



A Quick Introduction to OWL Web Ontology Language

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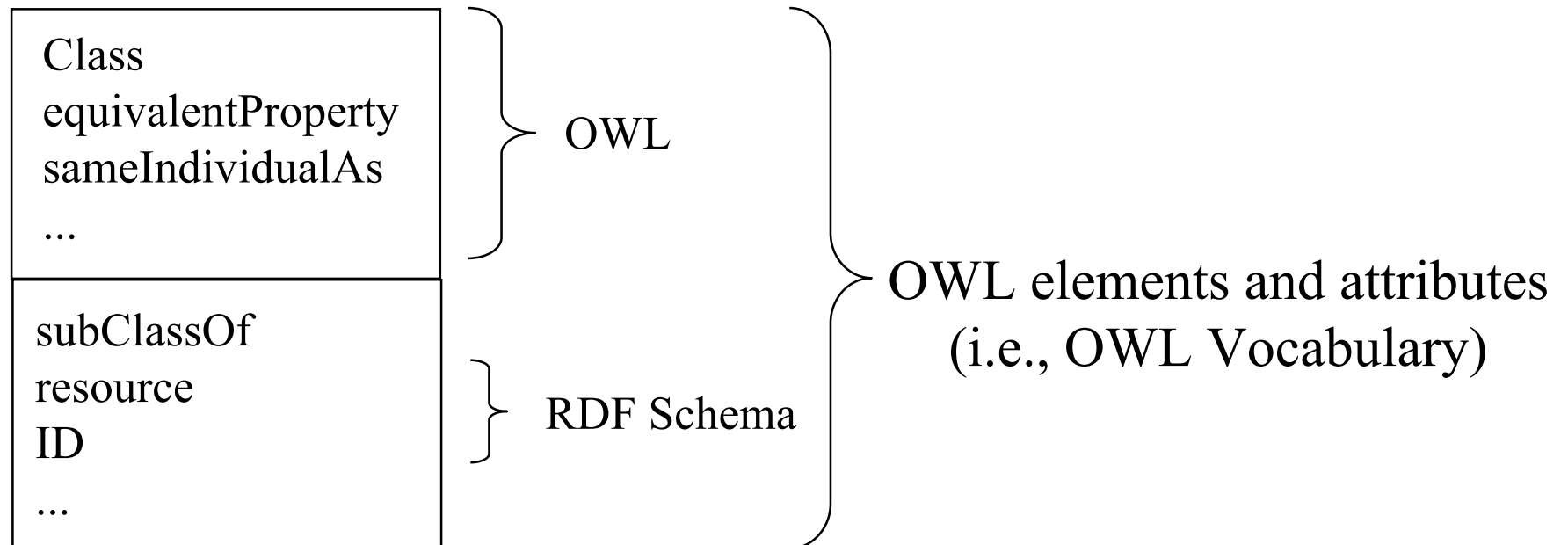
(The creation of this tutorial was sponsored by DARPA)



What is OWL?

Answer: OWL is a set of XML elements and attributes, with standardized meaning, that are used to define terms and their relationships.

OWL extends RDF Schema:





Example of using OWL to define two terms and their relationship

Example: Define the terms "Camera" and "SLR".
State that SLRs are a type of Camera.

Here's how these two terms (classes) and their
relationship is defined using the OWL vocabulary:

```
<owl:Class rdf:ID="Camera"/>
```

```
<owl:Class rdf:ID="SLR">  
  <rdfs:subClassOf rdf:resource="#Camera"/>  
</owl:Class>
```



Quick Intro Contents

- In this quick intro we present an example to demonstrate one of the utilities of OWL:
 - The example shows how OWL can be used to bridge terminology differences and thus enhance interoperability.



Example: Bridging the Terminology Gap using OWL

- A key problem in achieving interoperability is to be able to recognize that two pieces of data are talking about the same thing, even though different terminology is being used.
- The following slides presents an example to show how OWL may be used to bridge the "terminology gap".



Interested in Purchasing a Camera

- Scenario:
 - I am interested in purchasing a camera with a 75-300mm zoom lens size, that has an aperture of 4.5-5.6, and a shutter speed that ranges from 1/500 sec. to 1.0 sec.
 - I launch my personal "Web Bot" which crawls the Web looking for Web sites that can fulfill my request.
 - Assume that there exists an OWL Camera Ontology, which the Web Bot can "consult" upon its travels across the Web.



Is this document relevant?

The Web Bot
finds this
document at a
Web site:

```
<PhotographyStore rdf:ID="Hunts"
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  <store-location>Malden, MA</store-location>
  <phone>617-555-1234</phone>
  <catalog rdf:parseType="Collection">
    <SLR rdf:ID="Olympus-OM-10"
      xmlns="http://www.camera.org#">
      <lens>
        <Lens>
          <focal-length>75-300mm zoom</focal-length>
          <f-stop>4.5-5.6</f-stop>
        </Lens>
      </lens>
      <body>
        <Body>
          <shutter-speed rdf:parseType="Resource">
            <min>0.002</min>
            <max>1.0</max>
            <units>seconds</units>
          </shutter-speed>
        </Body>
      </body>
      <cost rdf:parseType="Resource">
        <rdf:value>325</rdf:value>
        <currency>USD</currency>
      </cost>
    </SLR>
  </catalog>
</PhotographyStore>
```

Is it relevant?

(Note: SLR = Single Lens
Reflex)



A Match?

```
<PhotographyStore rdfID="Hunts"
  xmlns:rdf="&rdf#">
  <store-location>Malden, MA</store-location>
  <phone>617-555-1234</phone>
  <catalog rdfparseType="Collection">
    <SLR rdfID="Olympus-OM-10"
      xmlns="http://www.camera.org#">
      <lens>
        <Lens>
          <focal-length>75-300mm zoom</focal-length>
          <f-stop>4.5-5.6</f-stop>
        </Lens>
      </lens>
      <body>
        <Body>
          <shutter-speed rdfparseType="Resource">
            <min>0.002</min>
            <max>1.0</max>
            <units>seconds</units>
          </shutter-speed>
        </Body>
      </body>
      <cost rdfparseType="Resource">
        <rdf:value>325</rdf:value>
        <currency>USD</currency>
      </cost>
    </SLR>
  </catalog>
</PhotographyStore>
```

← Match? →

I am interested in purchasing a camera with a 75-300mm zoom lens (size), that has an aperture of 4.5-5.6, and a shutter speed that ranges from 1/500 sec. to 1.0 sec.

To determine if there is a match, these questions must be answered:

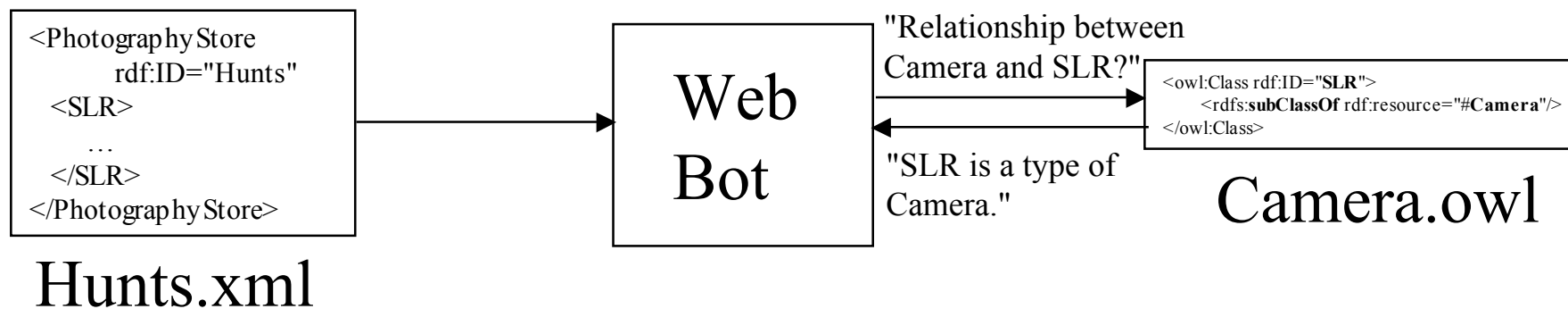
1. What's the relationship between "SLR" and "Camera"?
2. What's the relationship between "focal-length" and "size"?
3. What's the relationship between "f-stop" and "aperture"?



Relationship between SLR and Camera?

The Web Bot "consults" the OWL Camera Ontology. This OWL statement tells the Web Bot that a SLR is a type of Camera:

```
<owl:Class rdf:ID="SLR">
  <rdfs:subClassOf rdf:resource="#Camera"/>
</owl:Class>
```



Relationship between focal-length and lens size?

This OWL statement tells the Web Bot that focal-length is equivalent to lens size:

```
<owl:DatatypeProperty rdf:ID="focal-length">  
  <owl:equivalentProperty rdf:resource="#size"/>  
  <rdfs:domain rdf:resource="#Lens"/>  
  <rdfs:range rdf:resource="&xsd;#string"/>  
</owl:DatatypeProperty>
```

"focal-length is synonymous with (lens) size.
focal-length is to be used within a Lens.
focal-length has a value that is a string."

Relationship between f-stop and aperture?

This OWL statement tells the Web Bot that f-stop is equivalent to aperture:

```
<owl:DatatypeProperty rdf:ID="f-stop">  
  <owl:equivalentProperty rdf:resource="#aperture"/>  
  <rdfs:domain rdf:resource="#Lens"/>  
  <rdfs:range rdf:resource="&xsd;#string"/>  
</owl:DatatypeProperty>
```

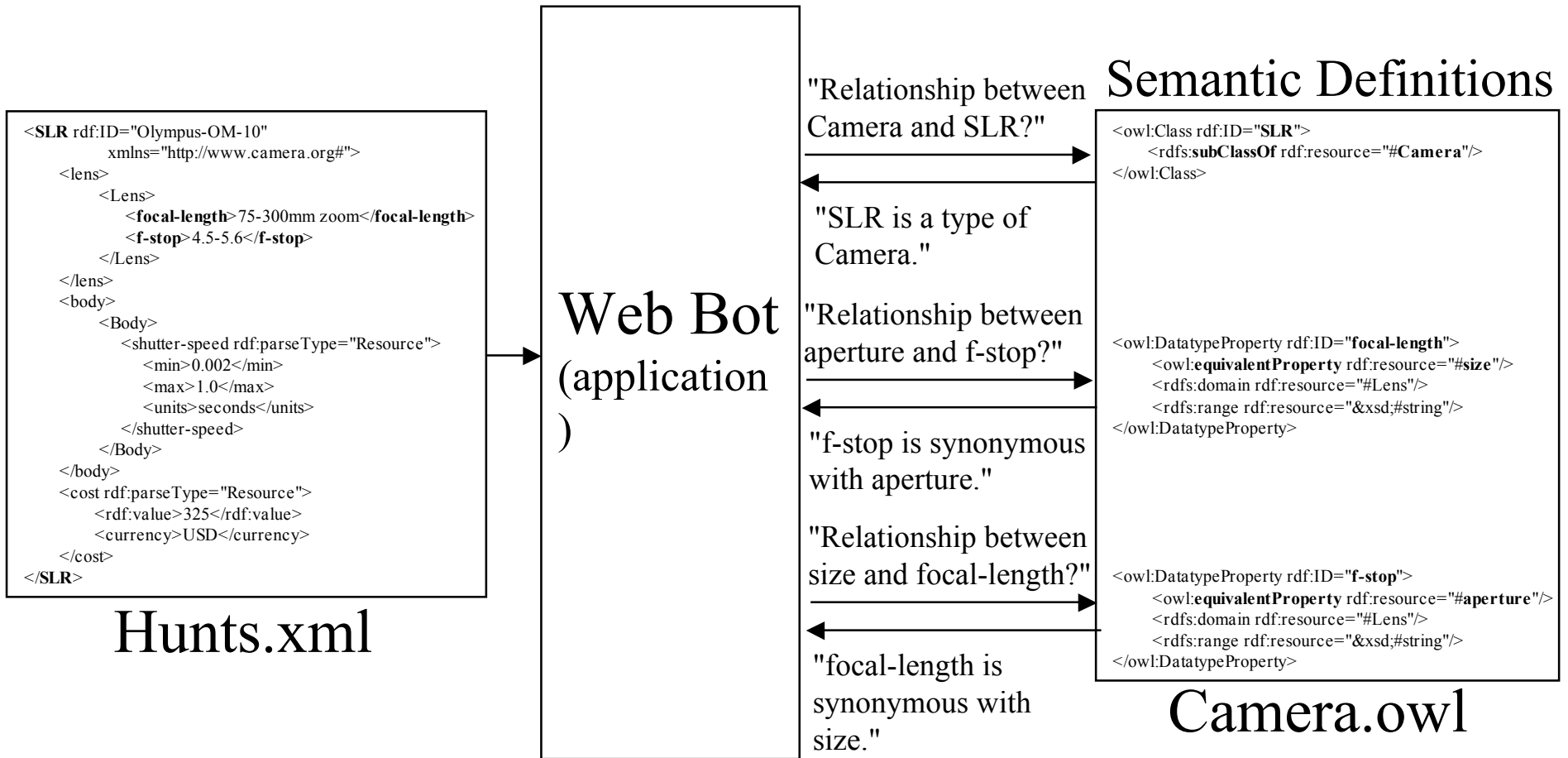
The Web Bot now recognizes that the XML document it found at the Web site

- is talking about Cameras, and it
- does show the lens size, and it
- does show the aperture for the camera, and
- the values for lens size, aperture, and shutter speed are met.

Thus, the Web Bot recognizes that the XML document is a match!



Semantic Definitions Separate from Application!



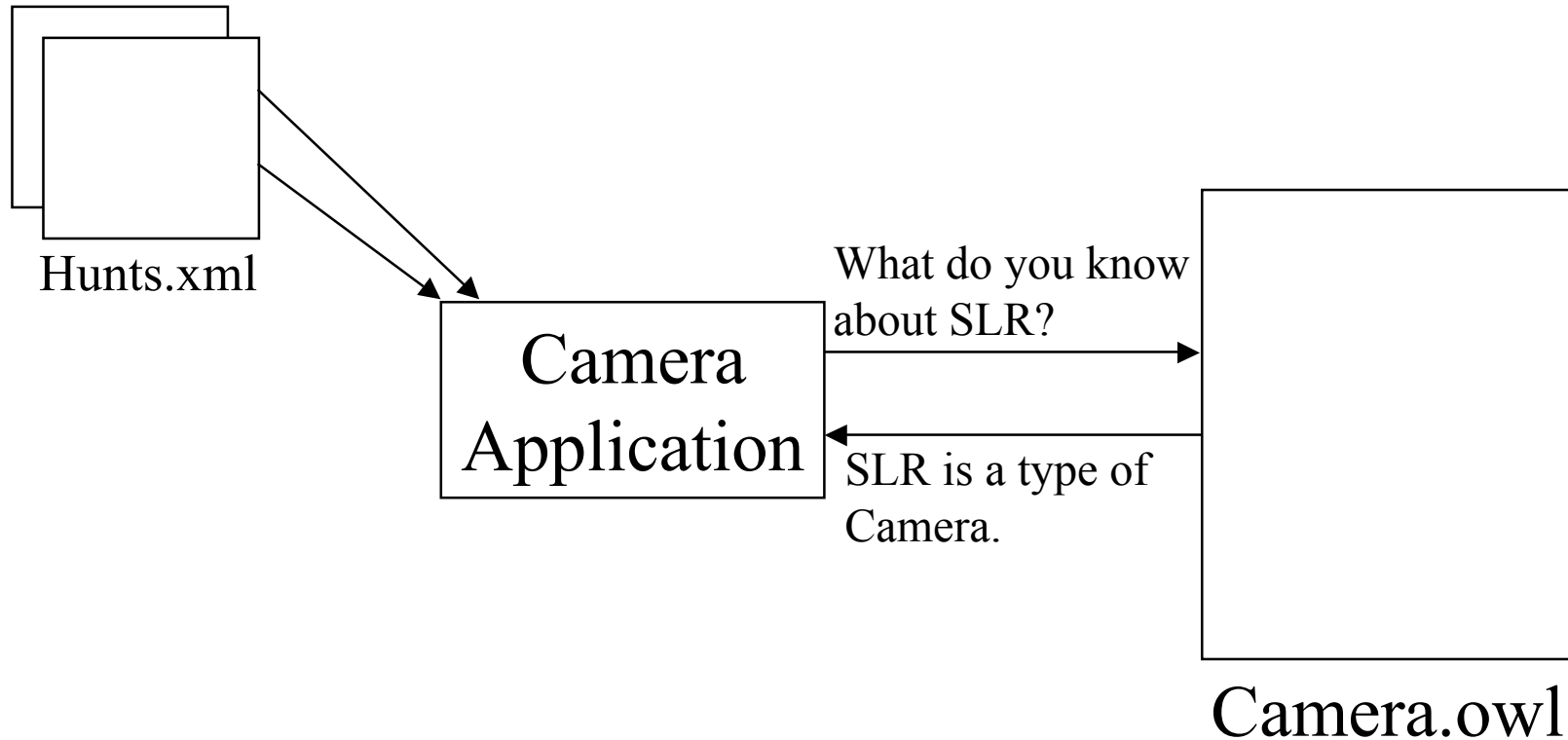
See the article "*Why use OWL?*" for a discussion of why it is good practice to separate the semantic definitions from the application.



Summary: Interoperability despite terminology differences!

- The example demonstrated how a Web Bot application was able to dynamically process an XML document from a Web site, despite the fact that the XML document used terminology different than was used to express the request. This interoperability was achieved by using the OWL Camera Ontology!
- This example also demonstrated the architectural design principle of cleanly separating the application code (e.g., Web Bot) from the semantic definitions (e.g., Camera.owl).

Demo of interoperability in a heterogeneous data environment





Demo - searching for Camera, lens size, aperture info

- The Camera Application is searching for documents that meet this desire:
 - I am interested in purchasing a Camera with a 75-300mm zoom lens size, that has an aperture of 4.5-5.6, and a shutter speed that ranges from 1/500 sec. to 1.0 sec.
- The Camera Application understands the terms (i.e., elements) Camera, lens size, and aperture.
- If a document uses terms that it does not understand, then the Camera application "consults" the Camera Ontology.

Hunts.xml - uses unfamiliar terminology

```
<PhotographyStore>
  <catalog rdf:parseType="Collection">
    <SLR rdf:ID="Olympus-OM-10"
      xmlns="http://www.xfront.com/owl/ontologies/camera/#">
      <lens>
        <Lens>
          <focal-length>75-300mm zoom</focal-length>
          <f-stop>4.5-5.6</f-stop>
        </Lens>
      </lens>
      <body>
        <Body>
          <shutter-speed rdf:parseType="Resource">
            <min>0.002</min>
            <max>1.0</max>
            <units>seconds</units>
          </shutter-speed>
        </Body>
      </body>
    </SLR>
  </catalog>
</PhotographyStore>
```

?

Need to consult the Camera Ontology!



QuikPhoto.xml - uses familiar terminology

```
<Camera>
  <lens>
    <Lens>
      <size>75-300mm zoom</size>
      <aperture>4.5-5.6</aperture>
    </Lens>
  </lens>
  <body>
    <Body>
      <shutter-speed rdf:parseType="Resource">
        <min>0.002</min>
        <max>1.0</max>
        <units>seconds</units>
      </shutter-speed>
    </Body>
  </body>
</Camera>
```

No need to
consult the
Camera
Ontology.

Lesson Learned

- The Camera Application is able to process documents that uses unfamiliar terminology.

