What is RDF?

- RDF stands for **R**esource **D**escription **F**ramework
- RDF is a framework for describing resources on the web
- RDF is designed to be read and understood by computers
- RDF is not designed for being displayed to people
- RDF is written in XML
- RDF is a part of the W3C's Semantic Web Activity
- RDF is a W3C Recommendation from 10. February 2004

RDF - Examples of Use

- Describing properties for shopping items, such as price and availability
- Describing time schedules for web events
- Describing information about web pages (content, author, created and modified date)
- Describing content and rating for web pictures
- Describing content for search engines
- Describing electronic libraries

RDF is Designed to be Read by Computers

RDF was designed to provide a common way to describe information so it can be read and understood by computer applications.

RDF descriptions are not designed to be displayed on the web.

RDF is Written in XML

RDF documents are written in XML. The XML language used by RDF is called RDF/XML.

By using XML, RDF information can easily be exchanged between different types of computers using different types of operating systems and application languages.

RDF and "The Semantic Web"

The RDF language is a part of the W3C's Semantic Web Activity. W3C's "Semantic Web Vision" is a future where:

- Web information has exact meaning
- Web information can be understood and processed by computers
- Computers can integrate information from the web

RDF uses Web identifiers (URIs) to identify resources.

RDF describes resources with properties and property values.

RDF Resource, Property, and Property Value

RDF identifies things using Web identifiers (URIs), and describes resources with properties and property values.

Explanation of Resource, Property, and Property value:

- A **Resource** is anything that can have a URI, such as "https://www.w3schools.com/rdf"
- A **Property** is a Resource that has a name, such as "author" or "homepage"
- A **Property value** is the value of a Property, such as "Jan Egil Refsnes" or "https://www.w3schools.com" (note that a property value can be another resource)

The following RDF document could describe the resource "https://www.w3schools.com/rdf":

```
<?xml version="1.0"?>

<RDF>
 <Description about="https://www.w3schools.com/rdf">
  <author>Jan Egil Refsnes</author>
  <homepage>https://www.w3schools.com</homepage>
 </Description>
</RDF>
```

The example above is simplified. Namespaces are omitted.

RDF Statements

The combination of a Resource, a Property, and a Property value forms a **Statement** (known as the **subject, predicate and object** of a Statement).

Let's look at some example statements to get a better understanding:

Statement: "The author of https://www.w3schools.com/rdf is Jan Egil Refsnes".

- The subject of the statement above is: https://www.w3schools.com/rdf
- The predicate is: author
- The object is: Jan Egil Refsnes

Statement: "The homepage of https://www.w3schools.com/rdf is https://www.w3schools.com".

- The subject of the statement above is: https://www.w3schools.com/rdf
- The predicate is: homepage
- The object is: https://www.w3schools.com

RDF Example

Here are two records from a CD-list:

Title	Artist	Country	Company	Price	Year
Empire Burlesque	Bob Dylan	USA	Columbia	10.90	1985
Hide your heart	Bonnie Tyler	UK	CBS Records	9.90	1988

Below is a few lines from an RDF document:

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Empire Burlesque">
  <cd:artist>Bob Dylan</cd:artist>
  <cd:country>USA</cd:country>
  <cd:company>Columbia</cd:company>
```

```
  <cd:price>10.90</cd:price>
  <cd:year>1985</cd:year>
</rdf:Description>

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Hide your heart">
  <cd:artist>Bonnie Tyler</cd:artist>
  <cd:country>UK</cd:country>
  <cd:company>CBS Records</cd:company>
  <cd:price>9.90</cd:price>
  <cd:year>1988</cd:year>
</rdf:Description>
.
.
.
</rdf:RDF>
```

The first line of the RDF document is the XML declaration. The XML declaration is followed by the root element of RDF documents: **<rdf:RDF>**.

The **xmlns:rdf** namespace, specifies that elements with the rdf prefix are from the namespace "http://www.w3.org/1999/02/22-rdf-syntax-ns#".

The **xmlns:cd** namespace, specifies that elements with the cd prefix are from the namespace "http://www.recshop.fake/cd#".

The **<rdf:Description>** element contains the description of the resource identified by the **rdf:about** attribute.

The elements: **<cd:artist>, <cd:country>, <cd:company>,** etc. are properties of the resource.

RDF Online Validator

W3C's RDF Validation Service is useful when learning RDF. Here you can experiment with RDF files.

The online RDF Validator parses your RDF document, checks your syntax, and generates tabular and graphical views of your RDF document.

Copy and paste the example below into W3C's RDF validator:

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:si="https://www.w3schools.com/rdf/">
<rdf:Description rdf:about="https://www.w3schools.com">
  <si:title>W3Schools.com</si:title>
  <si:author>Jan Egil Refsnes</si:author>
</rdf:Description>
</rdf:RDF>
```

When you parse the example above, the result will look something like this.

Triples of the Data Model

Subject	Predicate	Object
https://www.w3schools.com	https://www.w3schools.com/rdf/title	"W3Schools.com"
https://www.w3schools.com	https://www.w3schools.com/rdf/author	"Jan Egil Refsnes"

The original RDF/XML document

```
1: <?xml version="1.0"?>
2: <rdf:RDF
3: xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
4: xmlns:si="https://www.w3schools.com/rdf/">
5: <rdf:Description rdf:about="https://www.w3schools.com">
6: <si:title>W3Schools.com</si:title>
7: <si:author>Jan Egil Refsnes</si:author>
8: </rdf:Description>
9: </rdf:RDF>
```

Graph of the data model

RDF Elements

The main elements of RDF are the root element, <RDF>, and the <Description> element, which identifies a resource.

The <rdf:RDF> Element

<rdf:RDF> is the root element of an RDF document. It defines the XML document to be an RDF document. It also contains a reference to the RDF namespace:

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
  ...Description goes here...
</rdf:RDF>
```

The <rdf:Description> Element

The <rdf:Description> element identifies a resource with the about attribute.

The <rdf:Description> element contains elements that describe the resource:

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Empire Burlesque">
  <cd:artist>Bob Dylan</cd:artist>
  <cd:country>USA</cd:country>
  <cd:company>Columbia</cd:company>
  <cd:price>10.90</cd:price>
  <cd:year>1985</cd:year>
</rdf:Description>
```

```
</rdf:RDF>
```

The elements, artist, country, company, price, and year, are defined in the http://www.recshop.fake/cd# namespace. This namespace is outside RDF (and not a part of RDF). RDF defines only the framework. The elements, artist, country, company, price, and year, must be defined by someone else (company, organization, person, etc).

Properties as Attributes

The property elements can also be defined as attributes (instead of elements):

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Empire Burlesque"
cd:artist="Bob Dylan" cd:country="USA"
cd:company="Columbia" cd:price="10.90"
cd:year="1985" />

</rdf:RDF>
```

Properties as Resources

The property elements can also be defined as resources:

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Empire Burlesque">
```

```
 <cd:artist rdf:resource="http://www.recshop.fake/cd/dylan" />
 ...
 ...
</rdf:Description>

</rdf:RDF>
```

In the example above, the property artist does not have a value, but a reference to a resource containing information about the artist.

RDF Containers

RDF containers are used to describe group of things.

The following RDF elements are used to describe groups: <Bag>, <Seq>, and <Alt>.

The <rdf:Bag> Element

The <rdf:Bag> element is used to describe a list of values that do not have to be in a specific order.

The <rdf:Bag> element may contain duplicate values.

Example

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Beatles">
 <cd:artist>
  <rdf:Bag>
   <rdf:li>John</rdf:li>
   <rdf:li>Paul</rdf:li>
   <rdf:li>George</rdf:li>
   <rdf:li>Ringo</rdf:li>
```

```
  </rdf:Bag>
 </cd:artist>
</rdf:Description>

</rdf:RDF>
```

The <rdf:Seq> Element

The <rdf:Seq> element is used to describe an ordered list of values (For example, in alphabetical order).

The <rdf:Seq> element may contain duplicate values.

Example

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Beatles">
 <cd:artist>
  <rdf:Seq>
   <rdf:li>George</rdf:li>
   <rdf:li>John</rdf:li>
   <rdf:li>Paul</rdf:li>
   <rdf:li>Ringo</rdf:li>
  </rdf:Seq>
 </cd:artist>
</rdf:Description>

</rdf:RDF>
```

The <rdf:Alt> Element

The <rdf:Alt> element is used to describe a list of alternative values (the user can select only one of the values).

Example

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://www.recshop.fake/cd#">

<rdf:Description
rdf:about="http://www.recshop.fake/cd/Beatles">
 <cd:format>
  <rdf:Alt>
   <rdf:li>CD</rdf:li>
   <rdf:li>Record</rdf:li>
   <rdf:li>Tape</rdf:li>
  </rdf:Alt>
 </cd:format>
</rdf:Description>

</rdf:RDF>
```

RDF Terms

In the examples above we have talked about "list of values" when describing the container elements. In RDF these "list of values" are called members.

So, we have the following:

- A container is a resource that contains things
- The contained things are called members (not list of values)

RDF Collections

RDF collections describe groups that can ONLY contain the specified members.

The rdf:parseType="Collection" Attribute

As seen in the previous chapter, a container says that the containing resources are members - it does not say that other members are not allowed.

RDF collections are used to describe groups that can ONLY contain the specified members.

A collection is described by the attribute rdf:parseType="Collection".

Example

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:cd="http://recshop.fake/cd#">

<rdf:Description
rdf:about="http://recshop.fake/cd/Beatles">
 <cd:artist rdf:parseType="Collection">
  <rdf:Description rdf:about="http://recshop.fake/cd/Beatles/George"/>
  <rdf:Description rdf:about="http://recshop.fake/cd/Beatles/John"/>
  <rdf:Description rdf:about="http://recshop.fake/cd/Beatles/Paul"/>
  <rdf:Description rdf:about="http://recshop.fake/cd/Beatles/Ringo"/>
 </cd:artist>
</rdf:Description>

</rdf:RDF>
```

RDF Schema and Application Classes

RDF Schema (RDFS) is an extension to RDF.

RDF describes resources with classes, properties, and values.

In addition, RDF also needs a way to define application-specific classes and properties. Application-specific classes and properties must be defined using extensions to RDF.

One such extension is RDF Schema.

RDF Schema (RDFS)

RDF Schema does not provide actual application-specific classes and properties.

Instead RDF Schema provides the framework to describe application-specific classes and properties.

Classes in RDF Schema are much like classes in object oriented programming languages. This allows resources to be defined as instances of classes, and subclasses of classes.

RDFS Example

The following example demonstrates some of the RDFS facilities:

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xml:base="http://www.animals.fake/animals#">

<rdf:Description rdf:ID="animal">
 <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
</rdf:Description>

<rdf:Description rdf:ID="horse">
 <rdf:type rdf:resource="http://www.w3.org/2000/01/rdf-schema#Class"/>
 <rdfs:subClassOf rdf:resource="#animal"/>
</rdf:Description>

</rdf:RDF>
```

In the example above, the resource "horse" is a subclass of the class "animal".

Example Abbreviated

Since an RDFS class is an RDF resource we can abbreviate the example above by using rdfs:Class instead of rdf:Description, and drop the rdf:type information:

```
<?xml version="1.0"?>

<rdf:RDF
```

```
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
xml:base="http://www.animals.fake/animals#">

<rdfs:Class rdf:ID="animal" />

<rdfs:Class rdf:ID="horse">
  <rdfs:subClassOf rdf:resource="#animal"/>
</rdfs:Class>

</rdf:RDF>
```

That's it!

The Dublin Core

The Dublin Core Metadata Initiative (DCMI) has created some predefined properties for describing documents.

RDF is metadata (data about data). RDF is used to describe information resources.

The Dublin Core is a set of predefined properties for describing documents.

The first Dublin Core properties were defined at the **Metadata Workshop in Dublin, Ohio** in 1995 and is currently maintained by the Dublin Core Metadata Initiative.

Property	Definition
Contributor	An entity responsible for making contributions to the content of the resource
Coverage	The extent or scope of the content of the resource
Creator	An entity primarily responsible for making the content of the resource
Format	The physical or digital manifestation of the resource
Date	A date of an event in the lifecycle of the resource
Description	An account of the content of the resource

Identifier	An unambiguous reference to the resource within a given context
Language	A language of the intellectual content of the resource
Publisher	An entity responsible for making the resource available
Relation	A reference to a related resource
Rights	Information about rights held in and over the resource
Source	A Reference to a resource from which the present resource is derived
Subject	A topic of the content of the resource
Title	A name given to the resource
Type	The nature or genre of the content of the resource

A quick look at the table above indicates that RDF is ideal for representing Dublin Core information.

RDF Example

The following example demonstrates the use of some of the Dublin Core properties in an RDF document:

```
<?xml version="1.0"?>

<rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:dc= "http://purl.org/dc/elements/1.1/">

<rdf:Description rdf:about="https://www.w3schools.com">
  <dc:description>W3Schools - Free tutorials</dc:description>
  <dc:publisher>Refsnes Data as</dc:publisher>
  <dc:date>2008-09-01</dc:date>
  <dc:type>Web Development</dc:type>
  <dc:format>text/html</dc:format>
  <dc:language>en</dc:language>
</rdf:Description>
```

```
</rdf:RDF>
```

RDF Reference

The RDF namespace (xmlns:rdf) is: http://www.w3.org/1999/02/22-rdf-syntax-ns#

The RDFS namespace (xmlns:rdfs) is: http://www.w3.org/2000/01/rdf-schema#

The recommended file extension for RDF files is **.rdf**. However, the extension **.xml** is often used to provide compatibility with old xml parsers.

The MIME type should be **"application/rdf+xml"**.

RDFS / RDF Classes

Element	Class of	Subclass of
rdfs:Class	All classes	
rdfs:Datatype	Data types	Class
rdfs:Resource	All resources	Class
rdfs:Container	Containers	Resource
rdfs:Literal	Literal values (text and numbers)	Resource
rdf:List	Lists	Resource
rdf:Property	Properties	Resource
rdf:Statement	Statements	Resource
rdf:Alt	Containers of alternatives	Container
rdf:Bag	Unordered containers	Container
rdf:Seq	Ordered containers	Container

rdfs:ContainerMembershipProperty	Container membership properties	Property
rdf:XMLLiteral	XML literal values	Literal

RDFS / RDF Properties

Element	Domain	Range	Description
rdfs:domain	Property	Class	The domain of the resource
rdfs:range	Property	Class	The range of the resource
rdfs:subPropertyOf	Property	Property	The property is a sub property of a property
rdfs:subClassOf	Class	Class	The resource is a subclass of a class
rdfs:comment	Resource	Literal	The human readable description of the resource
rdfs:label	Resource	Literal	The human readable label (name) of the resource
rdfs:isDefinedBy	Resource	Resource	The definition of the resource
rdfs:seeAlso	Resource	Resource	The additional information about the resource
rdfs:member	Resource	Resource	The member of the resource
rdf:first	List	Resource	
rdf:rest	List	List	
rdf:subject	Statement	Resource	The subject of the resource in an RDF Statement
rdf:predicate	Statement	Resource	The predicate of the resource in an RDF Statement
rdf:object	Statement	Resource	The object of the resource in an RDF Statement
rdf:value	Resource	Resource	The property used for values
rdf:type	Resource	Class	The resource is an instance of a class

RDF Attributes

Attribute	Description
rdf:about	Defines the resource being described
rdf:Description	Container for the description of a resource
rdf:resource	Defines a resource to identify a property
rdf:datatype	Defines the data type of an element
rdf:ID	Defines the ID of an element
rdf:li	Defines a list
rdf:_*n*	Defines a node
rdf:nodeID	Defines the ID of an element node
rdf:parseType	Defines how an element should be parsed
rdf:RDF	The root of an RDF document
xml:base	Defines the XML base
xml:lang	Defines the language of the element content