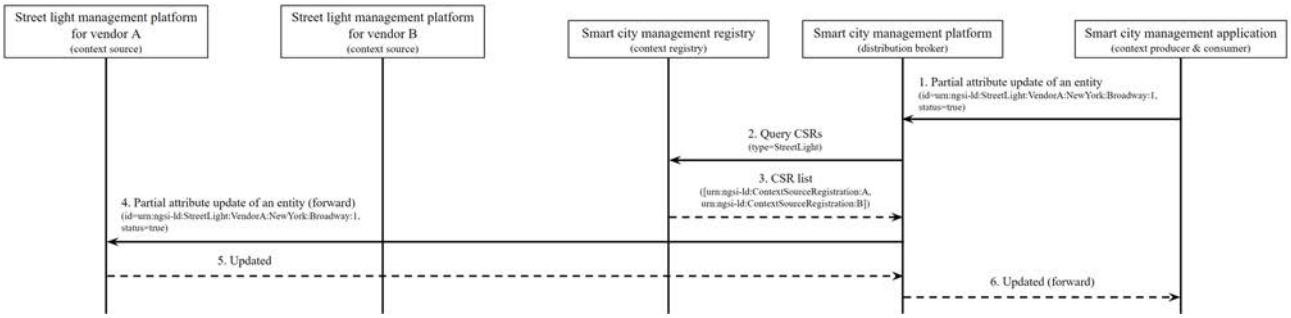

Figure 6.3.3.3-1: Communication flows to turn on street lights

Each step is described as follows:

1) Smart city management application requests smart city management platform to turn on the street light for the entity "urn:ngsi-ld:StreetLight:VendorA:NewYork:Broadway:1":

   - The partial attribute update request (see clause 5.6.4 in ETSI GS CIM 009 [i.1]) for the entity "urn:ngsi-ld:StreetLight:VendorA:NewYork:Broadway:1" is as follows:

```
{
  "status": {
    "type": "Property",
    "value": true,
    "observedAt": "2023-09-14T12:00:00Z"
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/street-light.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) Smart city management platform finds CSR information of the entity type *StreetLight* from smart city management registry:

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *StreetLight*.

3) Smart city management registry responds with a matching CSR list:

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:A",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "idPattern": "urn:ngsi-ld:StreetLight:VendorA:*",
            "type": "StreetLight"
          }
        ],
        "propertyNames": ["status", "vendorName"]
      }
    ],
    "mode": "exclusive",
    "endpoint": "http://street-light-management-platform.a",
    "@context": [
      "http://example.org/ngsi-ld/latest/street-light.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  },
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:B",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
```

```
            "idPattern": "urn:ngsi-ld:StreetLight:VendorB:*",
            "type": "StreetLight"
          }
        ],
        "propertyNames": ["status", "vendorName"]
      }
    ],
    "mode": "exclusive",
    "endpoint": "http://street-light-management-platform.b",
    "@context": [
      "http://example.org/ngsi-ld/latest/street-light.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

- From this step, the smart city management platform knows the request need to be forwarded to the smart light management platform for vendor A.

4) Smart city management platform forwards the partial attribute update request to street light management platform for vendor A.

5) Street light management platform for vendor A turns on the specified street light and responds with the successful response to smart city management platform.

6) Smart city management platform forwards the successful response to smart city management application.

6.4 Deployment scenario example #2 - national power line using inclusive mode

6.4.1 Overview

A country has a national power line platform that manages national power usage and availability. In the platform, power lines are grouped by geographical regions.

A regional power line company has a power line platform that manages specific power lines in the geographical region.

Now, an administrator of a national power line company wants to know the power line status and statistics of each region.

6.4.2 Service component mapping

Figure 6.4.2-1 shows a service component mapping to the NGSI-LD system.

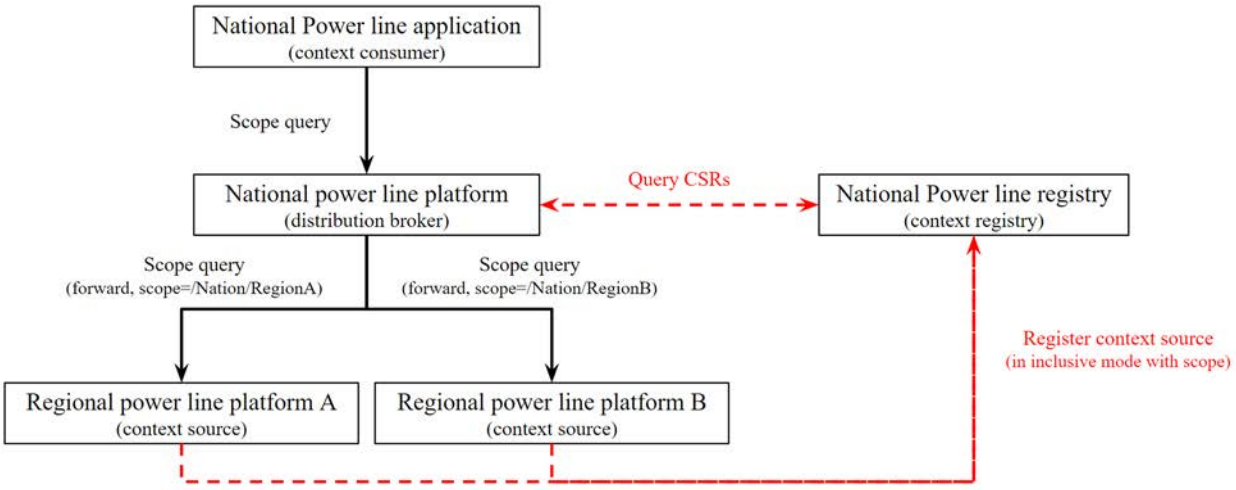

Figure 6.4.2-1: Service component mapping to the NGSI-LD system

Table 6.4.2-1 shows an example data model of the entity *PowerLine*. How to manage PowerLine entities in regional power line companies is beyond the scope of the present document. Each power line is mapped with *PowerLine* entity and their context information is persisted in a regional power line platforms.

Table 6.4.2-1: Example data model of entity *PowerLine*

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity ID of power line
type	String	It is equal to "http://example.org/ngsi-ld/PowerLine"	1	Entity type
usage	Float		1	Property for power line usage in kW
availability	Float		1	Property for power line availability in kW

An instance of the entity *PowerLine* is described as follows:

```
{
  "id": "urn:ngsi-ld:PowerLine:RegionA:Area1:1",
  "type": "PowerLine",
  "usage": {
    "type": "Property",
    "value": 300.6,
    "observedAt": "2023-01-01T12:00:00Z"
  },
  "availability": {
    "type": "Property",
    "value": 120.9,
    "observedAt": "2023-01-01T12:00:00Z"
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/power-line.jsonld",
    "http://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

6.4.3 Scenarios

6.4.3.1 Regional power line platform registration

Figure 6.4.3.1-1 shows communication flows to register regional power line platforms.

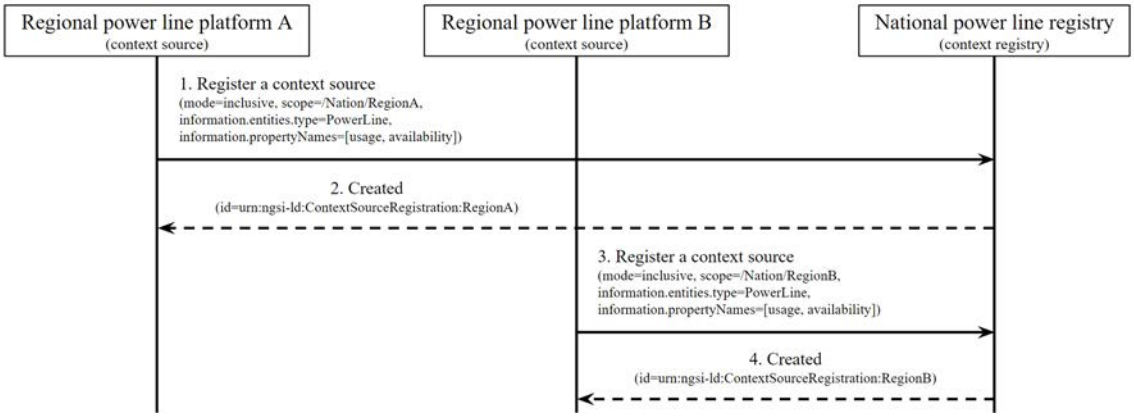

Figure 6.4.3.1-1: Communication flows to register regional power line platforms

Each step is described as follows:

1) Regional power line platform A registers to national power line registry with the scope "/Nation/RegionA", as a context source:

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the following CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "type": "PowerLine"
        }
      ],
      "propertyNames": ["usage", "availability"]
    }
  ],
  "scope": "/Nation/RegionA",
  "mode": "inclusive",
  "endpoint": "http://regional-power-line-platform.region-a.nation",
  "@context": [
    "http://example.org/ngsi-ld/latest/power-line.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) National power line registry creates CsourceRegistration resource and then responds with the registration ID:

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:A".

3) Regional power line platform B registers to national power line registry with the scope "/Nation/RegionB", as a context source:

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the following CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "type": "PowerLine"
        }
      ],
      "propertyNames": ["usage", "availability"]
    }
  ],
  "scope": "/Nation/RegionB"
  "mode": "inclusive",
  "endpoint": "http://regional-power-line-platform.region-b.nation",
  "@context": [
    "http://example.org/ngsi-ld/latest/power-line.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

4) National power line registry creates CsourceRegistration resource and then responds with the registration ID:

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:B".

6.4.3.2 Power line status retrieval

NOTE: This scenario assumes that the NGSI-LD system for this example already performed the procedures in clause 6.4.3.1. Thus, national power line registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:A" and "urn:ngsi-ld:ContextSourceRegistration:B".

Figure 6.4.3.2-1 shows communication flows to retrieve power line status.

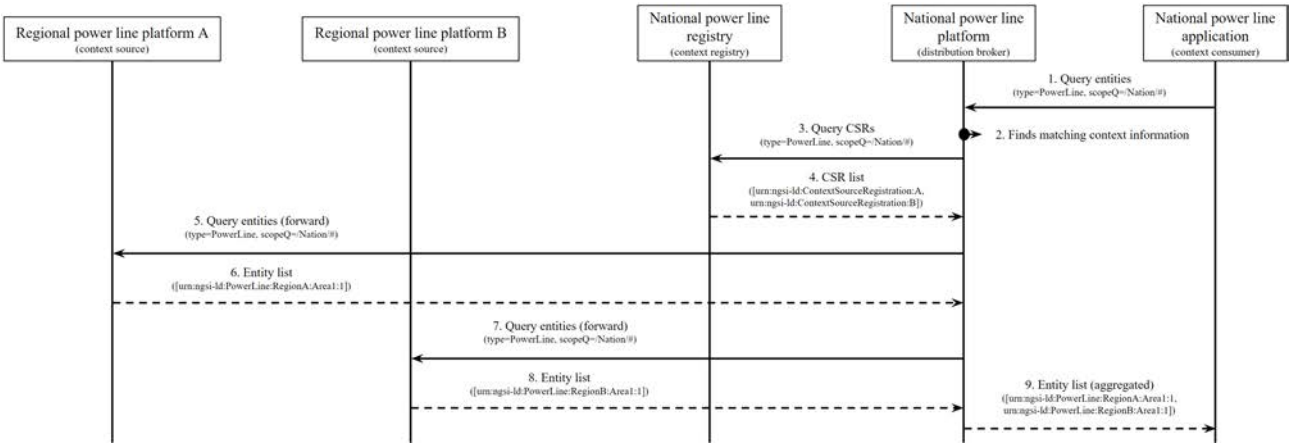

Figure 6.4.3.2-1: Communication flows to retrieve power line status

Each step is described as follows:

1) National power line application requests information on every power line status to national power line platform.

   - This request is querying entities (see clause 5.7.2 in ETSI GS CIM 009 [i.1]) with entity type *PowerLine* and scope "/Nation/#". The # means all regions (see clause 4.19 in ETSI GS CIM 009 [i.1]).

2) National power line platform finds matching context information locally, but there is no match.

3) National power line platform finds CSR information of entity type *PowerLine* from national power line registry.

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *PowerLine*.

4) National power line registry responds with a matching CSR list.

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:A",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "type": "PowerLine"
          }
        ],
        "propertyNames": ["usage", "availability"]
      }
    ],
    "scope": "/Nation/RegionA"
    "mode": "inclusive",
    "endpoint": "http://regional-power-line-platform.region-a.nation",
    "@context": [
      "http://example.org/ngsi-ld/latest/power-line.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  },
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:B",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "type": "PowerLine"
          }
        ],
        "propertyNames": ["usage", "availability"]
```

```
        }
      ],
      "scope": "/Nation/RegionB"
      "mode": "inclusive",
      "endpoint": "http://regional-power-line-platform.region-b.nation",
      "@context": [
        "http://example.org/ngsi-ld/latest/power-line.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
      ]
    }
  ]
```

- From this step, national power line platform knows the request needs to be forwarded to regional power line platform A and B.

5) National power line platform forwards the request to regional power line platform A.

6) Regional power line platform A responds with a matching entity list.

   - The matching entity list contains all entity information that is persisted in the regional power line platform A.

7) National power line platform forwards the request to regional power line platform B.

8) Regional power line platform B responds with a matching entity list.

   - The matching entity list contains all entity information that is persisted in the regional power line platform B.

9) National power line platform aggregates responses from each regional power line platform and responds to national power line application with an aggregated entity list.

   - The aggregated entity list contains the following entities:

```
[
  {
    "id": "urn:ngsi-ld:PowerLine:RegionA:Area1:1",
    "type": "PowerLine",
    "usage": {
      "type": "Property",
      "value": 300.6,
      "observedAt": "2023-01-01T12:00:00Z"
    },
    "availability": {
      "type": "Property",
      "value": 120.9,
      "observedAt": "2023-01-01T12:00:00Z"
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/power-line.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  },
  {
    "id": "urn:ngsi-ld:PowerLine:RegionB:Area1:1",
    "type": "PowerLine",
    "usage": {
      "type": "Property",
      "value": 10781.0,
      "observedAt": "2023-01-01T12:00:00Z"
    },
    "availability": {
      "type": "Property",
      "value": 972.3,
      "observedAt": "2023-01-01T12:00:00Z"
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/power-line.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

6.4.3.3 Power line statistics retrieval

NOTE: This scenario assumes that the NGSI-LD system for this example already performed the procedures in clause 6.4.3.1. Thus, national power line registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:A" and "urn:ngsi-ld:ContextSourceRegistration:B".

Figure 6.4.3.3-1 shows communication flows to retrieve hourly power line statistics.

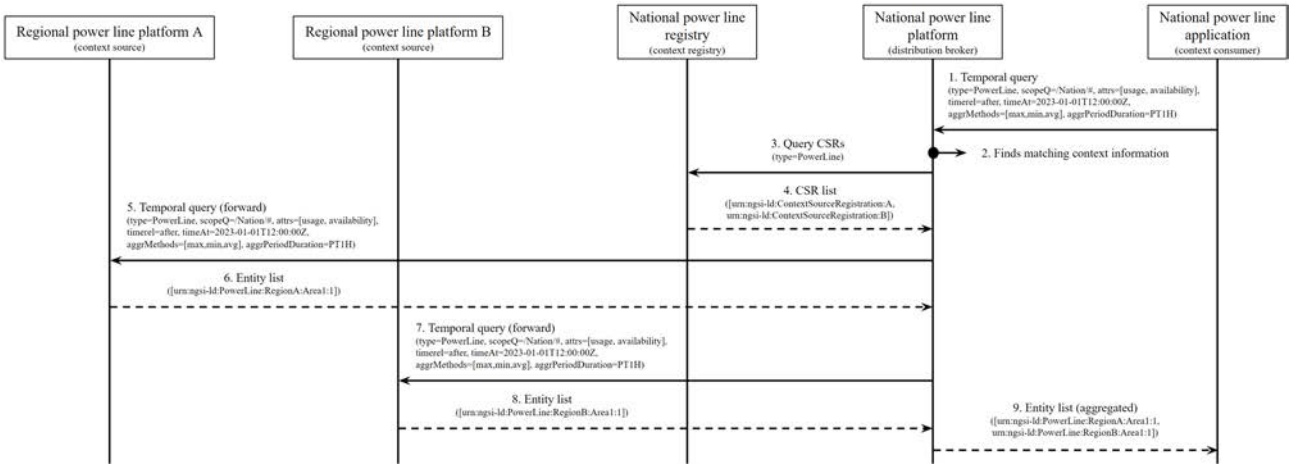

Figure 6.4.3.3-1: Communication flows to retrieve hourly power line statistics

Each step is described as follows:

1) National power line application requests hourly statistics for every regional power line to national power line platform.

   - This temporal query of entities request (see clause 5.7.4 in ETSI GS CIM 009 [i.1]) includes the following:

     - Entity type: *PowerLine*;
     - Scope (see clause 4.19 in ETSI GS CIM 009 [i.1]): /Nation/#;
     - Attributes: usage and availability;
     - Timing (see clause 4.11 in ETSI GS CIM 009 [i.1]): since 2023-01-01T12:00:00Z;
     - Aggregation methods (see clause 4.5.19 in ETSI GS CIM 009 [i.1]): max, min, and average;
     - Aggregation periods (see clause 4.5.19 also): every hours.

2) National power line platform finds matching context information locally, but there is no match.

3) National power line platform finds CSR information of entity type *PowerLine* from national power line registry.

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *PowerLine*.

4) National power line registry responds with a matching CSR list.

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:A",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "type": "PowerLine"
```

```
            }
          ],
          "propertyNames": ["usage", "availability"]
        }
      ],
      "scope": "/Nation/RegionA"
      "mode": "inclusive",
      "endpoint": "http://regional-power-line-platform.region-a.nation",
      "@context": [
        "http://example.org/ngsi-ld/latest/power-line.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
      ]
    },
    {
      "id": "urn:ngsi-ld:ContextSourceRegistration:B",
      "type": "ContextSourceRegistration",
      "information": [
        {
          "entities": [
            {
              "type": "PowerLine"
            }
          ],
          "propertyNames": ["usage", "availability"]
        }
      ],
      "scope": "/Nation/RegionB"
      "mode": "inclusive",
      "endpoint": "http://regional-power-line-platform.region-b.nation",
      "@context": [
        "http://example.org/ngsi-ld/latest/power-line.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
      ]
    }
  ]
```

- From this step, the national power line platform knows the request needs to be forwarded to regional power line platforms A and B.

5) National power line platform forwards the temporal query to regional power line platform A.

6) Regional power line platform A responds with a matching entity list with statistics information.

   - The matching entity list contains all entity information that is persisted in the regional power line platform A.

   - For usage and availability attributes in each entity, the aggregation methods (max, min, average) and aggregation periods (every hours) are applied to the matching entity list.

7) National power line platform forwards the temporal query to regional power line platform B.

8) Regional power line platform B responds with an matching entity list with statistics information.

   - The matching entity list contains all entity information that is persisted in the regional power line platform B.

   - For usage and availability attributes in each entity, the aggregation methods (max, min, average) and aggregation periods (every hour) are applied to the matching entity list.

9) National power line platform aggregates responses from each regional power line platform and responds to national power line application with an aggregated entity list.

   - The aggregated entity list contains the following entities:

```
[
  {
    "id": "urn:ngsi-ld:PowerLine:RegionA:Area1:1",
    "type": "PowerLine",
    "usage": {
      "type": "Property",
      "max": [
        [300.6, "2023-01-01T12:00:00Z"]
      ],
      "avg": [
```

```
          [300.6, "2023-01-01T12:00:00Z"]
        ],
        "min": [
          [300.6, "2023-01-01T12:00:00Z"]
        ]
      },
      "availability": {
        "type": "Property",
        "max": [
          [120.9, "2023-01-01T12:00:00Z"]
        ],
        "avg": [
          [120.9, "2023-01-01T12:00:00Z"]
        ],
        "min": [
          [120.9, "2023-01-01T12:00:00Z"]
        ]
      },
      "@context": [
        "http://example.org/ngsi-ld/latest/power-line.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld/core-context-v1.7.jsonld"
      ]
    },
    {
      "id": "urn:ngsi-ld:PowerLine:RegionB:Area1:1",
      "type": "PowerLine",
      "usage": {
        "type": "Property",
        "max": [
          [10781.0, "2023-01-01T12:00:00Z"]
        ],
        "avg": [
          [10781.0, "2023-01-01T12:00:00Z"]
        ],
        "min": [
          [10781.0, "2023-01-01T12:00:00Z"]
        ]
      },
      "availability": {
        "type": "Property",
        "max": [
          [972.3, "2023-01-01T12:00:00Z"]
        ],
        "avg": [
          [972.3, "2023-01-01T12:00:00Z"]
        ],
        "min": [
          [972.3, "2023-01-01T12:00:00Z"]
        ]
      },
      "@context": [
        "http://example.org/ngsi-ld/latest/power-line.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld/core-context-v1.7.jsonld"
      ]
    }
  ]
```


6.5 Deployment scenario example #3 - national disaster warning using redirect mode

6.5.1 Overview

A country has a national disaster warning platform that detects disaster events and forwards them to warning systems. The platform receives any type of disaster event from disaster detection systems and forwards it to the relevant warning system that supports such disaster types. When a warning system receives a disaster event, it notifies the event people about disaster type and severity.

Now, an earthquake detection system has detected an earthquake event and notifies the national disaster warning platform.

6.5.2 Service component mapping

Figure 6.5.2-1 shows a service component mapping to the NGSI-LD system.

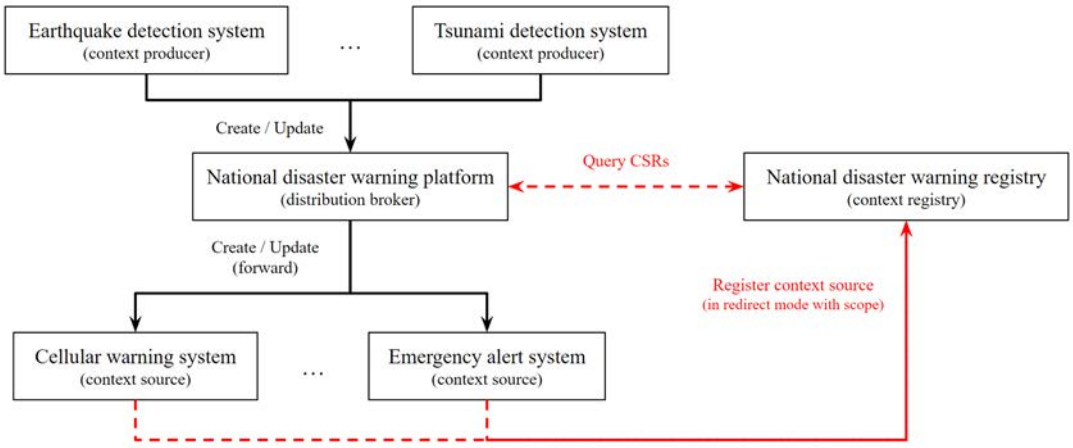

Figure 6.5.2-1: Service component mapping to the NGSI-LD system

Table 6.5.2-1 shows an example data model of the entity *EarthquakeEvent*. How to manage *EarthquakeEvent* entities in the cellular warning and emergency alert systems is beyond the scope of the present document. Each disaster detection system can create *EarthquakeEvent* entity for the national disaster warning platform and the actual context information is persisted in each warning system.

Table 6.5.2-1: Example data model for *EarthquakeEvent*

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity ID of disaster event
type	String	It is equal to "http://example.org/ngsi-ld/EarthquakeEvent"	1	Entity type
magnitude	Float		1	Property for the severity of earthquake
location	GeoJSON		0..1	Property for the location of earthquake

An instance of the entity *EarthquakeEvent* is described as follows:

```
{
  "id": "urn:ngsi-ld:EarthquakeEvent:region1:seismometer_001",
  "type": "EarthquakeEvent",
  "magnitude": {
    "type": "Property",
    "value": 4.0,
    "observedAt": "2023-09-11T11:13:00Z"
  },
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Point",
      "coordinates": [-73.990, 40.734]
    }
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

6.5.3 Scenarios

6.5.3.1 Warning system registration

Figure 6.5.3.1-1 shows communication flows to register warning systems.

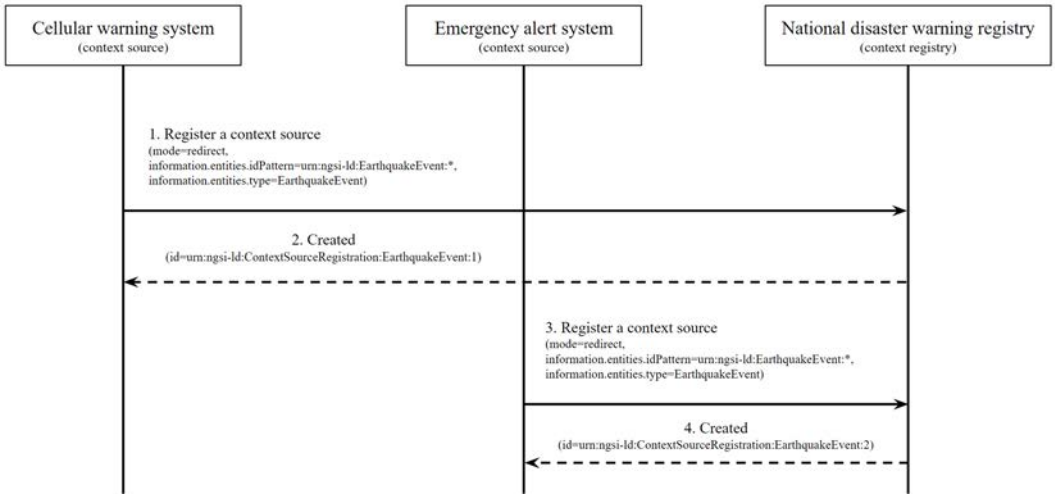

Figure 6.5.3.1-1: Communication flows to register warning systems

Each step is described as follows:

1) Cellular warning system registers to national disaster warning registry as a context source.

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "idPattern": "urn:ngsi-ld:EarthquakeEvent:*",
          "type": "EarthquakeEvent"
        }
      ]
    }
  ],
  "mode": "redirect",
  "endpoint": "http://cellular-warning-platform",
  "@context": [
    "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) National disaster warning registry creates CsourceRegistration resource and then responds with the registration ID.

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:1".

3) Emergency alert system registers to national disaster warning registry as a context source.

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
```

```
            "idPattern": "urn:ngsi-ld:EarthquakeEvent:*",
            "type": "EarthquakeEvent"
          }
        ]
      }
    ],
    "mode": "redirect",
    "endpoint": "http://emergency-alert-platform",
    "@context": [
      "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
```

4) National disaster warning registry creates CsourceRegistration resource and then responds with the registration ID.

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:2".

6.5.3.2 Disaster event trigger

NOTE: This scenario assumes that the NGSI-LD system for this example already performed the procedures in clause 6.5.3.1. Thus, national disaster warning registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:1" and "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:2".

Figure 6.5.3.2-1 shows communication flows to trigger a disaster event.

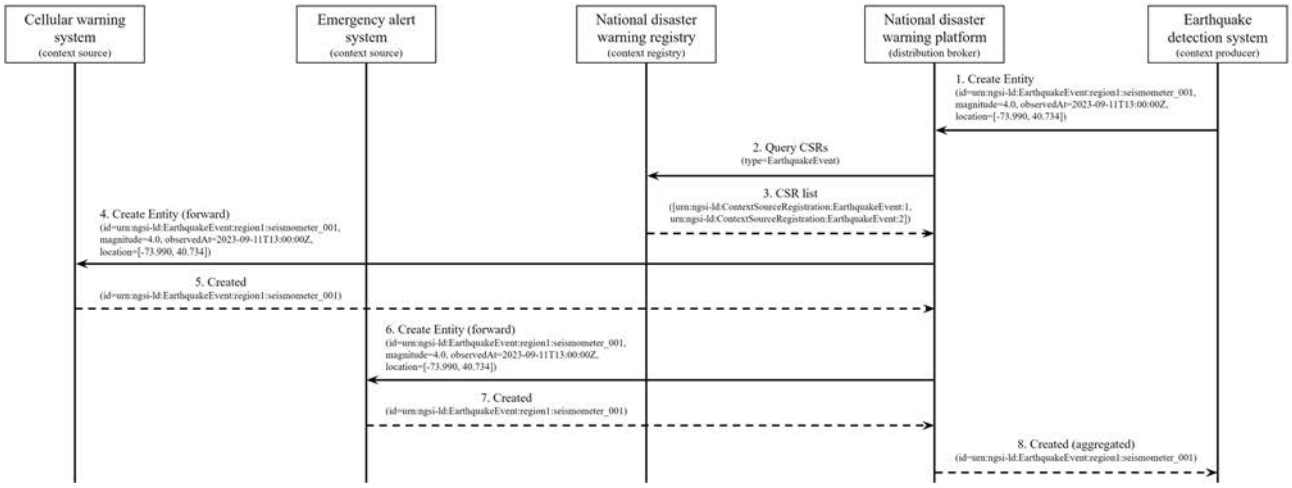

Figure 6.5.3.2-1: Communication flows to trigger disaster event

Each step is described as follows:

1) Earthquake detection system requests national disaster warning platform to create *EarthquakeEvent* entity of "urn:ngsi-ld:EarthquakeEvent:region1:seismometer_001".

   - The entity creation request (see clause 5.6.1 in ETSI GS CIM 009 [i.1]) includes the entity resource (see clause 5.2.4 in ETSI GS CIM 009 [i.1]):

```
{
  "id": "urn:ngsi-ld:EarthquakeEvent:region1:seismometer_001",
  "type": "EarthquakeEvent",
  "magnitude": {
    "type": "Property",
    "value": 4.0,
    "observedAt": "2023-09-11T11:13:00Z"
  },
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Point",
      "coordinates": [-73.990, 40.734]
```

```
      }
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
```

2) National disaster warning platform finds CSR information of entity type *EarthquakeEvent* from national disaster warning registry.

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *EarthquakeEvent*.

3) National disaster warning registry responds with a matching CSR list.

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:1",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "idPattern": "urn:ngsi-ld:EarthquakeEvent:*",
            "type": "EarthquakeEvent"
          }
        ]
      }
    ],
    "mode": "redirect",
    "endpoint": "http://cellular-warning-platform",
    "@context": [
      "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  },
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:2",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "idPattern": "urn:ngsi-ld:EarthquakeEvent:*",
            "type": "EarthquakeEvent"
          }
        ],
      }
    ],
    "mode": "redirect",
    "endpoint": "http://emergency-alert-platform",
    "@context": [
      "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

   - From this step, the national disaster warning platform knows the request needs to be forwarded to the cellular warning system and emergency alert system.

4) National disaster warning platform forwards the create entity request to cellular warning system.

5) Cellular warning system creates context information locally and responds successful response to national disaster warning platform.

6) National disaster warning platform forwards the create entity request to emergency alert system.

7) Emergency alert system creates context information locally and responds with the successful response to national disaster warning platform.

8) National disaster warning platform responds with the successful response to earthquake detection system.

6.5.3.3 Disaster event update

NOTE 1: This scenario assumes that the NGSI-LD system for this example already performed the procedures in clause 6.5.3.1. Thus, national disaster warning registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:1" and "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:2".

NOTE 2: This scenario also assumes that both cellular warning system and emergency alert system have context information of the entity "urn:ngsi-ld:EarthquakeEvent:region1:seismometer_001".

Figure 6.5.3.3-1 shows communication flows to update disaster events.

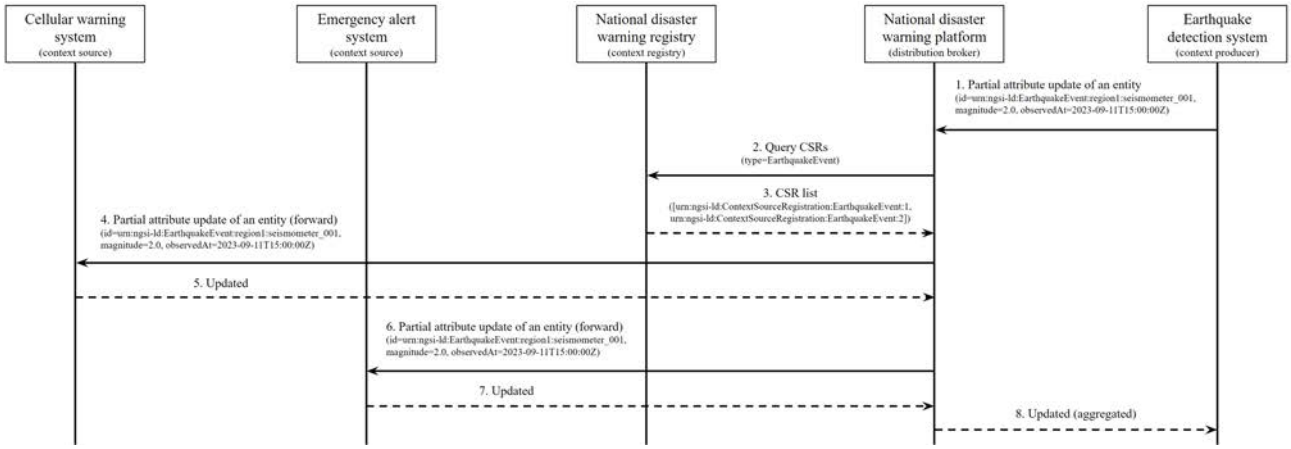

Figure 6.5.3.3-1: Communication flows to update disaster events

Each step is described as follows:

1) Earthquake detection system requests national disaster warning platform to update context information with recent measurements. The context information is the entity of "urn:ngsi-ld:EarthquakeEvent:region1:seismometer_001".

   - The partial attribute update request (see clause 5.6.4 in ETSI GS CIM 009 [i.1]) for the entity "urn:ngsi-ld:EarthquakeEvent:region1:seismometer_001" is as follows:

```
{
  "magnitude": {
    "Type": "Property",
    "value": 2.0,
    "observedAt": "2023-09-11T15:00:00Z"
  },
  "@context": [
    "http://example.org/ngsi-ld/disaster-event.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) National disaster warning platform finds CSR information of entity type *EarthquakeEvent* from national disaster warning registry.

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *EarthquakeEvent*.

3) National disaster warning registry responds with a matching CSR list.

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:1",
    "type": "ContextSourceRegistration",
    "information": [
```

```
        {
          "entities": [
            {
              "idPattern": "urn:ngsi-ld:EarthquakeEvent:*",
              "type": "EarthquakeEvent"
            }
          ]
        }
      ],
      "mode": "redirect",
      "endpoint": "http://cellular-warning-platform",
      "@context": [
        "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
      ]
    },
    {
      "id": "urn:ngsi-ld:ContextSourceRegistration:EarthquakeEvent:2",
      "type": "ContextSourceRegistration",
      "information": [
        {
          "entities": [
            {
              "idPattern": "urn:ngsi-ld:EarthquakeEvent:*",
              "type": "EarthquakeEvent"
            }
          ],
        }
      ],
      "mode": "redirect",
      "endpoint": "http://emergency-alert-platform",
      "@context": [
        "http://example.org/ngsi-ld/latest/disaster-event.jsonld",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
      ]
    }
  ]
```


- National disaster warning platform compares received CSR information with its local repository.
- From this step, the national disaster warning platform knows the request needs to be forwarded to the cellular warning system and emergency alert system.

4) National disaster warning platform forwards the partial attribute update request to cellular warning system.

5) Cellular warning system updates its context information and responds with the successful response to national disaster warning platform.

6) National disaster warning platform forwards the partial attribute update request to emergency alert system.

7) Emergency alert system updates its context information and responds with the successful response to national disaster warning platform.

8) National disaster warning platform responds with the successful response to earthquake detection system.

6.6 Deployment scenario example #4 - Off-street parking using auxiliary mode

6.6.1 Overview

A parking company operates a off-street parking management platform that manages multiple off-street parking areas. Every off-street parking area has a dedicated parking agent that updates information for its parking availability. The parking management platform receives overall information for parking availability from parking agents.

6.6.2 Service component mapping

Figure 6.6.2-1 shows a service component mapping to the NGSI-LD system.

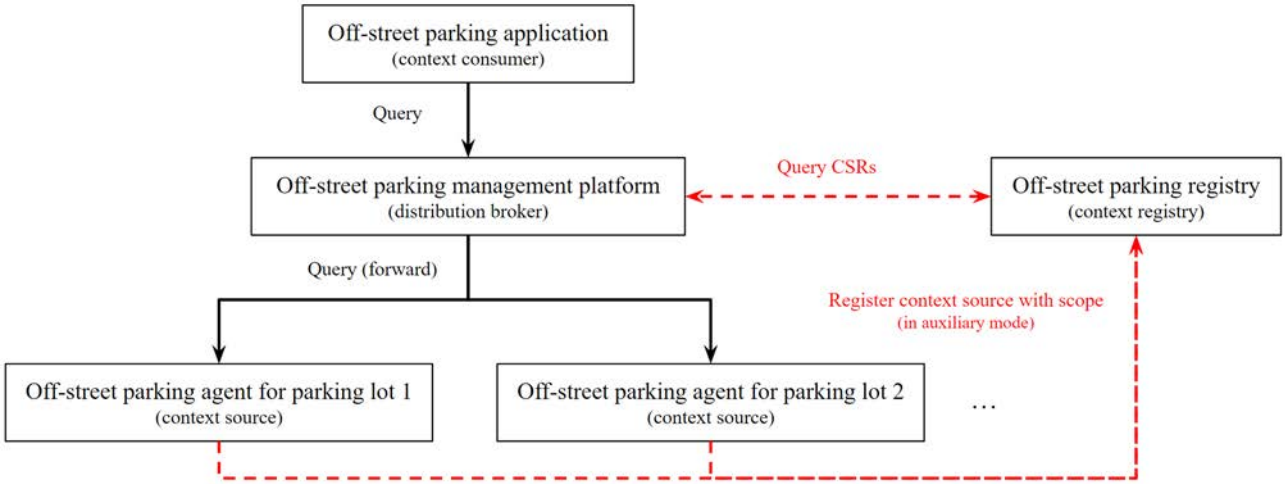

Figure 6.6.2-1: Service component mapping to the NGSI-LD system

Table 6.6.2-1 shows an example data model of the entity *OffStreetParking* (see clause C.2.3 in ETSI GS CIM 009 [i.1]). Off-street parking management platform has entity fragments (metadata of off-street parking lot) with name, location, totalSpotNumber attributes. Also, Off-street parking agent has remaining entity fragments (parking availability data) with availableSpotNumber attribute.

Table 6.6.2-1: Example data model for OffStreetParking

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity ID of off-street parking spot
type	String	It is equal to "http://example.org/ngsi-ld/OffStreetParking"	1	Entity type
name	String		1	Property for the name of the parking spot
availableSpotNumber	Integer		1	Property for the number of available parking spots
totalSpotNumber	Integer		1	Property for the number of total parking spot
location	GeoJSON		1	Property for the location of the parking spot

An instance of the entity *OffStreetParking* is described as follows:

```
{
  "id": "urn:ngsi-ld:OffStreetParking:ParkingLot:1",
  "type": "OffStreetParking",
  "name": {
    "type": "Property",
    "value": "Parking Lot 1"
  },
  "availableSpotNumber": {
    "type": "Property",
    "value": 10,
    "observedAt": "2024-01-01T12:00:00Z"
  },
  "totalSpotNumber": {
    "type": "Property",
    "value": 20
  },
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Polygon",
      "coordinates": [
        [
          [
            127.15866428212041,
            37.403833530626045
          ],
```

```
            [
              127.15866428212041,
              37.403450544406454
            ],
            [
              127.15976450944504,
              37.403450544406454
            ],
            [
              127.15976450944504,
              37.403833530626045
            ],
            [
              127.15866428212041,
              37.403833530626045
            ]
          ]
        ]
      }
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/parking.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
}
```

6.6.3 Scenarios

6.6.3.1 Off-street parking agent registration

Figure 6.6.3.1-1 shows communication flows to register off-street parking agents.

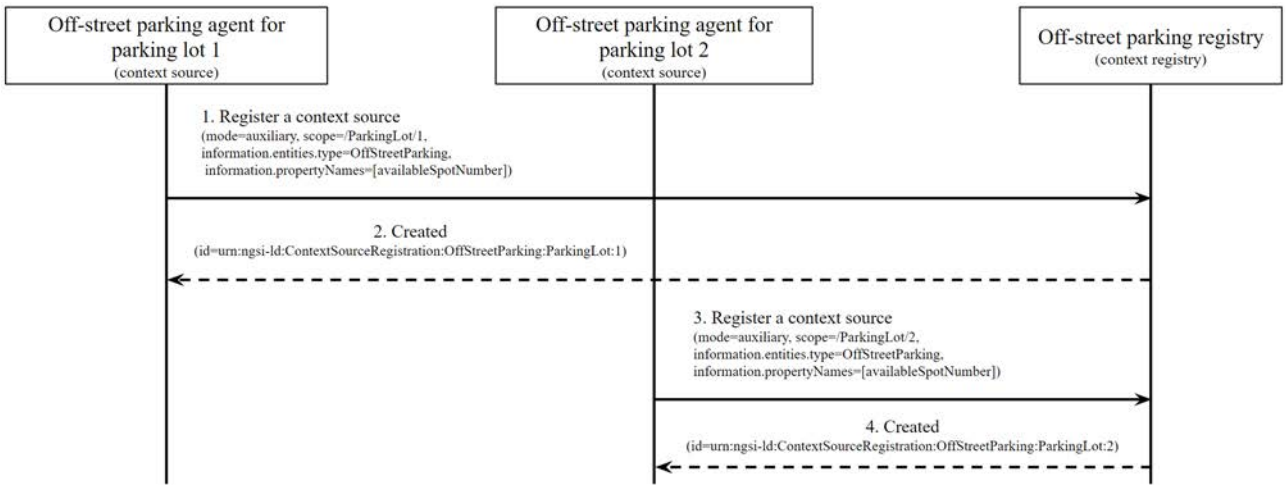

Figure 6.6.3.1-1: Communication flows to register off-street parking agents

Each step is described as follows:

1) Off-street parking agent for parking lot 1 registers to off-street parking registry as a context source.

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the following CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "type": "OffStreetParking"
        }
      ],
      "propertyNames": ["availableSpotNumber"]
    }
  ],
```

```
  "scope": "/ParkingLot/1",
  "mode": "auxiliary",
  "endpoint": "http://agent.1.site.offstreetparking",
  "@context": [
    "http://example.org/ngsi-ld/latest/parking.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) Off-street parking registry creates CsourceRegistration resource and then responds with the registration ID.

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:OffStreetParking:ParkingLot:1".

3) Off-street parking agent for parking lot 2 registers to off-street parking registry as a context source.

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the following CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "type": "OffStreetParking"
        }
      ],
      "propertyNames": ["availableSpotNumber"]
    }
  ],
  "scope": "/ParkingLot/2",
  "mode": "auxiliary",
  "endpoint": "http://agent.2.site.offstreetparking",
  "@context": [
    "http://example.org/ngsi-ld/latest/parking.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

4) Off-street parking registry creates CsourceRegistration resource and then responds with the registration ID.

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:OffStreetParking:ParkingLot:2".

6.6.3.2 information retrieval of off-street parking lot

NOTE: This scenario assumes that the NGSI-LD system for this example already performed the procedures in clause 6.6.3.1. Thus, off-street parking registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:OffStreetParking:ParkingLot:1" and "urn:ngsi-ld:ContextSourceRegistration:OffStreetParking:ParkingLot:2".

Figure 6.6.3.2-1 shows communication flows to retrieve information of off-street parking lot.

Figure 6.6.3.2-1: Communication flows to retrieve information of off-street parking lot

Each step is described as follows:

1) Off-street parking application makes a request to retrieve information about off-street parking lot 1 to off-street parking management platform.

   - The request is querying entities (see clause 5.7.2 in ETSI GS CIM 009 [i.1]) with entity type *OffStreetParking* and scope "/ParkingLot/1".

2) Off-street parking management platform finds matching context information locally.

   - Off-street parking management platform has entity fragments (metadata of off-street parking lot) with type *OffStreetParking*.

3) Off-street parking management platform finds CSR information of the entity type *OffStreetParking* with scope "/ParkingLot/1" from off-street parking registry.

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *OffStreetParking* and scope "/ParkingLot/1".

4) Off-street parking registry responds with a matching CSR list.

   - The CSR list has the following information:

```
[
  {
    "id": "urn-ngsi-ld:ContextSourceRegistration:OffStreetParking:ParkingLot:1",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "type": "OffStreetParking"
          }
        ],
        "propertyNames": ["availableSpotNumber"]
      }
    ],
    "scope": "/ParkingLot/1",
    "mode": "auxiliary",
    "endpoint": "http://agent.1.parking-lot.off-street-parking",
    "@context": [
      "http://example.org/ngsi-ld/latest/parking.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

   - From this step, the off-street parking management platform knows the request needs to be forwarded to the off-street parking agent for parking lot 1.

5) Off-street parking management platform forwards the request to off-street parking agent for parking lot 1.

6) Off-street parking agent for parking lot 1 responds with a matching entity list.

   - The matching entity list has entity fragment of the entity "urn:ngsi-ld:OffStreetParking:ParkingLot:1" with "availableSpotNumber" attribute.

7) Off-street parking platform receives the response from off-street parking agent for parking lot 1, merges entities, and responds to off-street parking application.

   - The off-street parking management platform knows the matching entity list from off-street parking agent for parking lot 1 is bound to auxiliary mode. Thus, the merge operation is performed as specified by the clause 5.7.2 in ETSI GS CIM 009 [i.1].

   - The resulting entity list has the following context information:

```
[
  {
    "id": "urn:ngsi-ld:OffStreetParking:ParkingLot:1",
    "type": "OffStreetParking",
    "name": {
```

```
      "type": "Property",
      "value": "Parking Lot 1"
    },
    "availableSpotNumber": {
      "type": "Property",
      "value": 10,
      "observedAt": "2024-01-01T12:00:00Z"
    },
    "totalSpotNumber": {
      "type": "Property",
      "value": 20
    },
    "location": {
      "type": "GeoProperty",
      "value": {
        "type": "Polygon",
        "coordinates": [
          [
            [
              127.15866428212041,
              37.403833530626045
            ],
            [
              127.15866428212041,
              37.403450544406454
            ],
            [
              127.15976450944504,
              37.403450544406454
            ],
            [
              127.15976450944504,
              37.403833530626045
            ],
            [
              127.15866428212041,
              37.403833530626045
            ]
          ]
        ]
      }
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/parking.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```


7 Deployment Scenario #3 - Federated Architecture

7.1 Introduction

The clause 7 describes an NGSI-LD API based interactions using the federated architecture (see clause 4.3.4 in ETSI GS CIM 009 [i.1]).

7.2 Architectural Configuration

Figure 7.2-1 shows an NGSI-LD system using the federated architecture.

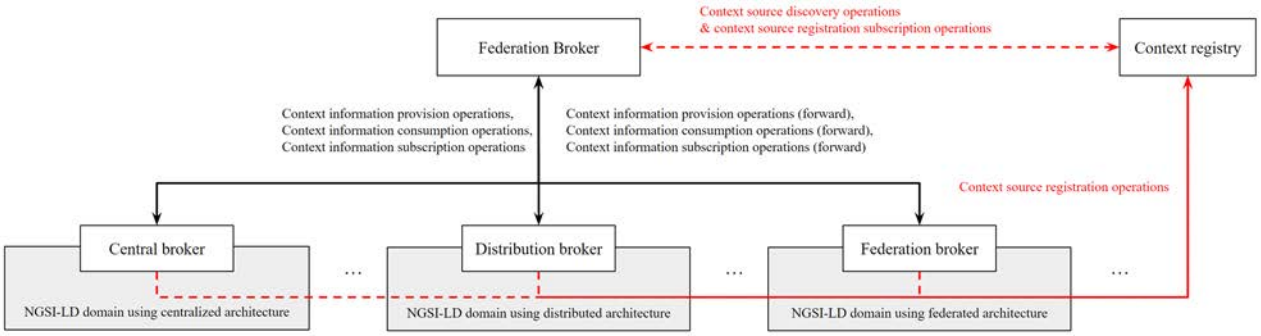

Figure 7.2-1: NGSI-LD system using the federated architecture

The definition of the central broker, distribution broker, federation broker, and context registry is specified in clause 3.1 of ETSI GS CIM 009 [i.1].

Context information provision operations are specified in clause 5.6 of ETSI GS CIM 009 [i.1].

Context information consumption operations are specified in clause 5.7 of ETSI GS CIM 009 [i.1].

Context information subscription operations are specified in clause 5.8 of ETSI GS CIM 009 [i.1].

Context source registration operations are specified in clause 5.9 of ETSI GS CIM 009 [i.1].

Context source discovery operations are specified in clause 5.10 of ETSI GS CIM 009 [i.1].

Context source registration subscription operations are specified in clause 5.11 of ETSI GS CIM 009 [i.1].

NOTE 1: In the federated architecture, the present document focuses on interactions between the federation broker and the brokers in each NGSI-LD domain. Detailed interaction inside each domain is outside the scope of the present document.

NOTE 2: The functionality of the federation broker and context registry can be integrated. How to integrate federation broker and context registry is outside the scope of the present document.

7.3 Deployment scenario example - national traffic ticket management

7.3.1 Overview

A country has a national traffic ticket management application that collects traffic violation events and publishes corresponding traffic tickets via a national traffic ticket management system. When the application finds a traffic violation event, it finds the registration information of the vehicle with traffic violations and publishes traffic tickets to the vehicle owner. The traffic violation event is collected and managed by several regional vehicle violation control platforms. Also, the vehicle registration information is managed by some regional vehicle registration platforms. These management platforms are distributed in the country, by following the geographical or administrative regions.

7.3.2 Service component mapping

Figure 7.3.2-1 shows a service component mapping to the NGSI-LD system.

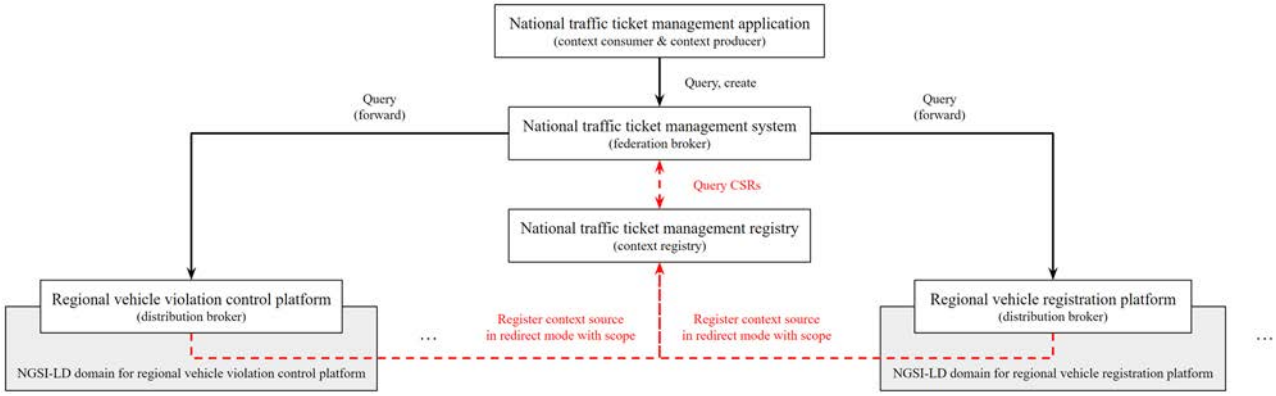

Figure 7.3.2-1: Service component mapping to the NGSI-LD system

In this deployment scenario, there are three example data models: *ViolationEvent*, *VehicleRegistration*, and *TrafficTicket*. How to manage *ViolationEvent* and *VehicleRegistration* entities in regional vehicle violation control platforms and regional vehicle registration platforms are beyond the scope of the present document. Table 7.3.2-1 shows an example data model of the *ViolationEvent*.

Table 7.3.2-1: Example data model for *ViolationEvent*

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity ID of traffic violation event
type	String	It is equal to "http://example.org/ngsi-ld/ViolationEvent"	1	Entity type
violationEventType	String		1	Property for the type of traffic violations • "speed" • "signal"
violationEventCondition	String		1	Property for the condition to trigger traffic violation event
violationEventValue	String		1	Property for the actual value of the vehicle with traffic violation
registrationPlateNumber	String		1	Property for the registration plate number of the vehicle with traffic violation

An instance of the entity *ViolationEvent* is described as follows:

```
{
  "id": "urn:ngsi-ld:ViolationEvent:20231025:abd23esf11",
  "type": "ViolationEvent",
  "violationEventType": {
    "type": "Property",
    "value": "speed"
  },
  "violationEventCondition": {
    "type": "Property",
    "value": ">100"
  },
  "violationEventValue": {
    "type": "Property",
    "value": "120.4",
    "observedAt": "2023-10-25T01:13:00Z"
  },
  "registrationPlateNumber": {
    "type": "Property",
    "value": "AA-123-AA",
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/violation-event.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

Table 7.3.2-2 shows an example data models of the entity *VehicleRegistration*.

Table 7.3.2-2: Example data model for *VehicleRegistration*

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity ID of the vehicle registration
type	String	It is equal to "http://example.org/ngsi-ld/VehicleRegistration"	1	Entity type
registrationPlateNumber	String		1	Property for the registration plate number of the vehicle
ownerLicenseNumber	String		1	Property for the license number of the vehicle owner
ownerName	String		1	Property for the name of the vehicle owner
ownerAddress	String		1	Property for the address of the vehicle owner

An instance of the entity *VehicleRegistration* is described as follows:

```
{
  "id": "urn:ngsi-ld:VehicleRegistration:AA-123-AA",
  "type": "VehicleRegistration",
  "registrationPlateNumber": {
    "type": "Property",
    "value": "AA-123-AA",
  },
  "ownerLicenseNumber": {
    "type": "Property",
    "value": "13AA00001",
  },
  "ownerName": {
    "type": "Property",
    "value": "John Smith",
  },
  "ownerAddress": {
    "type": "Property",
    "value": "Sophia Antipolis, 650 Rte des Lucioles, 06560 Valbonne, France",
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/vehicle-registration.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

Table 7.3.2-3 shows an example data models of the entity *TrafficTicket*.

Table 7.3.2-3: Example data model for *TrafficTicket*

Name	Type	Restriction	Cardinality	Description
id	URI		1	Entity ID of the traffic ticket
type	String	It is equal to "http://example.org/ngsi-ld/TrafficTicket"	1	Entity type
vehicleRegistration	Relationship		1	Property for the entity of the vehicle with *TrafficTicket*
fine	Double		1	Property for the amount of fine in euros
violationEvent	Relationship		1	Property for the entity of *ViolationEvent*

An instance of the entity *TrafficTicket* is described as follows:

```
{
  "id": "urn:ngsi-ld:TrafficTicket:AA-123-AA:20231204:00",
  "type": "TrafficTicket",
  "vehicleRegistration": {
```

```
    "type": "Relationship",
    "object": "urn:ngsi-ld:VehicleRegistration:AA-123-AA",
  },
  "fine": {
    "type": "Property",
    "value": 300.00,
  },
  "violationEvent": {
    "type": "Relationship",
    "object": "urn:ngsi-ld:ViolationEvent:20231025:abd23esf11",
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/traffic-ticket.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

7.3.3 Scenarios

7.3.3.1 Regional platform registration

Figure 7.3.3.1-1 shows communication flows to register regional vehicle violation control platform and regional vehicle registration platform to national traffic ticket management registry.

NOTE: How to manage context information and context source registration information in each NGSI-LD domain is outside the scope of the present document.

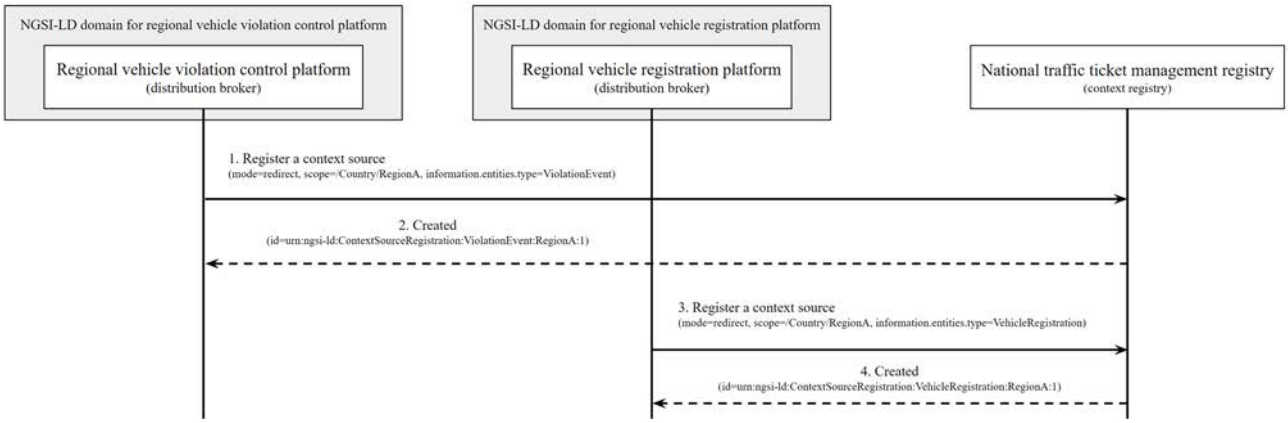

Figure 7.3.3.1-1: Communication flows to register regional platforms

Each step is described as follows:

1) Regional vehicle violation control platform registers to national traffic ticket management registry as a context source.

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the following CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "type": "ViolationEvent"
        }
      ]
    }
  ],
  "scope": "/Country/RegionA"
  "mode": "redirect",
  "endpoint": "http://a.region.vehicle-violation-control-platform.country,
  "@context": [
    "http://example.org/ngsi-ld/latest/violation-event.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
```

```
  ]
}
```

2) National traffic ticket management registry creates CsourceRegistration resource and then responds with the registration ID.

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:ViolationEvent:RegionA:1".

3) Regional vehicle registration platform registers to national traffic ticket management registry as a context source.

   - The context source registration request (see clause 5.9.2 in ETSI GS CIM 009 [i.1]) includes the CsourceRegistration resource (see clause 5.2.9 in ETSI GS CIM 009 [i.1]):

```
{
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "type": "VehicleRegistration"
        }
      ]
    }
  ],
  "scope": "/Country/RegionA"
  "mode": "redirect",
  "endpoint": "http://a.region.vehicle-registration-platform.country",
  "@context": [
    "http://example.org/ngsi-ld/latest/vehicle-registration.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

4) National traffic ticket management registry creates CsourceRegistration resource and then responds with the registration ID.

   - In this example, the registration ID is "urn:ngsi-ld:ContextSourceRegistration:VehicleRegistration:RegionA:1".

7.3.3.2 Information retrieval of traffic violation events

Figure 7.3.3.2-1 shows communication flows to retrieve information of traffic violation events.

NOTE 1: This scenario assumes that the NGSI-LD system for this example already performed the procedures in clause 7.3.3.1. Thus, national traffic ticket management registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:ViolationEvent:RegionA:1" and "urn:ngsi-ld:ContextSourceRegistration:VehicleRegistration:RegionA:1".

NOTE 2: Since the registration type for the *ViolationEvent* is redirect, there is no direct lookup in the federation broker itself.

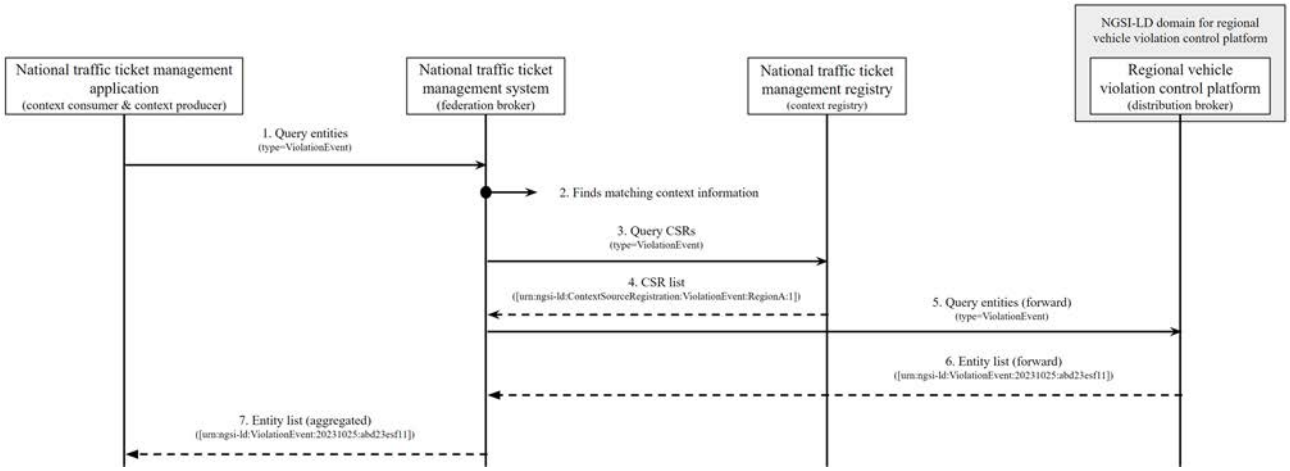

Figure 7.3.3.2-1: Communication flows to retrieve information on traffic violation events

Each step is described as follows:

1) National traffic ticket management application requests any violation events to national traffic ticket management system.

   - The request is querying entities (see clause 5.7.2 in ETSI GS CIM 009 [i.1]) with entity type *ViolationEvent*.

2) National traffic ticket management system finds matching context information locally, but there is no match.

3) National traffic ticket management system finds matching CSR information of the entity type *ViolationEvent* from national traffic ticket management registry.

   - the request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *ViolationEvent*.

4) National traffic ticket management registry responds with a matching CSR list.

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:ViolationEvent:RegionA:1",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "type": "ViolationEvent"
          }
        ]
      }
    ],
    "scope": "/Country/RegionA"
    "mode": "redirect",
    "endpoint": "http://a.region.vehicle-violation-control-platform.country,
    "@context": [
      "http://example.org/ngsi-ld/latest/violation-event.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

   - From this step, the national traffic ticket management system knows the request needs to be forwarded to the regional vehicle violation control platform.

5) National traffic ticket management system forwards the request to regional vehicle violation control platform.

6) Regional vehicle violation control platform responds with a matching entity list.

7) National traffic ticket management system aggregates the response from regional vehicle violation control platform and responds to national traffic ticket management application with an aggregated entity list.

- The aggregated entity list has the following context information:


```
[
  {
    "id": "urn:ngsi-ld:VehicleRegistration:AA-123-AA",
    "type": "VehicleRegistration",
    "registrationPlateNumber": {
      "type": "Property",
      "value": "AA-123-AA",
    },
    "ownerLicenseNumber": {
      "type": "Property",
      "value": "13AA00001",
    },
    "ownerName": {
      "type": "Property",
      "value": "John Smith",
    },
    "ownerAddress": {
      "type": "Property",
      "value": "Sophia Antipolis, 650 Rte des Lucioles, 06560 Valbonne, France",
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/vehicle-registration.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```


7.3.3.3 Registration information retrieval of vehicle with traffic violations

Figure 7.3.3.3-1 shows communication flows to retrieve registration information of vehicle with traffic violations.

NOTE 1: This scenario assumes that the NGSI-LD system for this example already performed the procedures in clause 7.3.3.1. Thus, national traffic ticket management registry has two context sources: "urn:ngsi-ld:ContextSourceRegistration:ViolationEvent:RegionA:1" and "urn:ngsi-ld:ContextSourceRegistration:VehicleRegistration:RegionA:1".

NOTE 2: Since the registration type for the *VehicleRegistration* is redirect, there is no direct lookup in the federation broker itself.

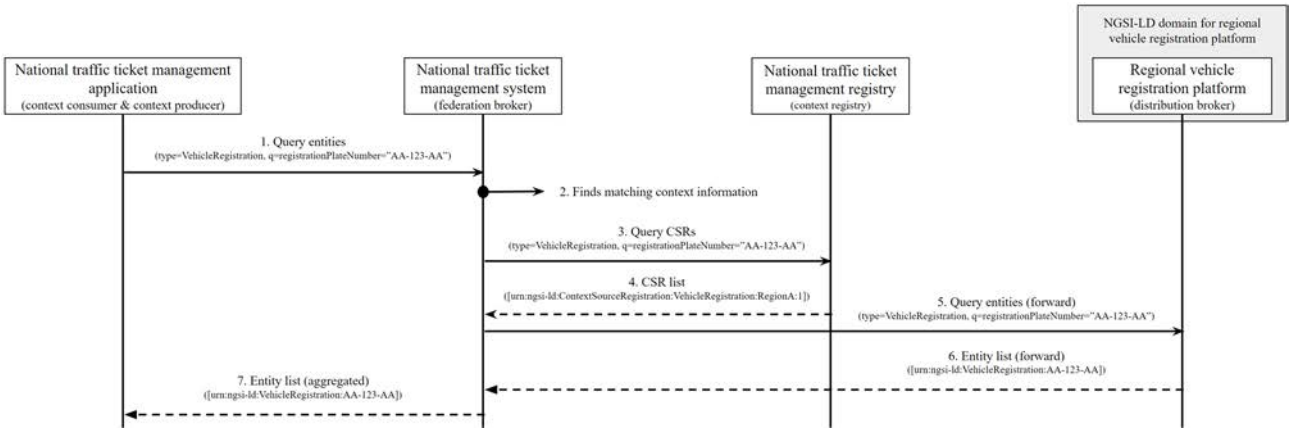

Figure 7.3.3.3-1: Communication flows to retrieve registration information of vehicles with traffic violations

Each step is described as follows:

1) National traffic ticket management application requests the registration information of vehicle with registrationPlateNumber "AA-123-AA" to national traffic ticket management system.

   - The request is querying entities (see clause 5.7.2 in ETSI GS CIM 009 [i.1]) with entity type *VehicleRegistration*, entity attribute "registrationPlateNumber" and its value is "AA-123-AA".

   - The value of registrationPlateNumber is extracted from the context information of *ViolationEvent*.

2) National traffic ticket management system finds matching context information locally, but there is no match.

3) National traffic ticket management system finds matching CSR information of the entity type *VehicleRegistration* from national traffic ticket management registry.

   - the request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *VehicleRegistration* and attribute name "registrationPlateNumber" and its value is "AA-123-AA".

4) National traffic ticket management registry responds with a matching CSR list.

   - The CSR list has the following information:

```
[
  {
    "id": "urn:ngsi-ld:ContextSourceRegistration:VehicleRegistration:RegionA:1",
    "type": "ContextSourceRegistration",
    "information": [
      {
        "entities": [
          {
            "type": "VehicleRegistration"
          }
        ]
      }
    ],
    "scope": "/Country/RegionA"
    "mode": "redirect",
    "endpoint": "http://a.region.vehicle-registration-platform.country",
    "@context": [
      "http://example.org/ngsi-ld/latest/vehicle-registration.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

   - From this step, the national traffic ticket management system knows the request needs to be forwarded to the regional vehicle registration platform.

5) National traffic ticket management system forwards the request to regional vehicle registration platform.

6) Regional vehicle registration platform responds with a matching entity list.

7) National traffic ticket management system aggregates the response from regional vehicle registration platform and responds to national traffic ticket management application with an aggregated entity list.

   - The aggregated entity list has the following context information:

```
[
  {
    "id": "urn:ngsi-ld:VehicleRegistration:AA-123-AA",
    "type": "VehicleRegistration",
    "registrationPlateNumber": {
      "type": "Property",
      "value": "AA-123-AA",
    },
    "ownerLicenseNumber": {
      "type": "Property",
      "value": "13AA00001",
    },
    "ownerName": {
      "type": "Property",
      "value": "John Smith",
```

```
    },
    "ownerAddress": {
      "type": "Property",
      "value": "Sophia Antipolis, 650 Rte des Lucioles, 06560 Valbonne, France",
    },
    "@context": [
      "http://example.org/ngsi-ld/latest/vehicle-registration.jsonld",
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
    ]
  }
]
```

7.3.3.4 Publish traffic tickets

Figure 7.3.3.4-1 shows communication flows to publish traffic tickets.

NOTE: This scenario assumes that the NGSI-LD system has performed the procedures in clause 7.3.3.1.

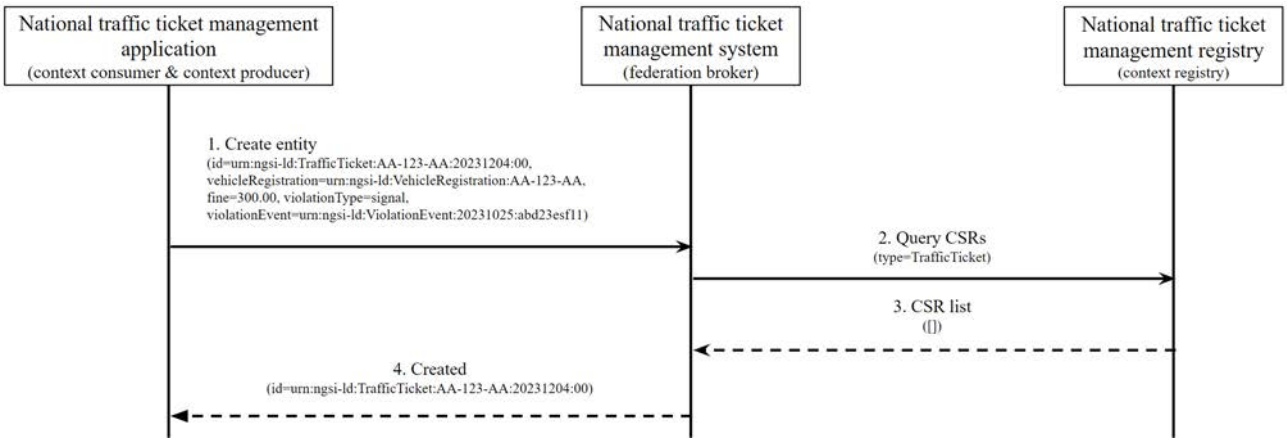

Figure 7.3.3.4-1: Communication flows to publish traffic tickets

Each step is described as follows:

1) National traffic ticket management application makes a request to national traffic ticket management system to create *TrafficTicket* entity of "urn:ngsi-ld:TrafficTicket:AA-123-AA:20231204:00".

   - The entity creation request (see clause 5.6.1 in ETSI GS CIM 009 [i.1]) includes the entity resource (see clause 5.2.4 in ETSI GS CIM 009 [i.1]):

```
{
  "id": "urn:ngsi-ld:TrafficTicket:AA-123-AA:20231204:00",
  "type": "TrafficTicket",
  "vehicleRegistration": {
    "type": "Relationship",
    "object": "urn:ngsi-ld:VehicleRegistration:AA-123-AA",
  },
  "fine": {
    "type": "Property",
    "value": 300.00,
  },
  "violationEvent": {
    "type": "Relationship",
    "object": "urn:ngsi-ld:ViolationEvent:20231025:abd23esf11",
  },
  "@context": [
    "http://example.org/ngsi-ld/latest/traffic-ticket.jsonld",
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

2) National traffic ticket management system finds matching CSR information of the entity type *TrafficTicket* from national traffic ticket management registry.

   - The request is discovering context source registrations (see clause 5.10.2 in ETSI GS CIM 009 [i.1]) with the entity type *TrafficTicket*.

3) National traffic ticket management registry responds with a matching CSR list.

   - Because there is no matching CSR information in national traffic ticket management registry, an empty list is returned.

   - National traffic ticket management system knows the request needs to be processed locally.

4) National traffic ticket management system creates context information locally and responds with the successful response to national traffic ticket management application.

8 Conclusions

The present document provides examples of NGSI-LD system configurations and procedures using the NGSI-LD distributed operations in different use case scenarios. While ETSI CIM GS 009 [i.1] specifies the distributed operations, how to use those APIs are suggested in the present document. As defined in the API specification, depending on the distributed operation mode (i.e. *mode* attribute of CSourceRegistration resource) in the context source registration information, behaviours of a Context Broker are different.

The given scenarios with the procedures could be referenced for real world deployments. Then the feedback from those deployments could serve as a basis for further enhancements to the API specification.

Annex A:
Change history

Date	Version	Information about changes
November 2021	V0.0.1	The initial baseline document is released.
December 2022	V0.0.2	Organized the structure of the baseline document (version 0.0.1) with the following structure: • clause 4: centralized broker • clause 5: context sources in exclusive mode • clause 6: context sources in redirect mode • clause 7: context sources in inclusive mode • clause 8: context sources in auxiliary mode • clause 9: combinations of architectures Added examples for clauses 4, 5 and 6.
July 2023	V0.0.3	Modified the structure of the baseline document (version 0.0.2) with the following structure: • clause 4: overview • clause 5: deployment scenario #1 - centralized architecture • clause 6: deployment scenario #2 - distributed architecture • clause 7: deployment scenario #3 - federated architecture • clause 8: combination of architectures Added deployment scenario examples for clauses 5 and 6.
November 2023	V0.1.0	Finalized to make the document ready to be a stable draft. Modified the structure of the baseline document (version 0.0.3) with the following structure: • clause 4: overview • clause 5: deployment scenario #1 - centralized architecture • clause 6: deployment scenario #2 - distributed architecture • clause 7: deployment scenario #3 - federated architecture Added deployment scenario examples for all clauses. Enhanced communication flows for each scenario example that uses NGSI-LD operations related to context source registrations. Formatted document entirely to comply with the current ETSI drafting guideline.
November 2023	V0.1.1	Editorial updates.
December 2023	v0.2.0	Changed the deployment scenario example for federated architecture (previous: global passport control, changed: national traffic ticket management) in the clause 7.3. Editorial updates.
December 2023	V0.2.1	Editorial updates with readability improvements. Corrected statements that is related to finding context information in the distributed and federated architectures.
January 2024	V1.1.1	Clean up by rephrasing introduction and conclusion clauses, removing redundant and implementation specific procedures. Technical Officer review for EditHelp publication pre-processing after TB approval.

History

Document history		
V1.1.1	February 2024	Publication