

# Things Data Interoperability Through Annotating oneM2M resources for NGSI-LD Entities

Sunil Kumar, SeungMyeong Jeong and Il-Yeop Ahn (Korea Electronics  
Technology Institute, South Korea); Muhammad Aslam Jarwar  
(University College London, United Kingdom)

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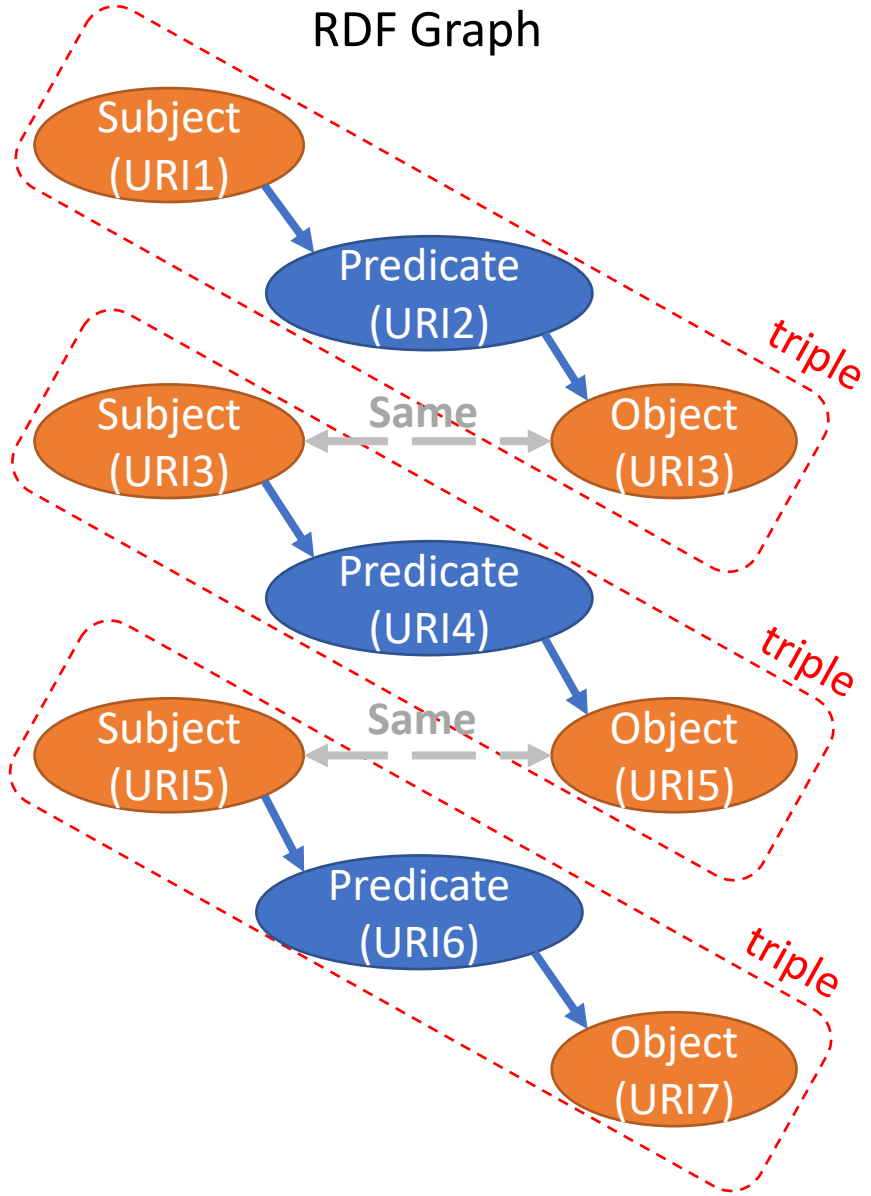
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# Background and Motivation

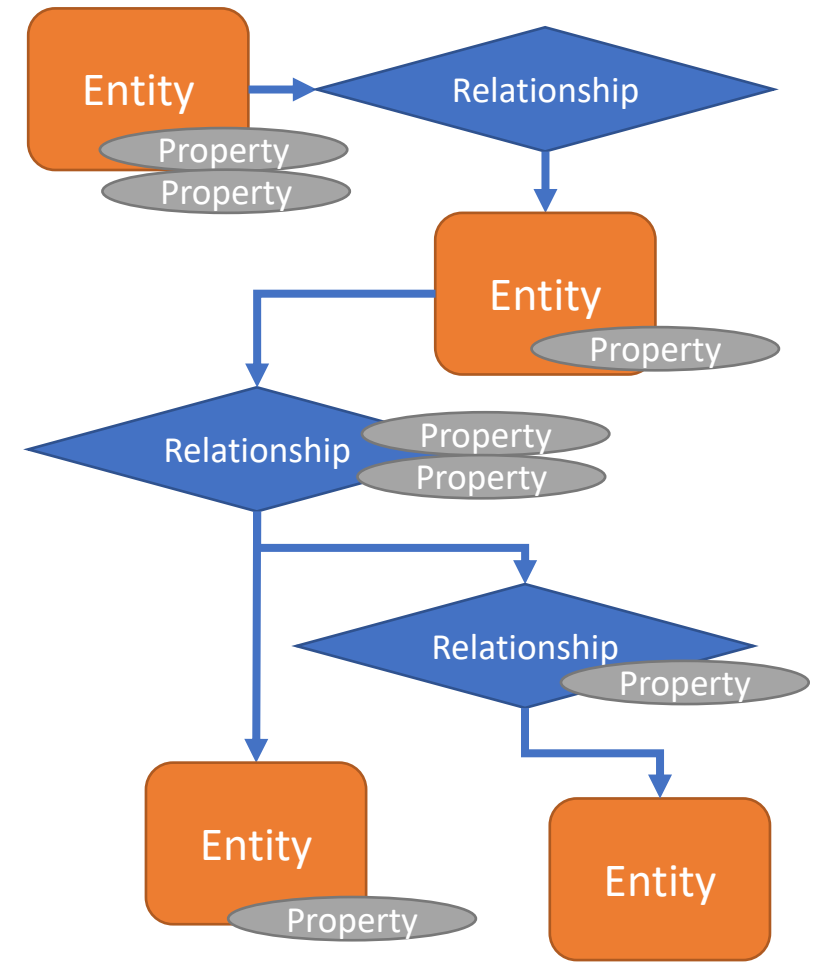
JSON

```
{  
  "key": {  
    "key": "value",  
    "key": { "key": "value" },  
    "key": [ "value", "value" ],  
    "key": {  
      "key": [ "value", "value" ],  
      "key": [ "value", "value" ],  
    }  
  },  
  "key": [  
    { "key": "value" },  
    { "key": "value" },  
  ]  
}
```

RDF Graph



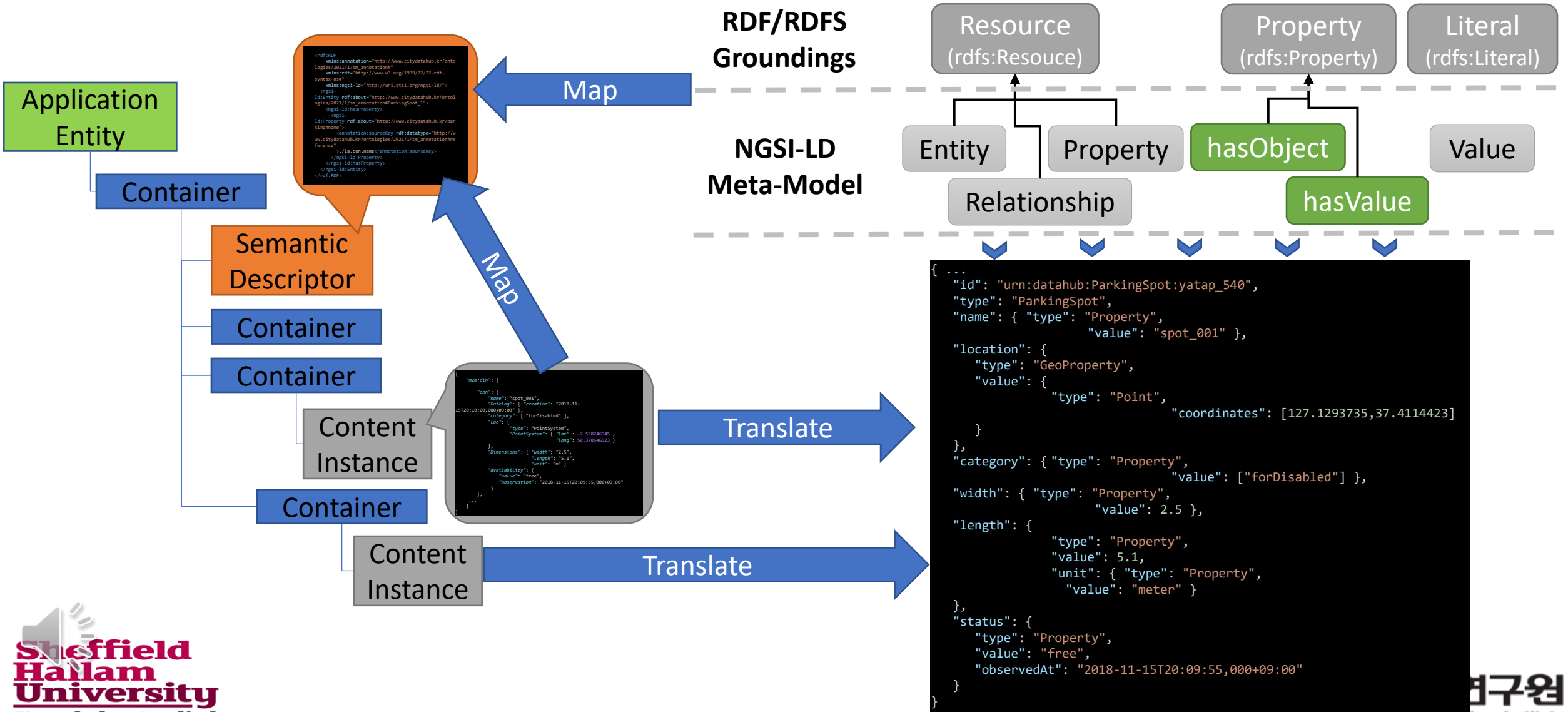
Labelled Property Graph



# Background and Motivation

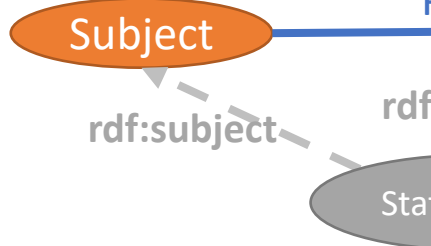
## oneM2M Resources

## NGSI-LD



# Background and Motivation

## Standard RDF Reification



## Singleton Property Reification



## Blank Node Reification



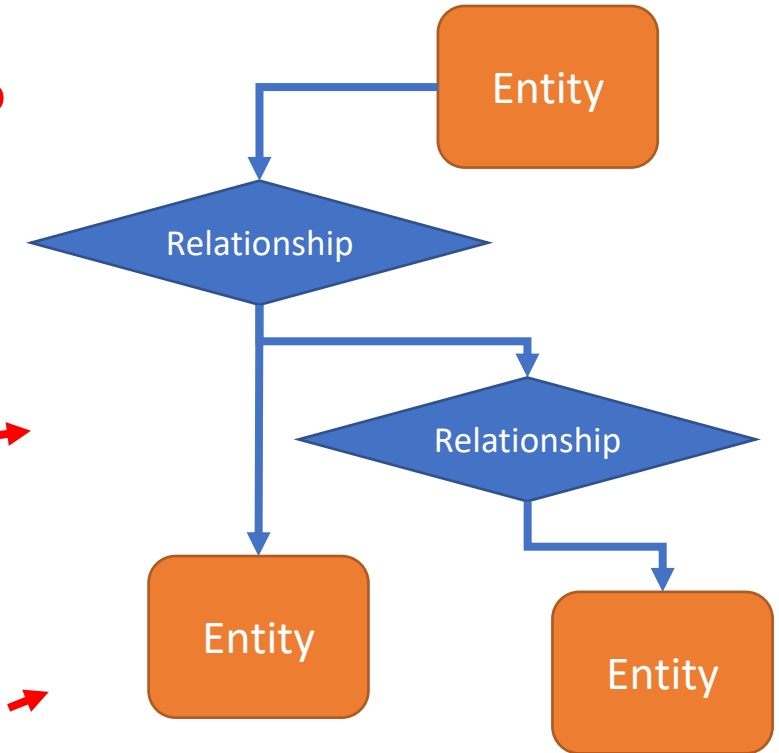
```
{  
  "key": {  
    "key": "value",  
    "key": { "key": "value" },  
    "key": [ "value", "value" ],  
    "key": {  
      "key": [ "value", "value" ],  
      "key": [ "value", "value" ],  
    }  
  },  
  "key": [  
    { "key": "value" },  
    { "key": "value" },  
  ]  
}  
...  
}
```

Translates to

Translates to

Translates to

## Labelled Property Graph



# Background and Motivation

- Bridge the gap between linked data support of oneM2M and NGSI-LD.
  - Requires translating the non-semantic oneM2M resources to an NGSI-LD-based semantic graph.
- Incorporate the framework based on the existing standards without restricting or modifying the standard principles and protocols.
  - The existing RDF-based semantic support can be utilized to translate the oneM2M resources to NGSI-LD based Entities.
- Consider the complex attribute values in oneM2M resources for appropriately translating them to NGSI-LD Values.

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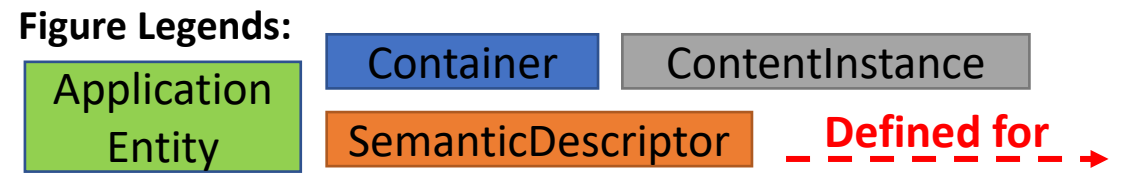
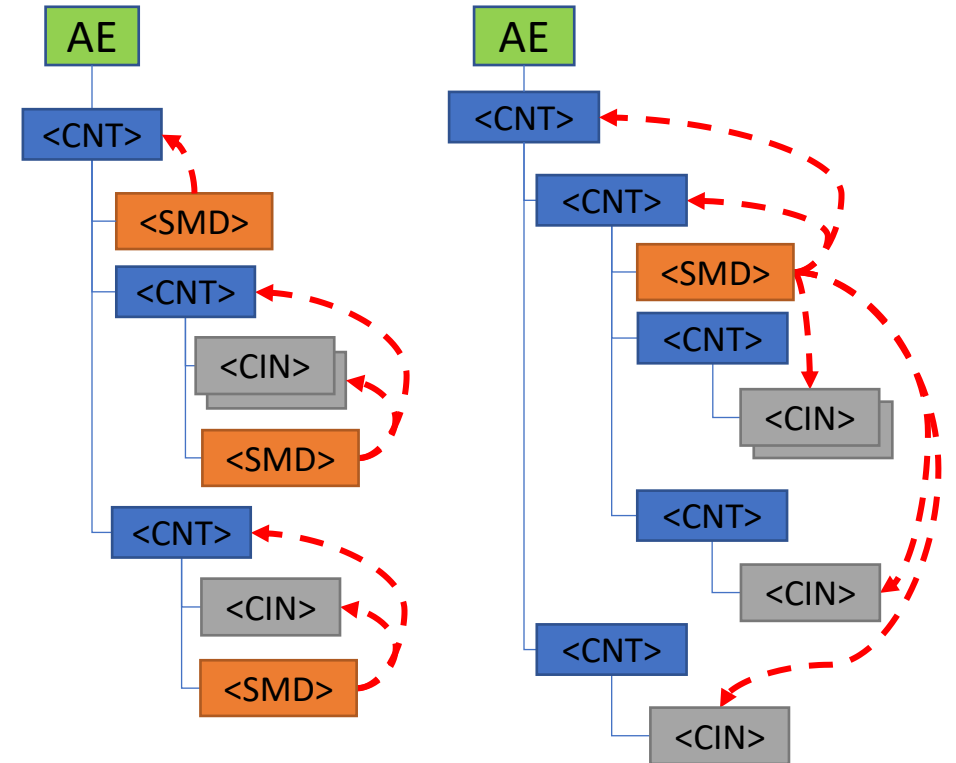
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# Mapping Considerations

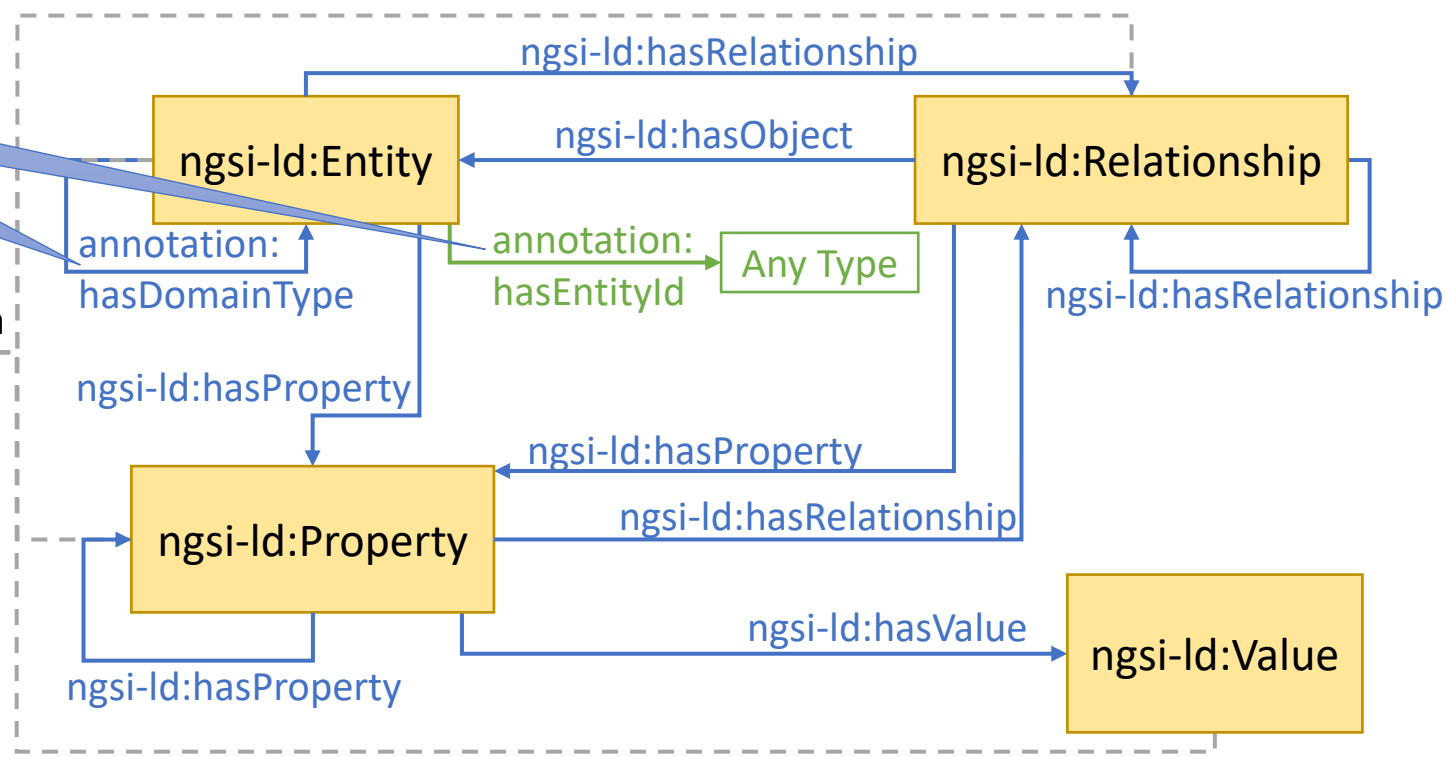
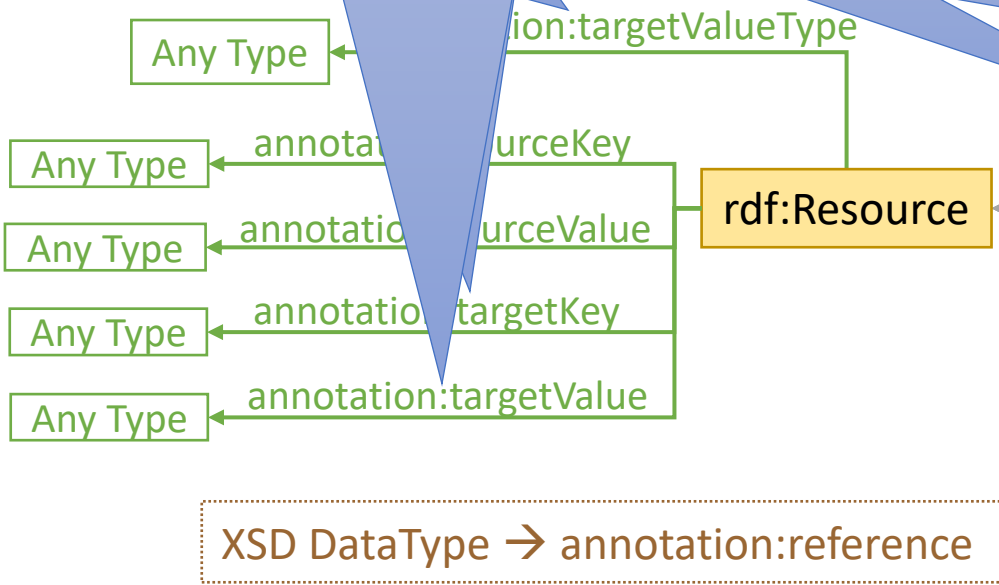
- The top-level resource (CSE, AE, or CNT) and their child resources should represent a single NGS- LD Entity.
- The underlying data will be mapped to the NGS- LD Properties and Values, belonging to that Entity, as well as the Relationships with other NGS- LD Entities.
- SMD is assumed to provide the mapping for the direct sibling CIN, and the direct parent CNT in the resource hierarchy.
- In the case of multiple sibling CINs, a single SMD will be used.

a) Considered ✓      b) Not Considered ✗



# Mapping Considerations: Mapping Ontology

Specify the explicit type of the NGSI-LD Value, which cannot be determined from the resource.



**Legends**

- rdf:Resource → rdf:Property → rdf:Resource
- rdf:Resource → rdf:Property → RDF Literal
- ngsi-ld: → <http://uri.etsi.org/ngsi-ld/>
- annotation: → [http://www.citydatahub.kr/ontologies/2021/1/sm\\_annotation#](http://www.citydatahub.kr/ontologies/2021/1/sm_annotation#)

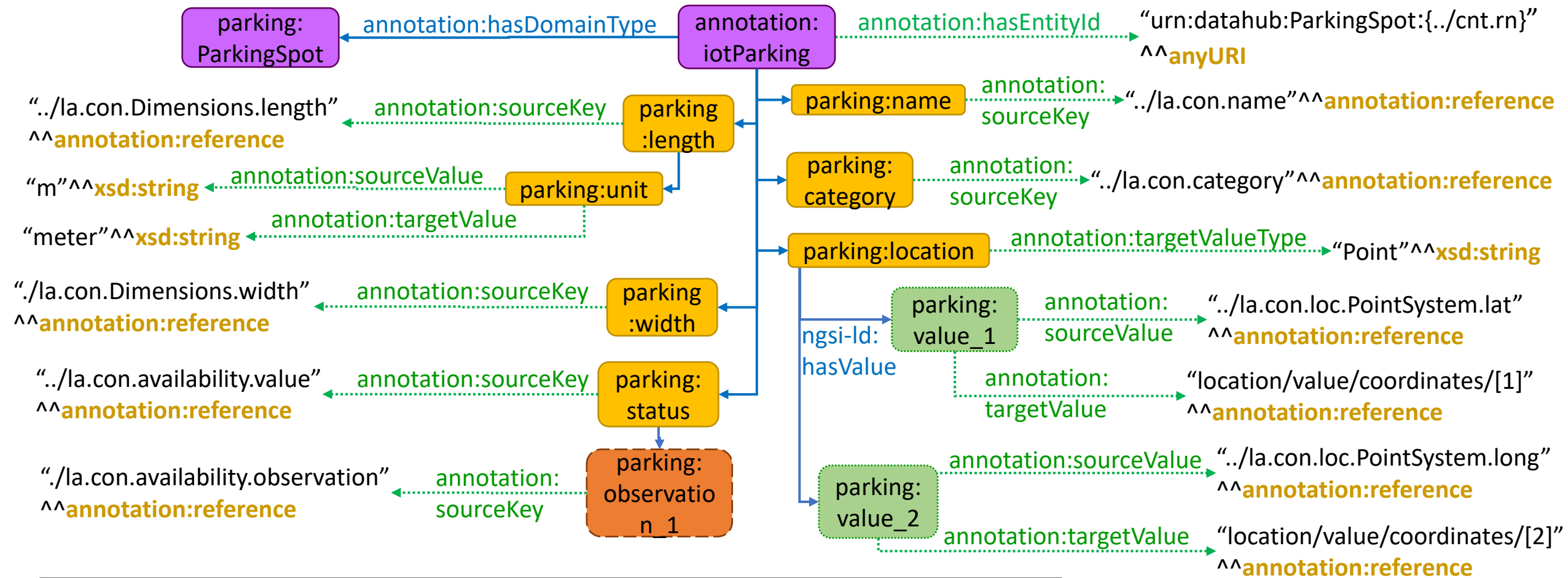
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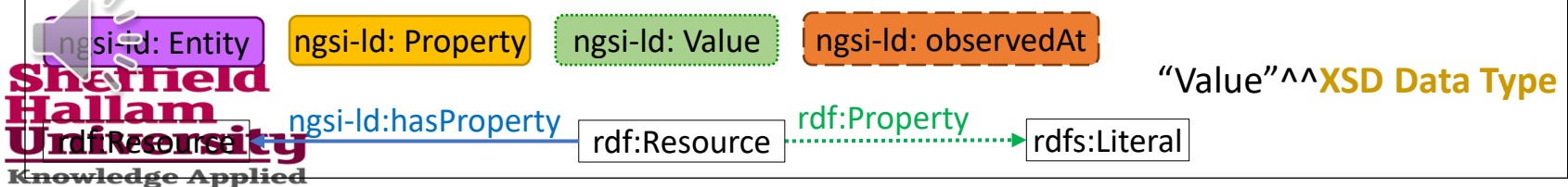
# Mapping Generation and Interpretation

```
{
  "m2m:cin": {
    ...
    "con": {
      "name": "spot_001",
      "Datelog": { "creation": "2018-11-15T20:10:00,000+09:00" },
      "category": [ "forDisabled" ],
      "Loc": {
        "type": "PointSystem",
        "PointSystem": { "Lat" : -2.558246945 ,
                        "Long": 50.378546923 }
      },
      "Dimensions": { "width": "2.5",
                      "length": "5.1",
                      "unit": "m" }
      "availability": {
        "value": "free",
        "observation": "2018-11-15T20:09:55,000+09:00",
      }
    },
    ...
  }
}
```

# Mapping Generation and Interpretation



## Figure Legends:

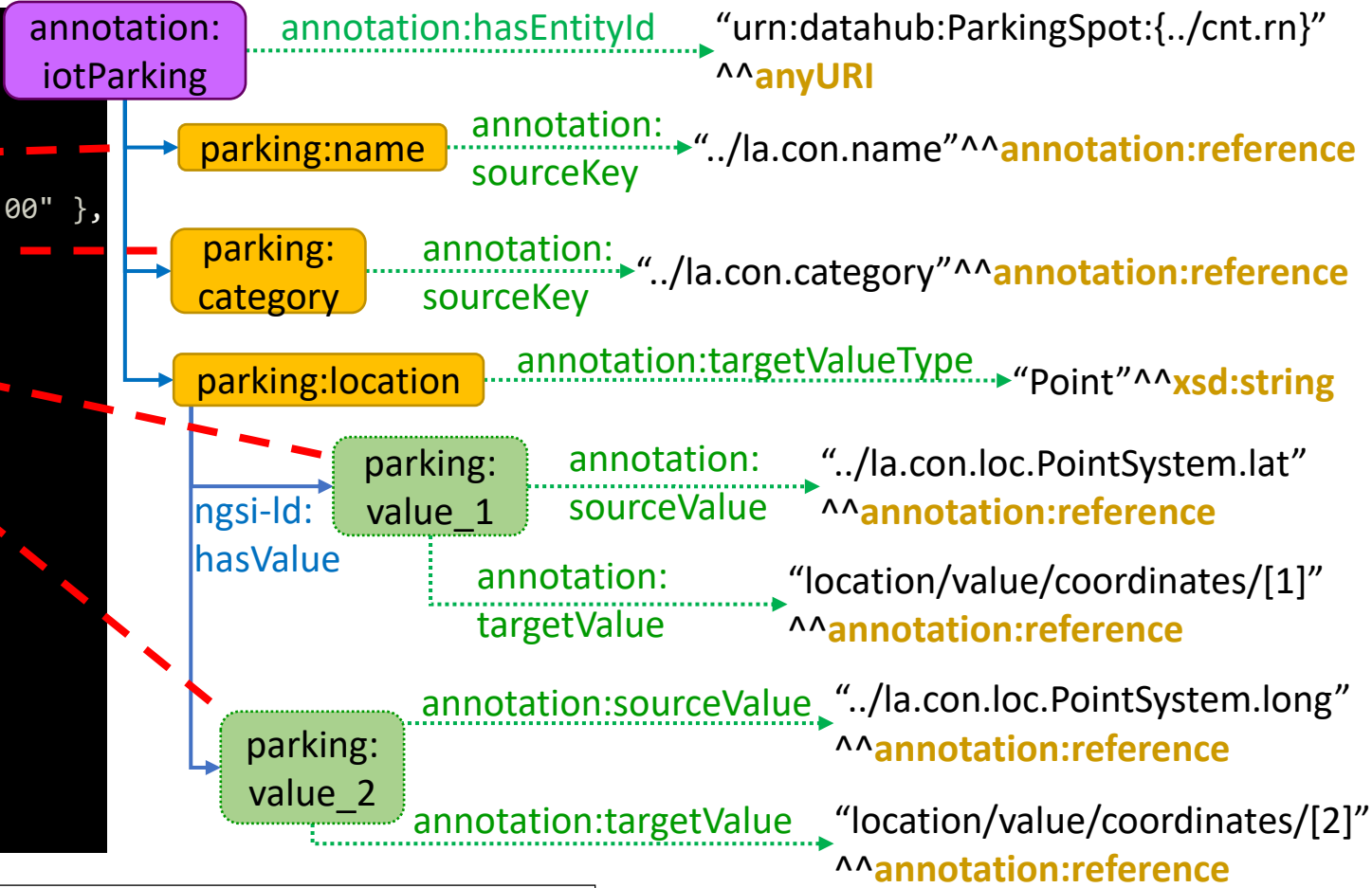


# Mapping Generation and Interpretation

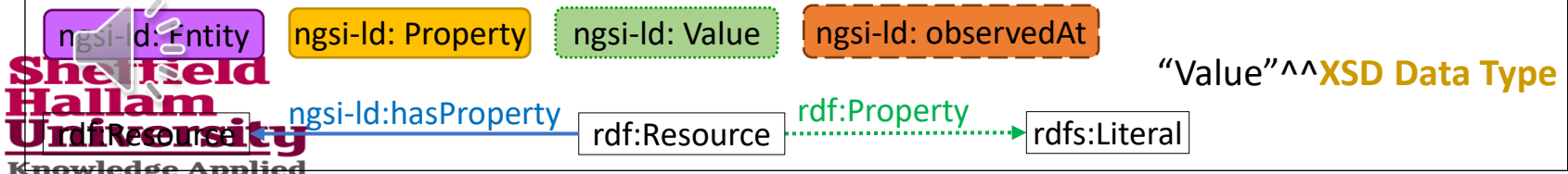
```

{
  "m2m:cin": {
    ...
    "con": {
      "name": "spot_001",
      "DateLog": { "creation": "2018-11-15T20:10:00,000+09:00" },
      "category": [ "forDisabled" ],
      "Loc": {
        "type": "PointSystem",
        "PointSystem": { "Lat" : -2.558246945 ,
                        "Long" : 50.378546923 }
      },
      "Dimensions": { "width": "2.5",
                      "length": "5.1",
                      "unit": "m" }
      "availability": {
        "value": "free",
        "observation": "2018-11-15T20:09:55,000+09:00",
      }
    }
  }
}

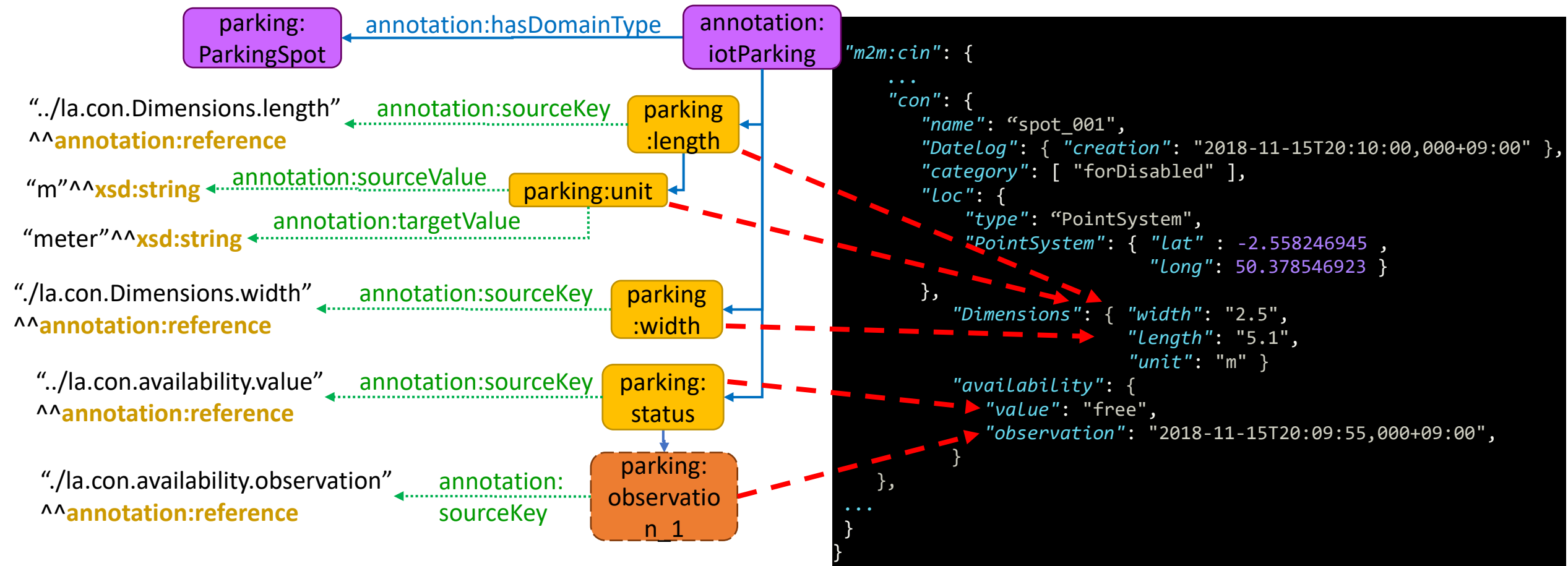
```



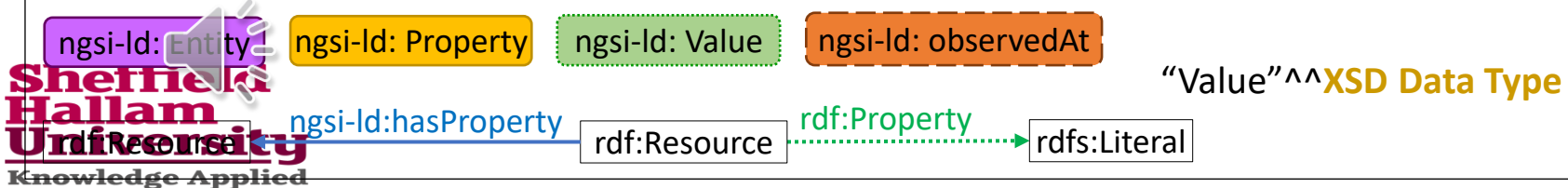
## Figure Legends:



# Mapping Generation and Interpretation



## Figure Legends:



# Mapping Generation and Interpretation

```
{ ...
  "id": "urn:datahub:ParkingSpot:yatap_540",
  "type": "ParkingSpot",
  "name": { "type": "Property",
            "value": "spot_001" },
  "location": {
    "type": "GeoProperty",
    "value": {
      "type": "Point",
      "coordinates": [127.1293735,37.4114423]
    }
  },
  "category": { "type": "Property",
                "value": ["forDisabled"] },
  "width": { "type": "Property",
             "value": 2.5 },
  "length": {
    "type": "Property",
    "value": 5.1,
    "unit": { "type": "Property",
              "value": "meter" }
  },
  "status": {
    "type": "Property",
    "value": "free",
    "observedAt": "2018-11-15T20:09:55,000+09:00"
  }
}
```



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# Conclusion

- In this paper, a novel approach to utilize RDF for annotating oneM2M resources into NGSI-LD, has been proposed.
- The mapping can provide an interpretation of value at some level of complexity.
  - The value-to-value mapping with different standards still has limitations and requires manual work.
- Linking the NGSI-LD Entities is also an important aspect of this research whose implementation feasibility is yet to be explored.

Thank You