UNIT-D

Ontology-Based Knowledge Representation.

* Ontologies and ontology languages have existed long before the semantic web.

* Semantic web is to extend unstructured Information which machine processable descriptions of the meaning (semantics) of Information.

* Challege of the semantic web as to ensure a shared interpretation of Information.

## Characteristics:-

* Ontologies build upon a shared understanding within a community.

* RDF and OWL are the languages most commonly used on the semantic web.

* It is hierarchy between the concepts (Subclass Relationships).

* Light weight ontology is Typically applica on ontologies.

* Heavyweight ontologies allow to describe

more precisely how classes are composed of
other classes.

Ontologies and ontology languages for the
semantic web:

  * The notion of ontologies is independent
of the web, ontologies play a special role in
the architecture of the semantic web.
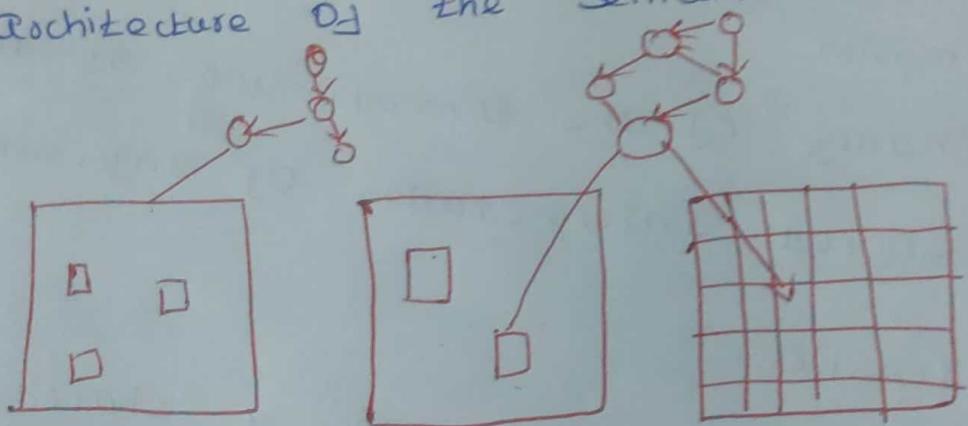
ontology languages for the semantic web:
  * The ontology languages RDF and OWL
have been standarized in recent years by
the world wide web consortium.

The Resource Description framework (RDF)
and PDF schema:-

  * RDF is domain-independent, Two kind
of primitives in RDF;   * Resources
            * Literals.

aggregator determines the atomic data and aggregates it.

- In the data processing Technique, data aggregators use numerous algorithms form the AI (or) ML techniques.

- And also utilizes statical Methodology to process it like the predictive analysis.

Presentation of data;

- In this step, the gathered Information will be summarized, providing a desirable statistical output with accurate data.

Data Aggregation can be divided into two Different Types: -

- Time Aggregation
- Spatial Aggregation.

Time Aggregation:-

- Time aggreation provides the data point for an Individual resource for a defined period.

Modelling and aggregation:

- Data Agreegator
- Working of data aggregators
    - Collection of data.
    - processing of data
    - presentation of data

Collection of Data | Processing Data | Presentation of data
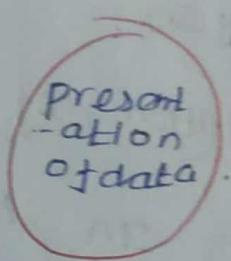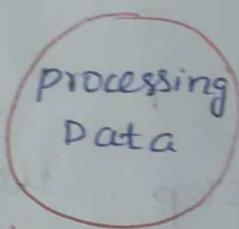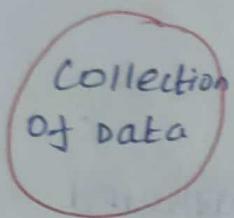
Collection of Data:-

collection of Data means, gathering Data from Different sources. The data can be extracted using the Internet of Things (IOT) such as

✓ Social Media Interaction.

✓ News headlines

✓ Speach recognition like call centers.

✓ Browsing Personal data and history of Devices

processing of data:

- Once data is collected, the data

* It also provides the Basic term & features to describe collections of instances and to make statements about statements.

The web ontology Language: (2 mark)

* The web ontology Language (OWL) was designed to add Constructs of
(DL) Description Language

* OWL Lite, OWL, DL and OWL full are set of three languages in OWL

* every OWL Lite document is a valid OWL DL document and has same semantics.

* OWL DL was the original target of standardization and it is a direct mapping to an expressive Description Logic.

* The full is a "limitless" OWL

D2

* Every RDF ontology is also a valid OWL full ontology and has the same semantics when considered as an OWL full Document.

* Resources are either Identified by URI or left blank.

* URI are identifiers with a special syntax.

* Blank Resources (Blank nodes) are the existential quantifiers of the language.

* Literals are strings [character Literals] with optional language and data type Identifiers

* Expressions are formed by making statements (Triples) of the form.
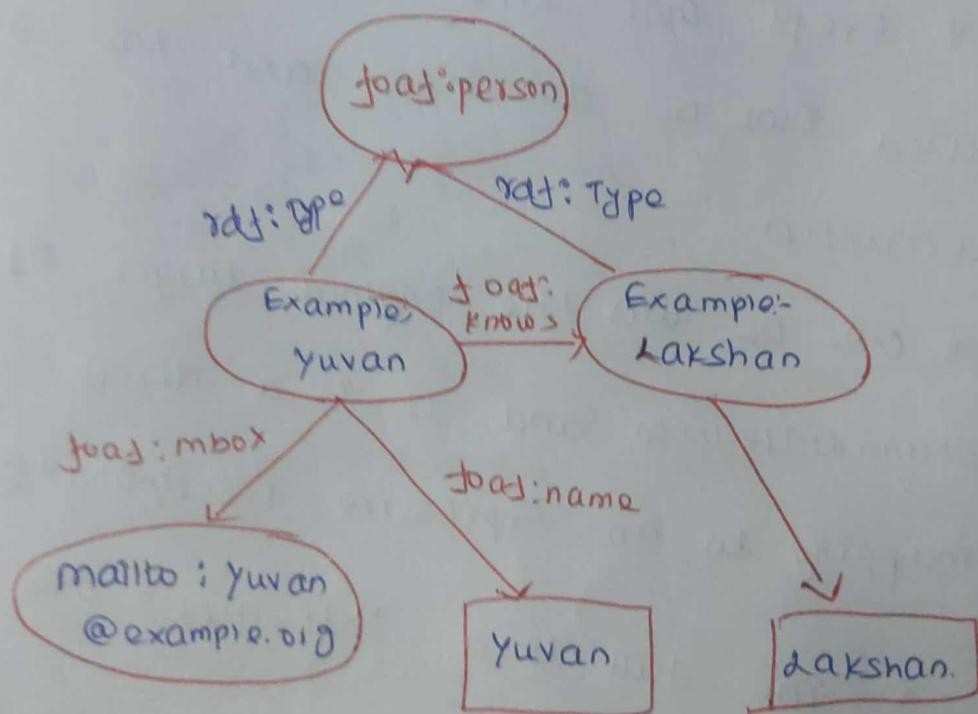
* RDF language provides the Basic Term to assign a Type to resource and to declare Resource property.

Data architatures Design this model.

- **physical Model:**
  - The physical model specifies how we Implement the data model through the Data Base management systems.
  - Data Base Developers and Administrator Create the physical model.

  Types of Data Models:-

- ER - [Entity Relationship Model):-
  - Establishes the theoretical view of of the data Bases.

- Entity:-
  The entity is a real - world object, we can Identify easily

- Entity:-
  Entity set is a group of similar Types of entities.

- Attributes:-
  Every attribute will have value.

Spatial aggregation:

- Spatial aggregation provides the data point for various groups of resources for a defined period.

Note: Data point,

Modelling In Data Mining:

- Data modelling occurs at three levels

1) physical model
2) Conceputal model
3) Logical data model

Logical Data model.

- The logical data model tells us how we should Implement the model.

- It contains all types of data what we need to capture like columns, tables etc.,

Conceptual Model:

- It mostly concentrates on Business oriented attributes, relations and entries

✓ Generally Business stake holders

- "Publish" is the Relationship between the "publisher" entity and the "Book" entity.

- Publisher can Publish many Books.

- It is a one to many Relationship.

2) Hierarchical model-

- Every child node have one parent node.

Example:-

One college can have different Departments and many faculties.

```
                    +-----------+
                    |  College  |
                    +-----------+
                     /         \
                    /           \
          +------------+      +-----------+
          | Department |      |  Infra    |
          +------------+      | Structure.|
             /    |   \       +-----------+
            /     |    \
      +--------+ +---------+ +----------+
      | Course | | Teachers| | Students |
      +--------+ +---------+ +----------+
         /   \
        /     \
  +--------+ +-------+
  | Theory | | Labs. |
  +--------+ +-------+
```
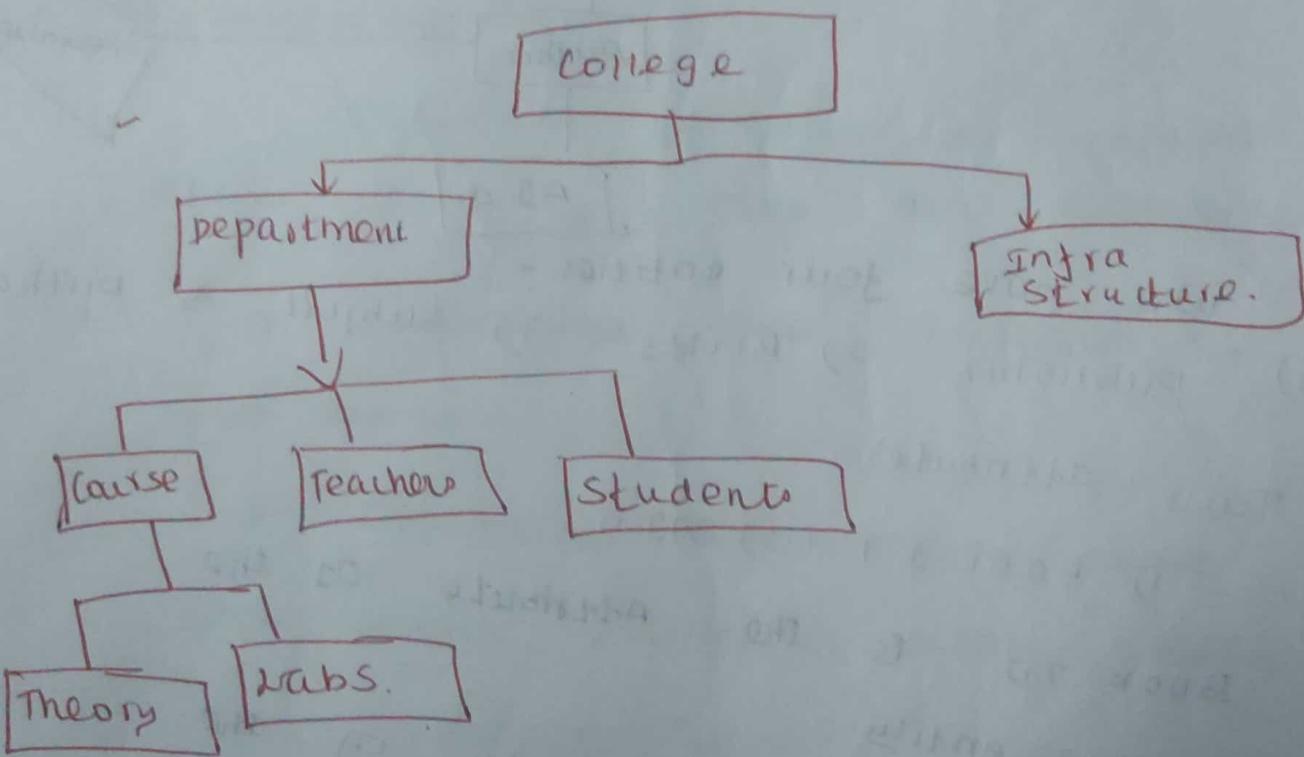
Relation Ship:-

The association among the entities
is known as a relationship.

Ex: Student "Studies" in a school.

Here "Studies" is the Relationship between
the "Student" and School.
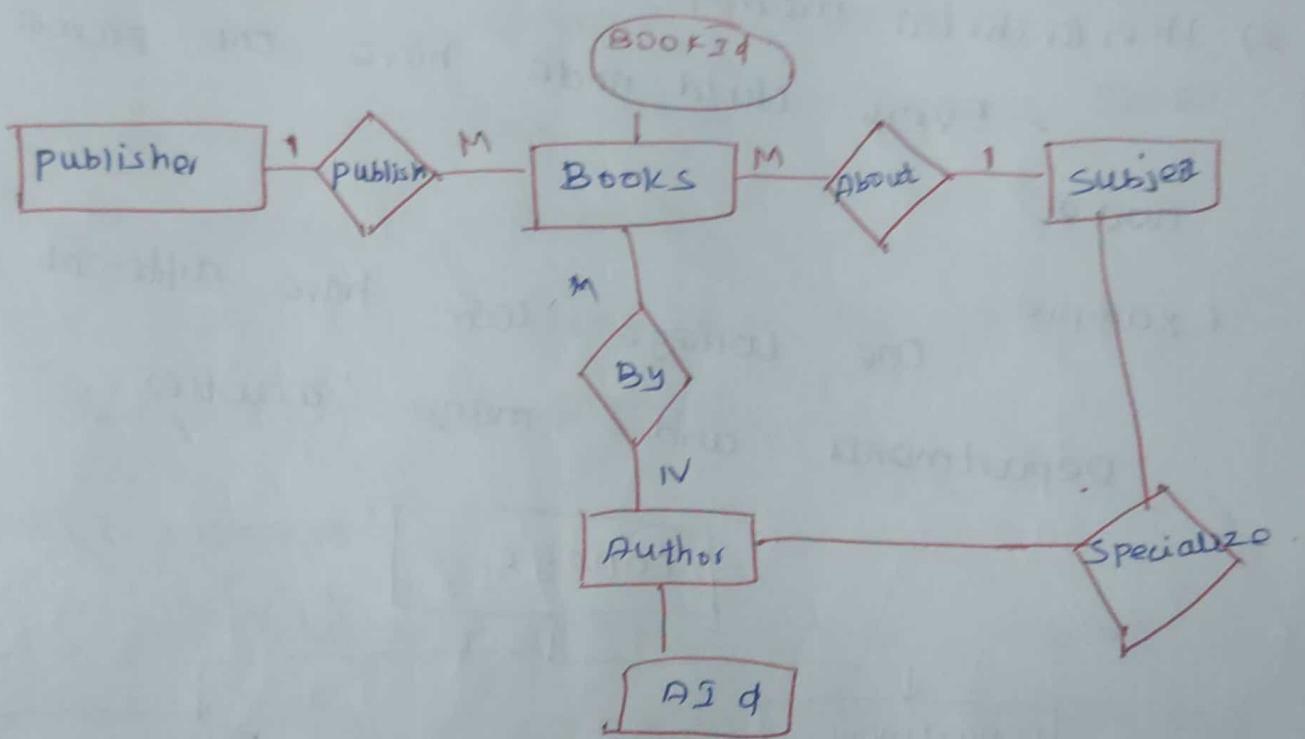
we have four entities:-

1) Publisher   2) Books   3) Subject   4) Author

Two attributes:-

1) BOOK Id   2) AID.

BOOK ID is the Attribute of the
"BOOKS" entity

Author ID is the Attribute of the
"Author" entity.

Resource Description framework:

1. RDF Documents are written in XML.

2. The XML language used by RDF is called RDF/XML.

3. By using XML, RDF Information can easily exchanged Between Difference Types of computer using Different Types of operating Systems.

4. RDF is a Part of the W3C's Semantic Web Activity

RDF_ examples:-

1. Describing properties for Shopping Items, Such as price and availability

2. Describing Time Schedules for web events.

3. Describing Information about web pages. [Content, author, created and modified date].

4. Describing electronic libraries

5. Describing Content for search Engine.

Example:-

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

<RDF>

    <Description
about = " http: // www. w3schools. com/rdf">

    <author> Jan   Egil
Ref snes < / author >

    <homepage> http:// www. w3schools.com

    </home page>
        </ Description>
        </RDF>
```

 - name space are omitted.

RDF statement.

Statement [Known as the
subject, predicate and object of a
statement).

subject of the statement.

 http: // www. w3schools. com/ rdf

 ✓ The predicate is: author

 - The subject is: Jan Egil Refsnes.

Web ontology language.

- ontologies generally describe specific Domains such as scientific research Area.

Example:

Thing

Movie

Person

Script

Thriller

Drama

classes.

Actor

Director

Type of persons.
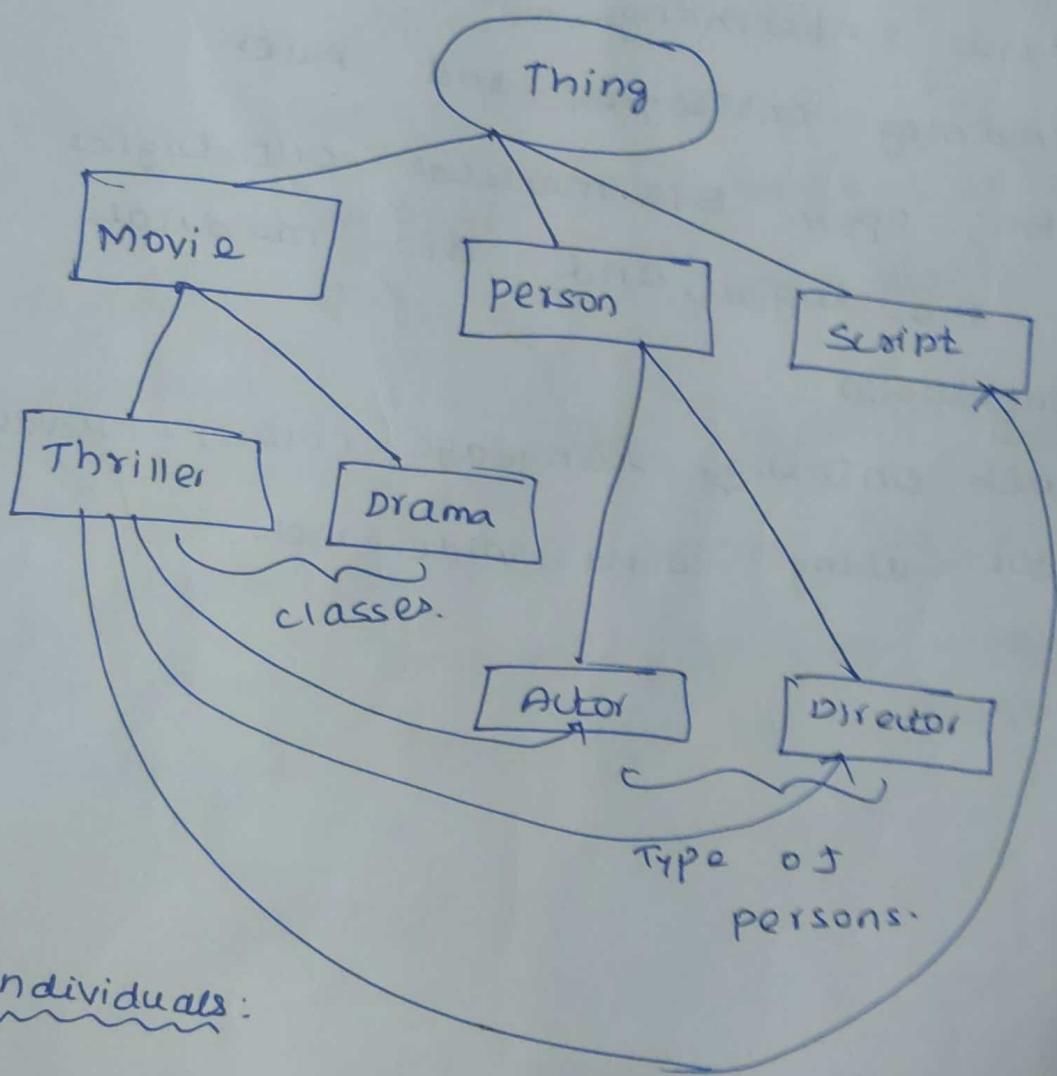
Individuals:

1. Individuals are also known as Instance of object or concepts.

Classes:

Collection of various object.

3. Attributes:-

Like Script, Director, Actors

4. Relations:-

Script and actors in it.

Different ontology languages:

- Cyc2 - First order predicate calculus
- Rule Interchange format (RIF):-
  combining ontologies and rules.
- OBO; open Bio-medical ontologies.
  Bio- logical, and Bio- medical

Ontologies.

- Web ontology Language (OWL)- Developed
  for using World- wide- web.

- In the below hierarchical model, "college" is the Root node and It has two child nodes: 1) Department 2) Infrastructure.

College has one to many Relationship with Department.

3. Relational model:

✓ the relational model is the most common Data model.

- It arranges the data into the Tables, and Tables are also known as relations.

✓ Tables will have column and rows.

- Every row is known as a Tuple.

- that comprise one to many, many to many and one to one Relationships

student name.

Student_Id	
01	Nijay
02	Ramesh
03	Rakesh
04	Varun

Subject Id	
001	Java
002	Linux
003	C
004	C++

| Student_Id	Subject Id
1	002
2	001
	003
3	001

State-of-the-art in Network Data Representation:

1) Graph ML files can be edited, stored, quired, Transformed etc., using generic XML Tools.

2) Attribute Data when entered electronic form is typically stored separately from network data in Excel sheets, databases or SP SS Tables.

Ontological Representation of social individuals:

1) FOAF (Friend-of-a-Friend) is an OWL based format for representing personal Information and an Individual social network.

2) The Idea of FOAF was to provide a machine processable format for representing the kind of Information, that made original web successful, namely the kind of personal Information described in homepages of Individuals.

3) FOAF became the center point of Interest in 2003, with the spread of social networking services such friendster

State of the art in Network data Representation

|H| ; n=4

vertices 4

1. A
2. B
3. C
4. D

Edge

1   1
1   2
1   3
1   4
2

Ddata :
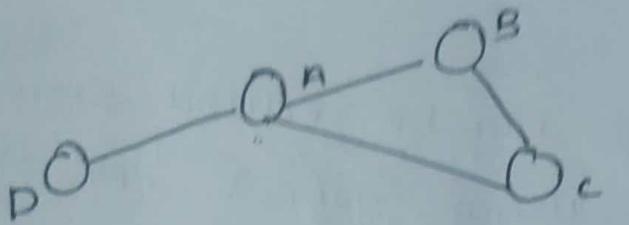
A B
A C
A D
B C.

```
<? xml version = "1. 0"  encoding = " UTF - 8" ?>
<graphml   xmlns = " http'. || graphml. graphdrawing.
           org. | xmlns'7
<graph Id = "G" edge default = " undirected">
   <node  id = "a"/>
   <node  id = "b"/>
   <node  id = "c"/>
   <node  id = "d"/>
   <edge source = "a" target = "b"/>
   <edge source = "a" target = "c"/>
   <edge source = "a" target = "d"/>
   <edge source = "b" target = "c"/>
   </graph>
   </graphml>.
```

LinkedIn etc.,

Drawbacks:

- Information is under the control of Data Base owner.

- FOAF profiles are created and controlled by the Individual user and shared in a distributed fashion.

- FOAF profiles are Typically posted on the personal website of the user and liked from the user's Home page with the HTML META Tag.

FOAF Basics
Agent
person
name
nick
title
Surename
family name
given name
First name.

personal Information
weblog
Interest
current project
Past project
Plan
publications
geek code
Dna checksum.

online
Accounts /M

Online Account
Online chat Account
Online Ecommerce Account
Online Gaming Account
holds Account
Yahoo chat ID
account
name

Projects
and Groups

Project
organization
Group.
member
membership class
theme.

Documents
and Images.

Documents
Image
Personal profile
Document
Topic (page)
thumbnail
logo.

Example:-

Teacher and Student.

Teacher and Students are subclass of

foat; Person.

Ontological Representation of Social Relationships

+ To support the automated Integration of Social Information on a somantical basis.

+ To capture established concepts in social network analysis.

Characterstics of Social Relationships:-

* Sign; A Relationship can Represent both positive and negative attitudes such a like or hate.

* Strength:- The Strength lists the following:-
Frequency/frequent contact, Trust/ Enforceable Trut,

+ Provenance; A Social Relationship may be viewed differentyy by the Individual Participants of the Relationship.

* Relationship history:- Social Relationships come into existence by some event Involving two Individuals.

* Relationship roles:- A Social Relationship may have a number of Social Roles associated with it, which we call Relationship roles.

Conceptual model;

* Social relations could be represented as n-ary predicates

  * To deal n-ary relations we employ the Technique that is known as rajivation.

  * RDF has a reified representation of statements. The raf: statement object represents the class of statements.

  * This class has three properties that correspond to the components of a statement namely raf: subject, raf: predicate, raf: object.

  * Relationship become subclasses of the raf: statement class.

  * Relationship class is related to a general parameter class by the has parameter relationship

  * Relationship Types such as Friendship are subclasses of the Relationship class, while parameter (such as strength or frequency) are subtypes of the parameter class.

rdf:class

rdf:type

foaf:person

foaf:
knows

http://Jack

http://Jill

rdf:
subject

rdf:
predicate

rdf:
object

rdf:Statement

rdfs:-
subclass
of

foaf:x:Relationship

foaf:x:friendship

rdf:type

http://Jack
AND Jill

socio:strength

rdf:class

rdf:
Subclassof

foaf:x:parameter

rdfs:
subclassof

→xsd:
socio.strength Integer

foaf:
x:has
parameter

rdf:Type

12
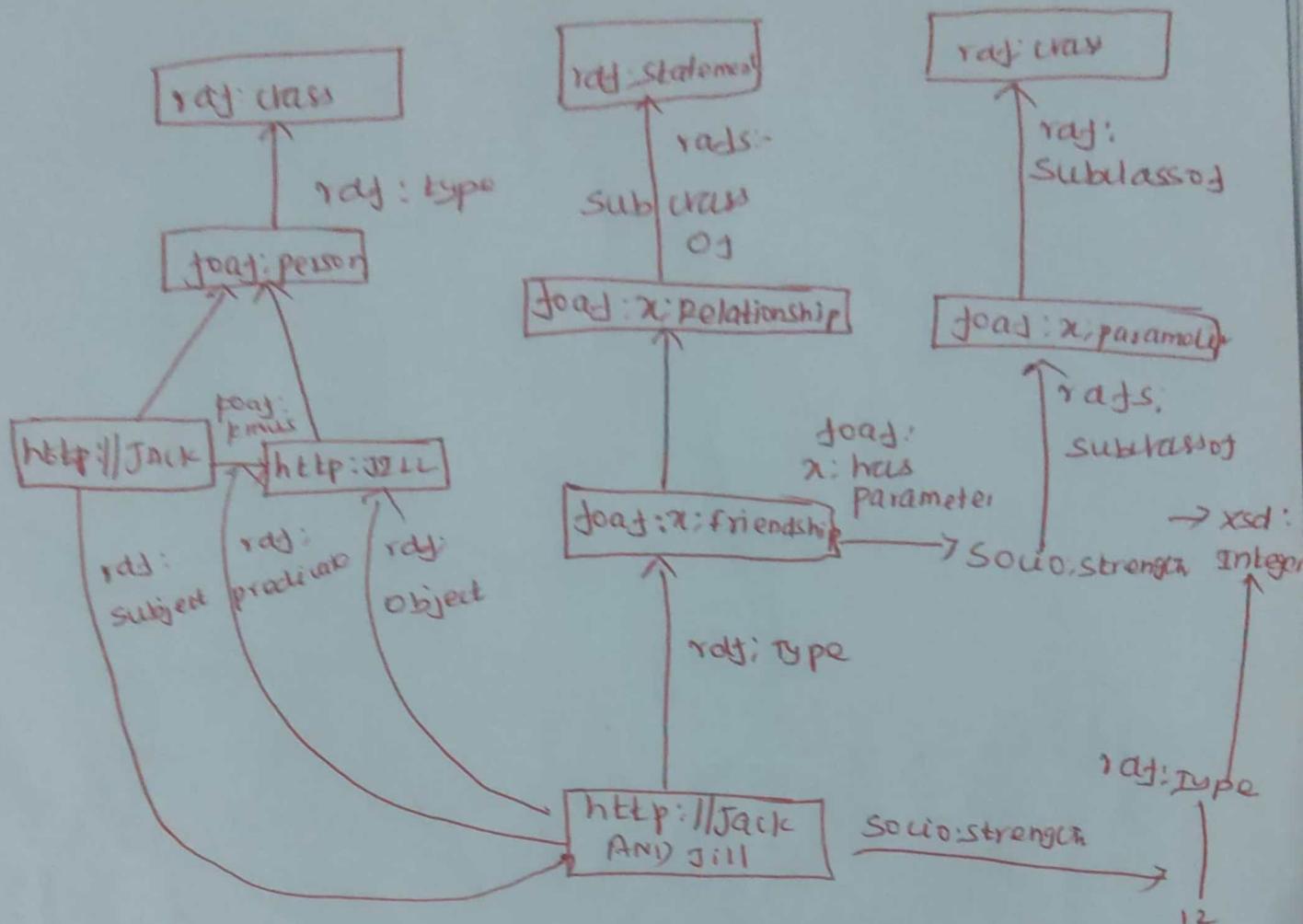
* cognitive Structuring: works by applying the generic pattern we associate with such a Relationship to the actual-state of affairs we observe.

Example:- a student/professor relationship.