Step 1:

Analyzing the netflixdata.csv and creating ontology as per requirements:

A	B	C	D	
show_id	type	title	director	cast
81145628	Movie	Norm of the North: King Sized Adventur	Richard Finn, Tim Maltby	Alan Marriott, Andrew Toth, Brian Dobson, Cole Howard, Jennifer Cameron, Jonathan Holmes, Lee Tockar, Lisa Du
80117401	Movie	Jandino: Whatever it Takes		Jandino Asporaat
70234439	TV Show	Transformers Prime		Peter Cullen, Sumalee Montano, Frank Welker, Jeffrey Combs, Kevin Michael Richardson, Tania Gunadi, Josh Kea
80058654	TV Show	Transformers: Robots in Disguise		Will Friedle, Darren Criss, Constance Zimmer, Khary Payton, Mitchell Whitfield, Stuart Allan, Ted McGinley, Peter
80125979	Movie	#realityhigh	Fernando Lebrija	Nesta Cooper, Kate Walsh, John Michael Higgins, Keith Powers, Alicia Sanz, Jake Borelli, Kid Ink, Yousef Erakat,
80163890	TV Show	Apaches		Alberto Ammann, Eloy Azorín, Verónica Echegui, Lucía Jiménez, Claudia Traisac
70304989	Movie	Automata	Gabe Ibáñez	Antonio Banderas, Dylan McDermott, Melanie Griffith, Birgitte Hjort Sørensen, Robert Forster, Christa Campbell, Ti
80164077	Movie	Fabrizio Copano: Solo pienso en mi	Rodrigo Toro, Francisco Schultz	Fabrizio Copano
80117902	TV Show	Fire Chasers		
70304990	Movie	Good People	Henrik Ruben Genz	James Franco, Kate Hudson, Tom Wilkinson, Omar Sy, Sam Spruell, Anna Friel, Thomas Arnold, Oliver Dimsdale,
80169755	Movie	Joaquín Reyes: Una y no más	José Miguel Contreras	Joaquín Reyes
70299204	Movie	Kidnapping Mr. Heineken	Daniel Alfredson	Jim Sturgess, Sam Worthington, Ryan Kwanten, Anthony Hopkins, Mark van Eeuwen, Thomas Cocquerel, Jemima
80182480	Movie	Krish Trish and Baltiboy		Damandeep Singh Baggan, Smita Malhotra, Baba Sehgal
80182483	Movie	Krish Trish and Baltiboy: Battle of Wits	Munjal Shroff, Tilak Shetty	Damandeep Singh Baggan, Smita Malhotra, Baba Sehgal, Deepak Chachra
80182596	Movie	Krish Trish and Baltiboy: Best Friends F	Munjal Shroff, Tilak Shetty	Damandeep Singh Baggan, Smita Malhotra, Deepak Chachra
80182482	Movie	Krish Trish and Baltiboy: Comics of Indi	Tilak Shetty	Damandeep Singh Baggan, Smita Malhotra, Baba Sehgal
80182597	Movie	Krish Trish and Baltiboy: Oversmartness	Tilak Shetty	Rishi Gambhir, Smita Malhotra, Deepak Chachra
80182481	Movie	Krish Trish and Baltiboy: Part II		Damandeep Singh Baggan, Smita Malhotra, Baba Sehgal
80182621	Movie	Krish Trish and Baltiboy: The Greatest T	Munjal Shroff, Tilak Shetty	Damandeep Singh Baggan, Smita Malhotra, Baba Sehgal
80057969	Movie	Love	Gaspar Noé	Karl Glusman, Klara Kristin, Aomi Muyock, Ugo Fox, Juan Saavedra, Gaspar Noé, Isabelle Nicou, Benoît Debie, V

Class Hierarchy Explanation:

Movie and TvShow represent the main concept. They are disjoint from each other as a TvShow cannot overlap with a Movie. (their instances will be the name of the Movie/TvShow)
Under Collection
Cast (Subclass) : represent set of actors
CountryReleaseSet (Subclass): represent set of country where movie/TvShow is released
DirectorSet (Subclass): represent set of director
GenreSet (Subclass): represent set of genre

The instances of cast, CountryReleaseSet, DirectorSet,GenreSet will be blank nodes which will connect them to the corresponding values.

Under Concept (Agent-Role ODP)
Role (Agent-Role ODP): represent the kind of role the actor and director plays
Its instance will be acting and directing only.

Country: represent the individual country. Instance: United States, UK,etc...
Description: represent the description of the movie and TvSeries. Its instance will again be a blank node which will be connected to string description via hasDescription function.
Duration: represent the duration of the movie/TvSeries. Its instance will be a blank node which will be connected to string description via hasValue function which defines the Rating.
Genre: represent the duration of the movie/TvSeries. Instance: genre like Comedy,action,etc…
Rating:represent the rating of the movie/TvSeries. Instance: blank node connected to string via hasValue property which has ratings like PG-13, R,etc...

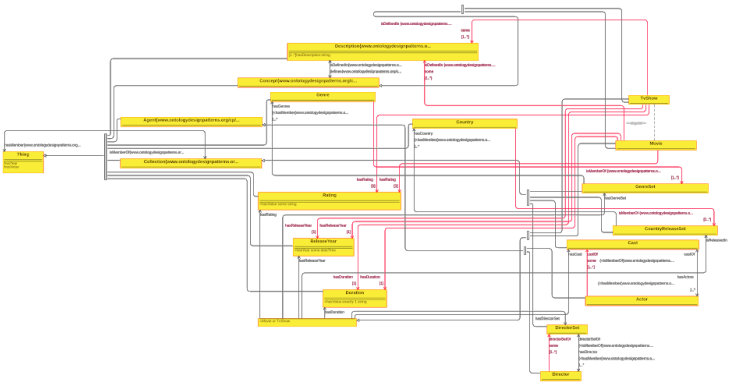
ReleaseYear: represent the year of release of the movie/TvSeries. Instance: blank node connected to dateTime via hasYear property which has Years of the release

In Object (Agent-Role ODP)

Agent (Agent-Role ODP)

Actor (Subclass): represent the Actor entity. Instance: Name of Actor : John Krasinski, etc..

Director (Subclass): represent the Director entity. Instance: Name of Director: Steven Spilberg.



ODP Used:
Agent-role ODP :
http://ontologydesignpatterns.org/wiki/Submissions:AgentRole
Collection:
http://ontologydesignpatterns.org/wiki/Submissions:Collection
Description:
http://ontologydesignpatterns.org/wiki/Submissions:Description

Ontology created by name: ontology_netflix.owl (Can be opened using protege)

Step 2:
Creating the Knowledge Graph from the csv formatted netflix data

How to Run:

Setup up environment :
Create a user library by adding all the jars in the lib folder to the user library.

Run code Q1_2016105 in eclipse with all the configurations set default. This code will create a Knowledge graph on the ontology defined in the previous step.

Step 3:
Linking the dataset to other datasets and making it a 5-star data.

I have linked my data set to dbpedia and geonames.org datasets.
Below is the screenshot of nodes linked to dbpedia and geonames:

	subject	object
1	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Denmark>	<https://www.geonames.org/countries/DK/denmark.html>
2	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Chile>	<https://www.geonames.org/countries/CL/chile.html>
3	<http://dbpedia.org/resource/Bob_Odenkirk>	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Bob_Odenkirk>
4	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Thailand>	<https://www.geonames.org/countries/TH/thailand.html>
5	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Italy>	<https://www.geonames.org/countries/IT/italy.html>
6	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#China>	<https://www.geonames.org/countries/CN/china.html>
7	<http://dbpedia.org/resource/Big_Miracle>	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Big_Miracle>
8	<http://dbpedia.org/resource/Anthony_Hopkins>	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Anthony_Hopkins>
9	<http://dbpedia.org/resource/Angela_Bassett>	<http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Angela_Bassett>
		<http://www.semanticweb.org/suyash-

Subject (Entities)	Object (corresponding linked entity)
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Denmark	https://www.geonames.org/countries/DK/denmark.html
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Chile	https://www.geonames.org/countries/CL/chile.html
http://dbpedia.org/resource/Bob_Odenkirk	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Bob_Odenkirk
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Thailand	https://www.geonames.org/countries/TH/thailand.html

http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Italy	https://www.geonames.org/countries/IT/italy.html
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#China	https://www.geonames.org/countries/CN/china.html
http://dbpedia.org/resource/Big_Miracle	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Big_Miracle
http://dbpedia.org/resource/Anthony_Hopkins	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Anthony_Hopkins
http://dbpedia.org/resource/Angela_Bassett	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Angela_Bassett
http://dbpedia.org/resource/Jennifer_Lafleur	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Jennifer_Lafleur
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Pakistan	https://www.geonames.org/countries/PK/pakistan.html
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Spain	https://www.geonames.org/countries/ES/spain.html
http://dbpedia.org/resource/Abhinav_Gomatam	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Aakash_Dabhade
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Belgium	https://www.geonames.org/countries/BE/belgium.html
http://dbpedia.org/resource/Taissa_Farmiga	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Taissa_Farmiga
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Netherlands	https://www.geonames.org/countries/NL/netherlands.html
http://dbpedia.org/resource/Adam_Conover	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Adam_Conover
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#United_Kingdom	https://www.geonames.org/countries/GB/united-kingdom.html
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Sweden	https://www.geonames.org/countries/SE/sweden.html
http://dbpedia.org/resource/Ben_10:_Alien_Swarm	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Ben_10
http://dbpedia.org/resource/John_Krasinski	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#John_Krasinski

http://dbpedia.org/resource/T._J._Miller	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#T.J._Miller
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Turkey	https://www.geonames.org/countries/TR/turkey.html
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#South_Korea	https://www.geonames.org/countries/KR/south-korea.html
http://dbpedia.org/resource/6_Years	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#6_Years
http://dbpedia.org/resource/Aamir_Khan	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Aamir_Khan
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#India	https://www.geonames.org/countries/IN/india.html
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Bulgaria	https://www.geonames.org/countries/BG/bulgaria.html
http://dbpedia.org/resource/Boman_Irani	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Boman_Irani
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Canada	https://www.geonames.org/countries/CA/canada.html
http://dbpedia.org/resource/Anushka_Sharma	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Anuskha_Sharma
http://dbpedia.org/resource/Ben_Kingsley	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Ben_Kingsley
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#United_States	https://www.geonames.org/countries/GB/united-states.html
http://dbpedia.org/resource/Adam_Ruins_Everything	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Adam_Ruins_Everything
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#France	https://www.geonames.org/countries/FR/france.html
http://dbpedia.org/resource/Andy_Serkis	http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Andy_Serkis
http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Brazil	https://www.geonames.org/countries/BR/brazil.html

2 ways of linking dataset are:

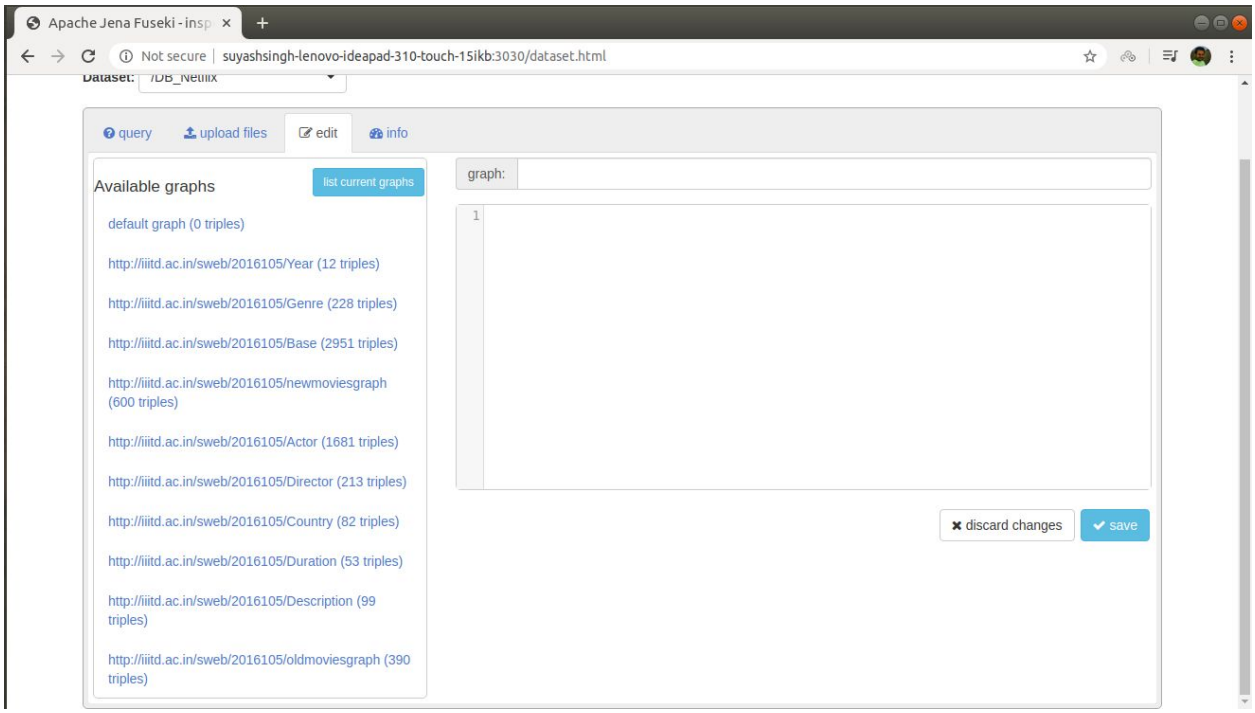
1. **owl:sameAs (adding extra dbpedia and geonames.org individual and linking them using sameAsIndividual method of protege)**
2. **Replacing the IRI of the entity with dbpedia/geonames entity.**

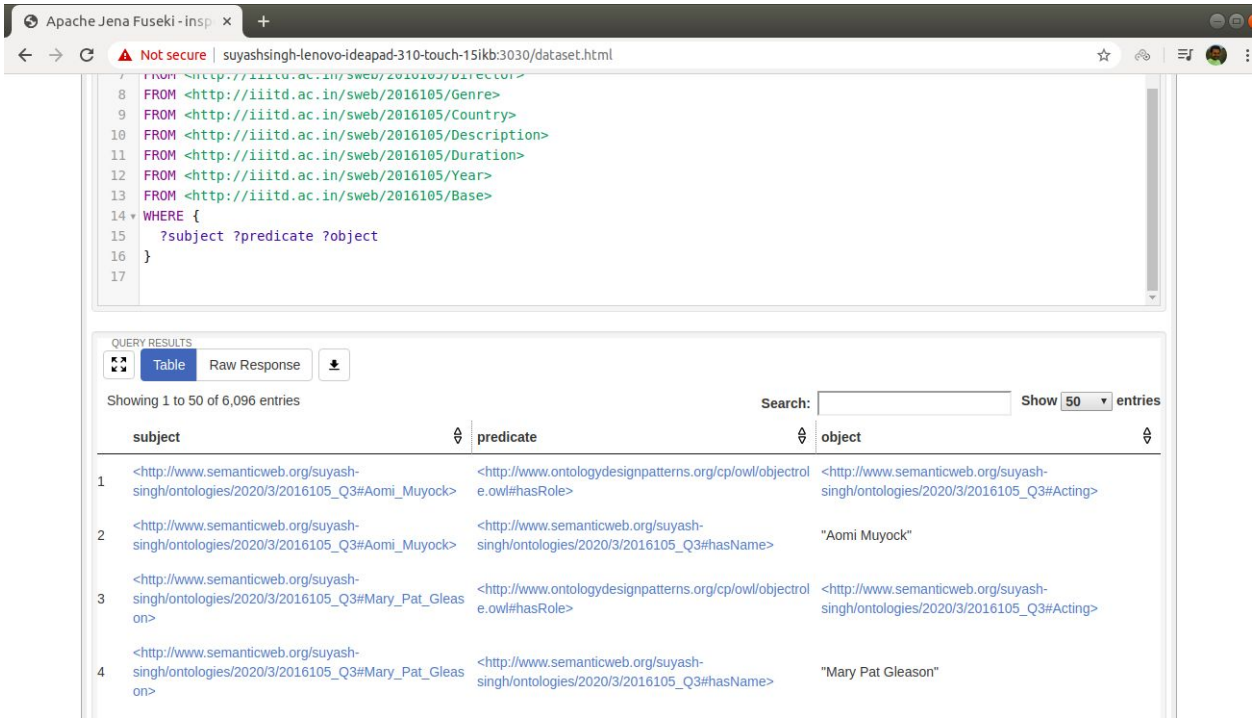
The graph linked_Kg.owl is a 5 star linked data as it has a sparql endpoint and is of rdf format, along with that it is linked to two external dataset. Hence it satisfies all the conditions of a 5 star linked data.

Step 4:
Setting up Fuseki for Sparql Query

Run fuseki-server bash script to host fuseki on local server

Upon running you can easily upload graph on fuseki server to use sparql endpoints and run sparql query.





Step 5:
Splitting default graph to different Named Graph:

Keep fuseki running in the background.
In order to create a named graph, run Q1c_2016105 in the project on eclipse.

I have made a total of 10 named graphs. The names of graphs are as follows :

a. FROM <http://iiitd.ac.in/sweb/2016105/Actor> : represents the triples associated with the actor.
b. FROM <http://iiitd.ac.in/sweb/2016105/newmoviesgraph> represents the triples associated with the movies/tvshows that were released post 2016.
c. FROM <http://iiitd.ac.in/sweb/2016105/oldmoviesgraph> represents the triples associated with the movies/tvshows that were released before 2016.
d. FROM <http://iiitd.ac.in/sweb/2016105/Director>: represents the triples associated with the director.
e. FROM <http://iiitd.ac.in/sweb/2016105/Genre>: represents the triples associated with the genre.
f. FROM <http://iiitd.ac.in/sweb/2016105/Country>: represents the triples associated with the country.

g. FROM <http://iiitd.ac.in/sweb/2016105/Description> : represents the triples associated with the description.
h. FROM <http://iiitd.ac.in/sweb/2016105/Duration>: represents the triples associated with the duration.
i. FROM <http://iiitd.ac.in/sweb/2016105/Year>: represents the triples associated with the year.
j. FROM <http://iiitd.ac.in/sweb/2016105/Base>: represents the triples that contain non base-uri objects and predicates like owl:sameAs,etc. .

The distribution can be observed on fuseki

Step 6:
Giving the Knowledge Graph a front end using pubby

In order to run pubby we have to use a servlet namely Tomcat. In the tomcat's webapp folder copy the pubby folder in the project. (Please note that all the configurations should match the requirements with the fuseki configuration) (to modify configuration make changes in the config.n3 file in WEB-INF folder).

```
# Server configuration section
<> a conf:Configuration;
    # Project name for display in page titles
    conf:projectName "Netflix movie Graph";
    # Homepage with description of the project for the link in the page header
    conf:projectHomepage <http://localhost:8080/>;
    # The Pubby root, where the webapp is running inside the servlet container.
    conf:webBase <http://localhost:8080/pubby/>;
    # URL of an RDF file whose prefix mapping is to be used by the
    # server; defaults to <>, which is *this* file.
    conf:usePrefixesFrom <>;
    # If labels and descriptions are available in multiple languages,
    # prefer this one.
    conf:defaultLanguage "en";
    # When the homepage of the server is accessed, this resource will
    # be shown.
    conf:indexResource <http://www.semanticweb.org/suyash-singh/ontologies/2020/3/2016105_Q3#Watchman>;
```

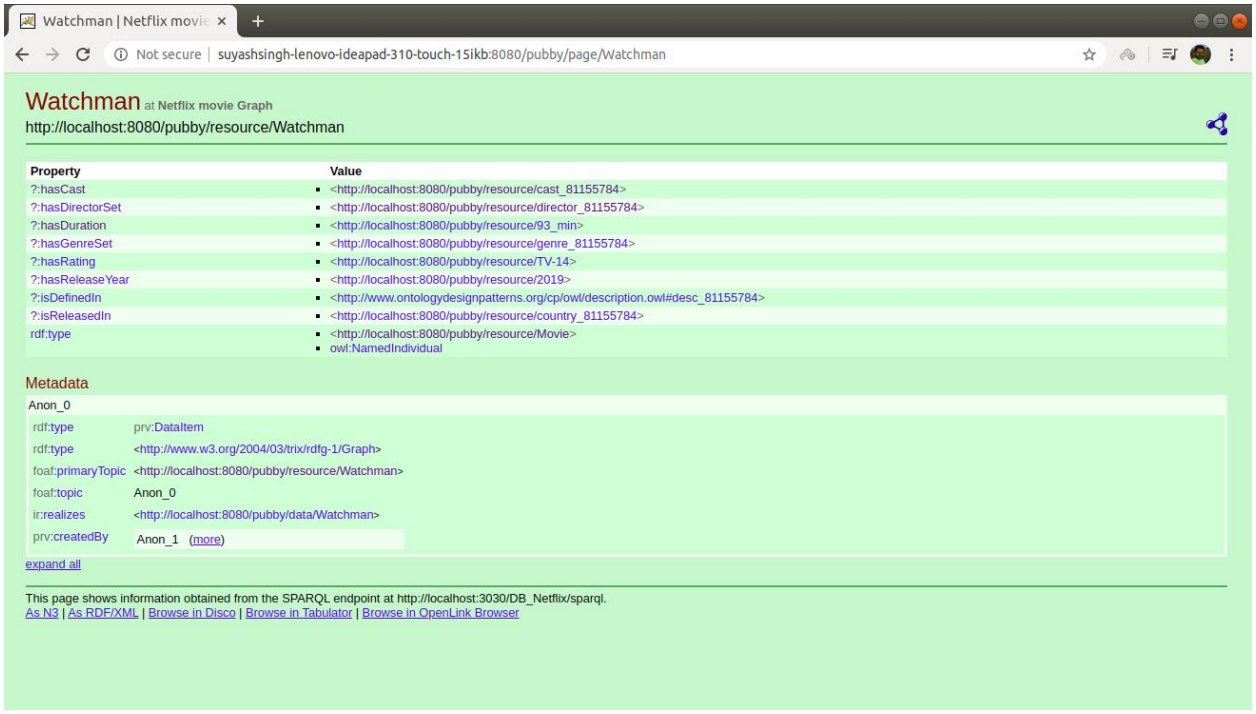
Config.n3 file

Before starting tomcat make sure port 8080 is free using:

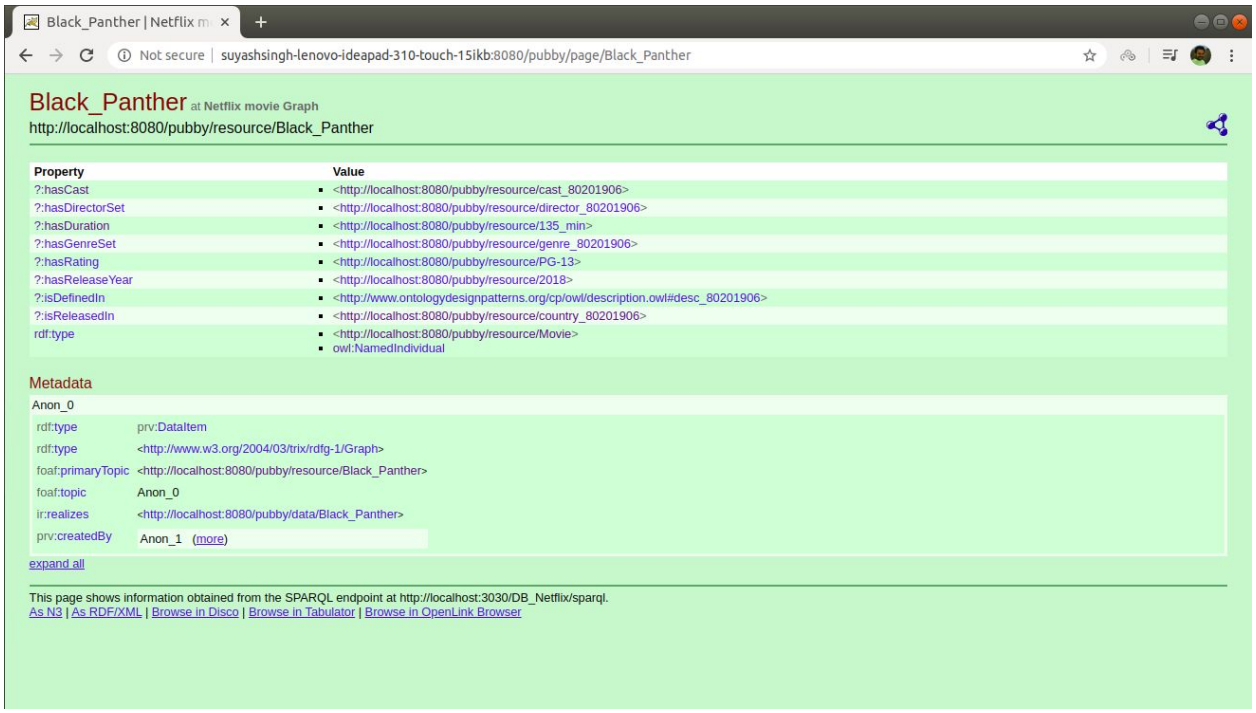
```
sudo kill -9 `sudo lsof -t -i:8080`
```

Run tomcat on localhost 8080 (run catalina.sh in bin folder) and in the browser type localhost:8080/pubby and you will see a front end to the project.

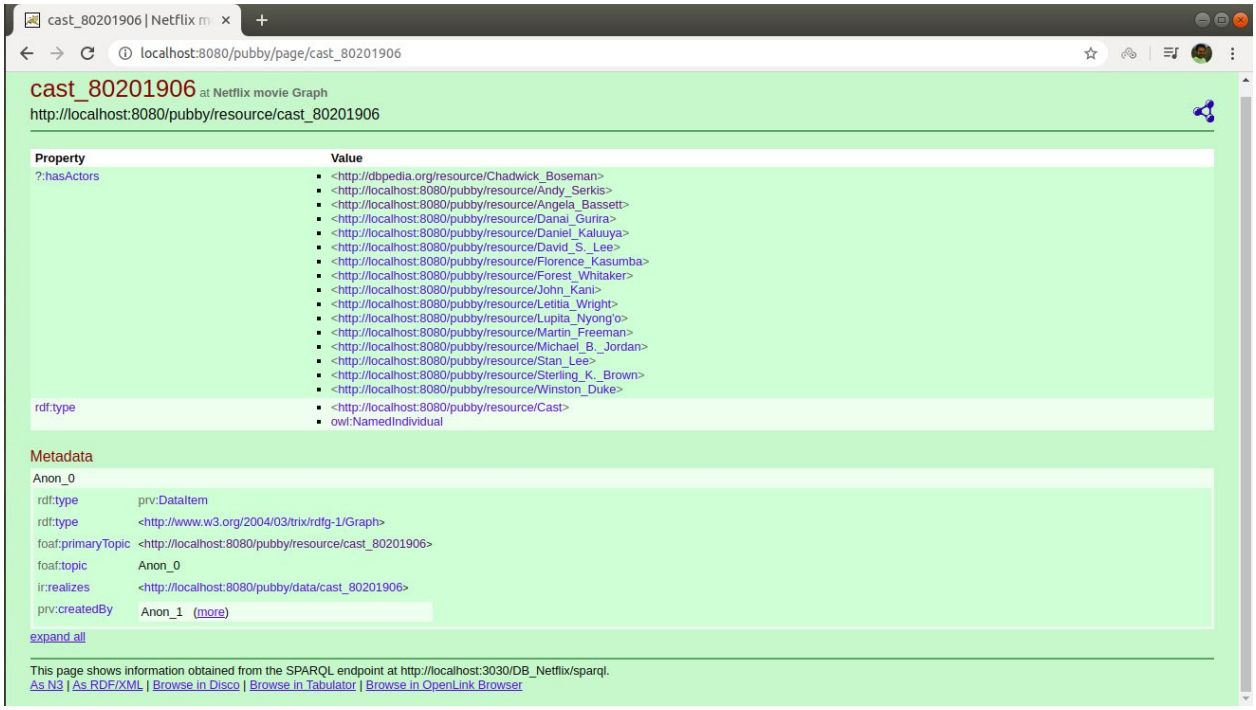
Below are the screenshots of pubby front end given to the KG:



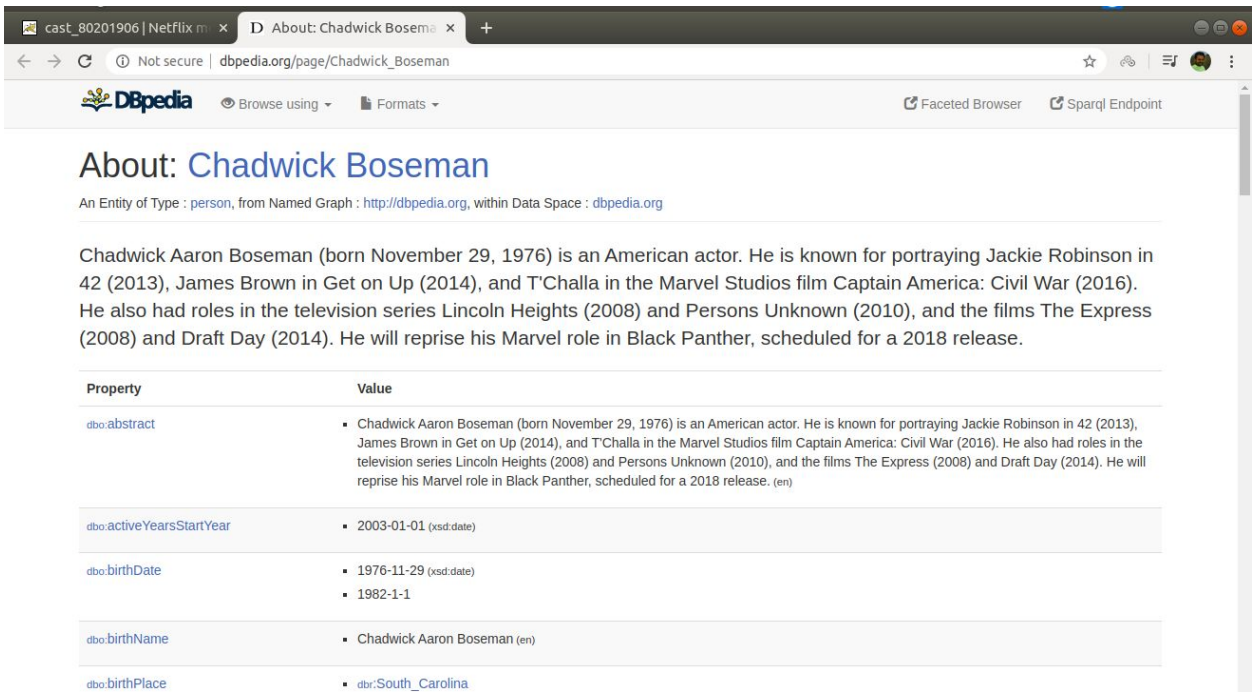
(Watchman page)



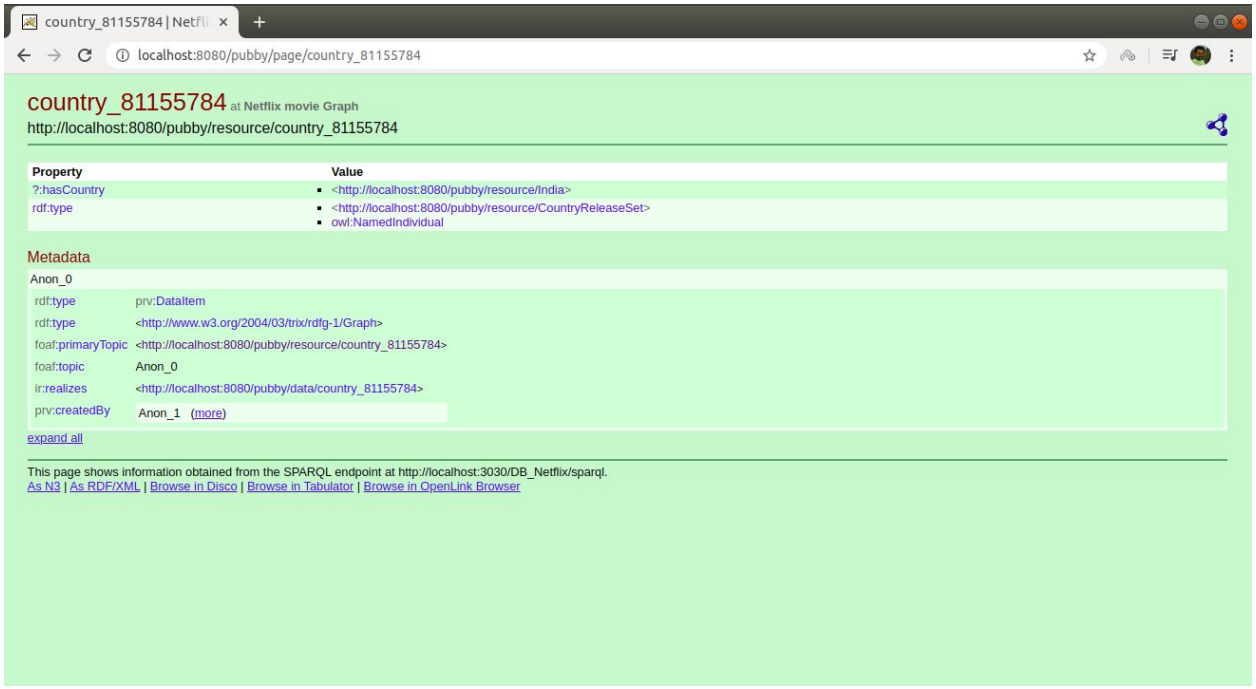
(Black panther)



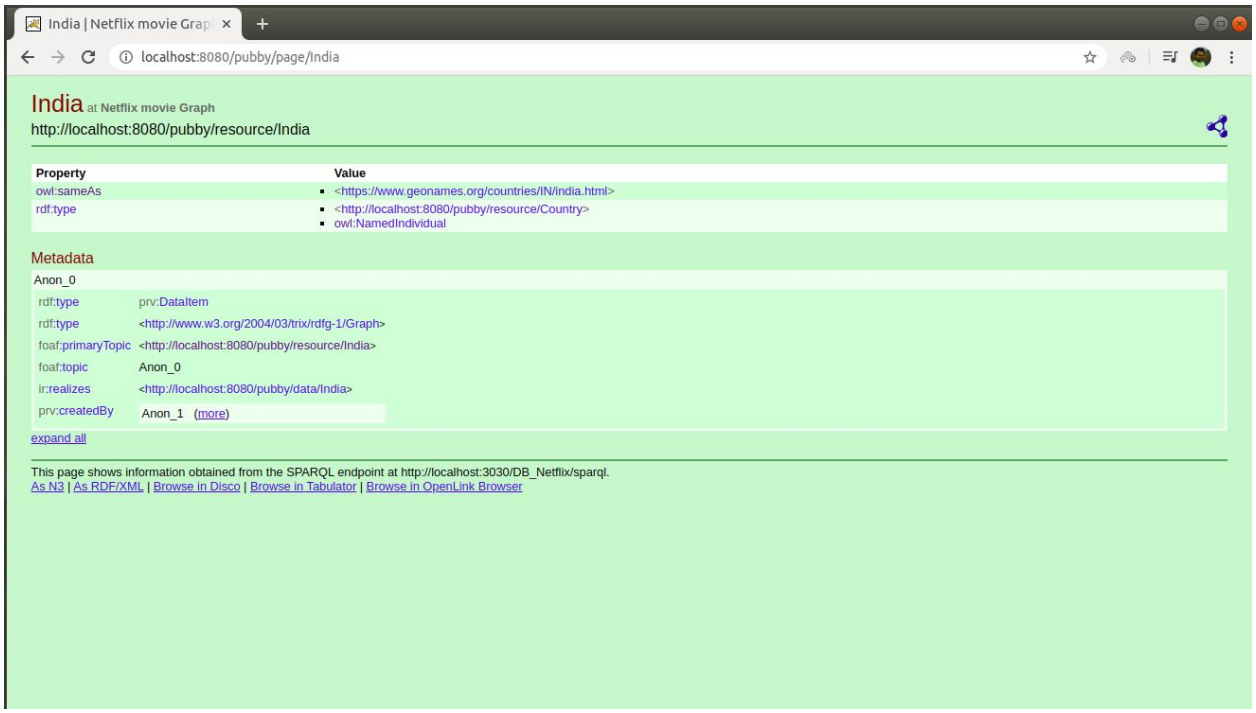
(Black Panther has cast)



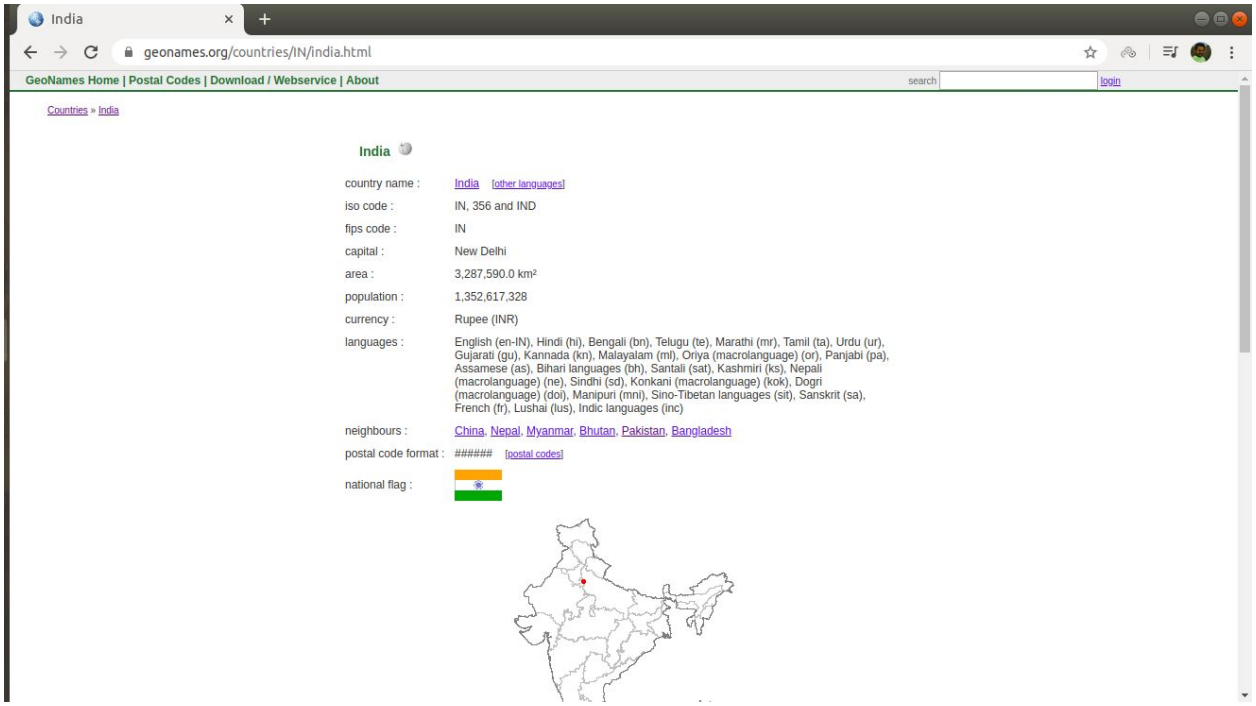
(Chadwick boseman dbpedia link as an actor)



(is released in country set)



(India has owl sameAs geoname.org link of India)



(geoname.org page of India)

NOTE:

For the case of fuseki all the code and configuration assumes that the name of the database is DB_Netflix. If the name of your database is different then please change the name of local_host variable in configuration.properties.

```
input_owl = ontology_netflix.owl
csv_file = NetflixList.csv
output_owl = KG_netflix.ttl
kg_file = linked_KG.owl
local_host = http://localhost:3030/DB_Netflix
```

And for pubby please change the sparql endpoint configuration accordingly that matches the name of your database.

Thank you