

Appendix A

A.1 List of the Useful SPARQL Queries Covering the Required Objectives and Criteria

Query A1: Retrieve the list of all Web resources

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource; gradys:Id ?Res_id;
    gradys:Title ?Res_title; gradys:Exposed_by ?plat .
    ?plat rdf:type gradys:Platform
}
```

Query A2: Retrieve the Web resources exposed by connected objects

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource; gradys:Id ?Res_id ;
    gradys:Title ?Res_title; gradys:Exposed_by ?dev .
    ?dev rdf:type gradys:Device
}
```

Query A3: Retrieve the Web resources exposed by connected objects

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource; gradys:Id ?Res_id ;
    gradys:Title ?Res_title; gradys:Exposed_by ?plat .
    ?plat rdf:type gradys:Platform
    FILTER NOT EXISTS {
        ?res gradys:Exposed_by ?dev .
        ?dev rdf:type gradys:Device
    }
}
```

Query A4: Retrieve the list of elementary Web resources

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:ElementaryResource;
    gradys:Id ?Res_id; gradys:Title ?Res_title
}
```

Query A5: Retrieve the composed Web resources exposed by platforms (which are not connected objects)

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:CompositeResource;
    gradys:Id ?Res_id; gradys:Title ?Res_title;
    gradys:Exposed_by ?plat .
    ?plat rdf:type gradys:Platform
    FILTER NOT EXISTS {
        ?res gradys:Exposed_by ?dev .
        ?dev rdf:type gradys:Device
    }
}
```

Query A6: Retrieve the Web resources belonging to a given category

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource .
    ?res gradys:Has_MainCategory ?cat .
    ?cat gradys:Category_value "Data Collection"^^xsd:string .
    ?res gradys:Id ?Res_id . ?res gradys:Title ?Res_title
}
```

Query A7: Retrieve the Web resources providing a given function

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource;
    gradys:Provides ?Operation .
    ?Operation gradys:Function "Collect Temperature" .
    ?res gradys:Id ?Res_id; gradys:Title ?Res_title
}
```

Query A8: Retrieve the list of all the functions provided by the Web environment

```
SELECT ?fun
WHERE {
    ?res rdf:type gradys:Resource.
    ?res gradys:Provides ?Operation .
    ?Operation gradys:Function ?fun
}
```

Query A9: Retrieve the output parameters of a Web resource and the input parameters of another

```
SELECT ?res1id ?res2id ?Paramin_name ?Paramin_datatype
?Paramout_name ?Paramout_datatype
WHERE {
    {
        ?res1 rdf:type gradys:Resource . ?res1 gradys:Id "Res_4"
        ↪ ^^xsd:string .
        ?res1 gradys:Id ?res1id . ?res1 gradys:Provides ?op .
        ?op gradys:Expects ?Paramin .
        ?Paramin gradys:Param_name ?Paramin_name .
        ?Paramin gradys:Param_datatype ?Paramin_datatype
    }
    UNION
    {
        ?res2 rdf:type gradys:Resource .
        ?res2 gradys:Id "Res_2"^^xsd:string .
        ?res2 gradys:Id ?res2id . ?res2 gradys:Provides ?op .
        ?op gradys>Returns ?Paramout .
        ?Paramout gradys:Param_name ?Paramout_name .
        ?Paramout gradys:Param_datatype ?Paramout_datatype
    }
}
```

Query A10: Retrieve the Web resources exposed in a given location

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource .
    ?res gradys:Id ?Res_id .
    ?res gradys:Title ?Res_title .
    ?dev rdf:type hssn:Device .
    ?dev gradys:Exposes ?res .
    ?loc rdf:type hssn:Location .
    ?dev hssn:currentlyLocatedAt ?loc .
    ?loc gradys:Location_id "Zone 1"^^xsd:string
}
```

Query A11: Retrieve the Web resources that are the same (same-as) as a Web resource

```
SELECT ?res_id
WHERE {
    ?res rdf:type gradys:Resource .
    ?res gradys:Id "Res_5"^^xsd:string .
    ?res gradys:Same_As ?otheres .
    ?otheres gradys:Id ?res_id
}
```

Query A12: Retrieve the Web resources that are complementary (follows) to a Web resource

```
SELECT ?res_id
WHERE {
    ?res rdf:type gradys:Resource .
    ?res gradys:Id "Res_3"^^xsd:string .
    ?res gradys:Follows ?otheres .
    ?otheres gradys:Id ?res_id
}
```

Query A13: Retrieve the workflow of a composed Web resource

```
SELECT ?list_res_id
WHERE {
    ?res rdf:type gradys:CompositeResource .
    ?res gradys:Id "Res_co_1"^^xsd:string .
    ?res gradys:Has_Workflow ?wf .
    ?wf gradys:Has_Component ?comp .
    ?comp gradys:Represents ?list_res .
    ?list_res gradys:Id ?list_res_id
}
```

Query A14: Retrieve the sequential order of the workflow components of a composed Web resource

```
SELECT ?list_res1_id ?list_res2_id
WHERE {
    ?res1 rdf:type gradys:CompositeResource .
    ?res1 gradys:Id "Res_co_1"^^xsd:string .
    ?res1 gradys:Has_Workflow ?wf .
    ?wf gradys:Has_Component ?comp .
    ?comp gradys:Represents ?list_res1 .
    ?list_res1 gradys:Id ?list_res1_id .
    ?comp gradys:Precedes ?othercomp .
    ?othercomp gradys:Represents ?list_res2 .
    ?list_res2 gradys:Id ?list_res2_id
}
```

Query A15: Retrieve the functions provided by the virtual Web resources

```
SELECT ?fun
WHERE {
    ?res rdf:type gradys:VirtualResource.
    ?res gradys:Provides ?0operation .
    ?0operation gradys:Function ?fun
}
```

Query A16: Retrieve a Web resource providing a given function with a quality criterion (e.g. Accuracy > %80)

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource.
    ?res gradys:Provides ?Operation .
    ?Operation gradys:Function "Temperature Prediction" .
    ?res gradys:Id ?Res_id .
    ?res gradys:Title ?Res_title .
    ?res gradys:Has_QoR ?qor .
    ?qor gradys:QoR_name "Accuracy"^^xsd:string .
    ?qor gradys:QoR_value ?val .
    FILTER (?val > 80)
}
```

Query A17: Retrieve a Web resource collecting data within a location with a quality criterion (e.g. Bandwidth> 400 Mbits/sec)

```
SELECT ?Res_id ?Res_title
WHERE {
    ?res rdf:type gradys:Resource.
    ?res gradys:Has_MainCategory ?cat .
    ?cat gradys:Category_value "Data Collection"^^xsd:string .
    ?res gradys:Id ?Res_id .
    ?res gradys:Title ?Res_title .
    ?dev rdf:type hssn:Device .
    ?dev gradys:Exposes ?res .
    ?loc rdf:type hssn:Location .
    ?dev hssn:currentlyLocatedAt ?loc .
    ?loc gradys:Location_id "Zone 1"^^xsd:string .
    ?res gradys:Has_QoR ?qor .
    ?qor gradys:QoR_name "Bandwidth"^^xsd:string .
    ?qor gradys:QoR_value ?val .
    FILTER (?val > 400)
}
```

A.2 The SPARQL Queries Required for the Motivating Scenario

In this section, we list the SPARQL queries that are necessary to form the required composed resource related to the motivating scenario:

Retrieve the Web resources providing the required functions

```
SELECT ?Res_id
WHERE {
    ?res rdf:type gradys:Resource; gradys:Provides ?Operation .
    ?Operation gradys:Function "External Temperature" .
    ?res gradys:Id ?Res_id
}

SELECT ?Res_id
WHERE {
    ?res rdf:type gradys:Resource; gradys:Provides ?Operation .
    ?Operation gradys:Function "External Humidity" .
    ?res gradys:Id ?Res_id
}

SELECT ?Res_id
WHERE {
    ?res rdf:type gradys:Resource; gradys:Provides ?Operation .
    ?Operation gradys:Function "Temperature Unit Conversion" .
    ?res gradys:Id ?Res_id
}

SELECT ?Res_id
WHERE {
    ?res rdf:type gradys:Resource; gradys:Provides ?Operation .
    ?Operation gradys:Function "Energy Consumption Prediction" .
    ?res gradys:Id ?Res_id
}
```

Retrieve the internal data collection resource exposed in the required location (the corresponding floor in this case)

```
SELECT ?Res_id
WHERE {
  ?res rdf:type gradys:Resource ; gradys:Id ?Res_id ; ?gradys:
    ↪ Provides ?Operation .
  ?Operation gradys:Function "Internal Temperature" .
  ?dev rdf:type hssn:Device . ?dev gradys:Exposes ?res .
  ?loc rdf:type hssn:Location .
  ?dev hssn:currentlyLocatedAt ?loc .
  ?loc gradys:Location_id "Floor 1"^^xsd:string
}
```

Retrieve the output parameters of a resource and the input parameters of another to check whether the resources can be correctly linked

```
SELECT ?res1id ?res2id ?Paramin_name ?Paramin_datatype
?Paramout_name ?Paramout_datatype
WHERE {
  {
    ?res1 rdf:type gradys:Resource . ?res1 gradys:Id "Res_4"
    ↪ ↪ ^xsd:string .
    ?res1 gradys:Id ?res1id . ?res1 gradys:Provides ?op .
    ?op gradys:Expects ?Paramin .
    ?Paramin gradys:Param_name ?Paramin_name .
    ?Paramin gradys:Param_datatype ?Paramin_datatype
  }
  UNION
  {
    ?res2 rdf:type gradys:Resource .
    ?res2 gradys:Id "Res_2"^^xsd:string .
    ?res2 gradys:Id ?res2id . ?res2 gradys:Provides ?op .
    ?op gradys>Returns ?Paramout .
    ?Paramout gradys:Param_name ?Paramout_name .
    ?Paramout gradys:Param_datatype ?Paramout_datatype
  }
}
```

The previous query should be executed for each two linked resources in the composition scenario (e.g., between the External Temperature and Temperature Unit Conversion resources, and between Temperature Unit Conversion and Energy Consumption Prediction resources).